



# RADIO SERVICE NEWS

VOLUME XVI, No. 2

RCA TUBE DEPARTMENT, HARRISON, NEW JERSEY

April-May, 1951

## POWERFUL RCA BATTERY ADVERTISING AND SALES PROMOTION PROGRAM TO BACK SERVICE DEALERS

**"Buy RCA Portable-Radio Batteries from Your Local Radio Dealer"**  
—Theme of Extensive Advertising Campaign

To help radio dealers and servicemen to get a greater share of the portable-radio battery business, RCA has launched the most forceful advertising and sales promotion program ever attempted in the radio-battery industry.

Spearheading the program is national advertising directing set owners to buy RCA radio batteries from their local radio dealers and servicemen. Unique in the battery business, this advertising is intended to divert to radio-service dealers a large volume of battery sales currently being enjoyed by non-radio outlets.

The target of this advertising is the largest weekly audience in advertising history—39,205,000 people. RCA Battery commercials will appear on a variety of the nation's most popular daytime and evening programs: "The Big Show," "Boston Pops Orchestra," "Duffy's Tavern," "The Man Called X," "\$64 Question," and "The Magnificent Montague." Television, the dynamic advertising medium, will be employed to obtain that needed impact for this sensational campaign. NBC's famous puppet show, "Kukla, Fran, and Ollie" will provide visual product identification and hard-hitting commercials, on RCA batteries. These commercials will also direct RCA Battery Sales to local radio dealers and servicemen.

Advertising that builds battery sales for the radio trade is another reason why it pays to stock and sell RCA Batteries—the batteries for the Radio Trade!



*The Fact-Finder eliminates searching through catalogs, guides, charts, etc.—a compact time-saving index containing all the battery information you need at the point of sale.*

## UNUSUAL SALES AIDS WILL STIMULATE BATTERY SALES

Included in the 1951 RCA Battery Sales Promotion Program are unique sales and servicing aids for the radio dealer.

### Fact-Finder for Battery Data

A compact time saving index of battery information — the Fact-Finder includes price and technical data on all RCA Batteries. Interchangeable type numbers of eight leading battery brands are indexed for pointer selection. Also listed, by radio model number, is the battery complement of more than 500 portable radios produced by 32 manufacturers. The Fact-Finder places at your fingertips all the battery information you need at the point of sale. It eliminates searching through individual catalogs, guides, charts, and price lists provided by four major battery suppliers—a real selling help!

### Interchangeable Type Numbers on New RCA Battery Pencil

Another unique service aid and a must in every dealer's pocket, is RCA's new Interchangeable Types Battery Pencil. The pencil has a rotatable sleeve which selects, from a chart on the barrel, the corresponding type numbers of the ten most popular battery types of RCA and three leading battery manufacturers. At a glance you can solve 85 per cent of your battery interchangeability problems. This useful pencil is handsomely designed, complete with a concealed eraser and a spare lead compartment.

### New Sign and Display Available

To build battery sales, it is important that you prominently identify yourself as a battery dealer. For positive identification as an RCA battery dealer, RCA has available a giant, illuminated "B" battery display which is a replica of the RCA VS016. Durably constructed of metal and plastic, this display includes a removable light flashing unit. "RCA Batteries for All Makes of Radios"—this display will command attention and build sales by strongly identifying you as the neighborhood headquarters for RCA portable-radio batteries.

In addition, an 8 by 20-inch permanent display sign provides triple sales impact. "PORTABLE RADIO SALES AND SERVICE—We Sell

## VOL. V OF RCA VICTOR SERVICE DATA IN STOCK

Complete servicing information on all RCA radios, phonographs, and television receivers, manufactured during 1949, is now available in Volume V of the RCA Victor Service Data series. This bound volume contains over 300 pages of technical material on more than 50 RCA models. This essential reference manual contains invaluable service data such as schematic diagrams, voltage charts, chassis layouts, alignment procedures, troubleshooting suggestions, typical test patterns, and wave shapes . . . plus other valuable servicing information.

(Continued on Page 7, Col. 4)

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## INCREASED PRESTIGE FOR SERVICE DEALER GOAL OF NEW RCA TUBE CAMPAIGN

**Preview of Dynamic New Promotion to Sell Service and Build Solidly for the Future**

Will your earnings this year reflect the record earnings enjoyed in 1950? How strongly will military priorities and material shortages affect your operations? Because conditions during 1951 will continue to be unpredictable, a consistent hard-hitting promotion assumes new responsibility and added significance to the service dealer. Sales promotion now becomes the basic tool for protecting your market position and for building your business.

An intensive promotional campaign designed to enhance the prestige of the radio and television service dealer in his own community has been announced by the RCA Tube Department. The campaign will also seek to attract business to the service dealer by emphasizing that the service he renders is essential to community welfare.

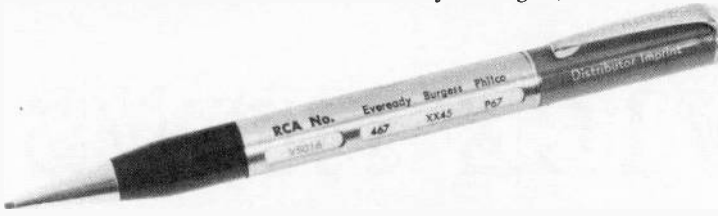
The "Serving the Community"

(Continued on Page 7, Col. 1)

(Continued on Page 2, Col. 1)

Photolithographed in U. S. A.

**UNUSUAL SALES AIDS** (Continued from Page 1)



This pencil has a rotatable sleeve which selects, from a chart on the barrel, the corresponding type numbers of the ten most popular battery types of RCA and three leading battery manufacturers.

RCA Radio Batteries"—identifies your store as the local headquarters for portable radios, batteries, and service!

Proven popular promotions, the

RCA Battery Basic Sales Aid Kit and the RCA Battery "Fireball"-Clock Sign are also available to RCA Battery dealers. The Basic Sales Aid Kit contains a catalog, window



Designed to identify your store as the local headquarters for portable radios, batteries, and service!

**NOTES ON THE WIDE-BAND MODULATOR IN THE WR-39B TELEVISION CALIBRATOR**

Many important improvements in TV test equipment for the serviceman have been nearly overshadowed by the recent advances in the design of television receivers. So much so, that the busy serviceman is apt to derive only limited utility from a particular piece of test equipment because he lacks a full appreciation of the features incorporated in the instrument.

This has been attested by the receipt of numerous inquiries, by RCA's Test and Measuring Equipment Section, for further details on the various pieces of test equipment. These inquiries form the basis for the following discussion on the purpose, operation, and control of the wide-band modulator employed in the RCA WR-39B Television Calibrator. Included are simple conversion instructions to permit the disabling of the wide-band modulator in some of the early models (code numbers 450 and 1149).

Bandwidth measurements on response curves for tuned circuits in TV and FM receivers were made with the WR-39A, the first instrument in the WR-39 series of Television Calibrators, by determining the difference frequency corresponding to two settings of the variable-frequency oscillator.

In addition to the adjustable marker provided by the variable-frequency oscillator, the WR-39B provides marker pips spaced either 4.5 Mc or .25 Mc. on each side of the main marker frequency. The 4.5-Mc markers facilitate the alignment of tuned circuits in rf amplifiers of TV receivers; the .25-Mc markers are useful in adjusting discriminators and ratio detectors.

These additional marker signals are generated by two crystal oscillators. The output of either crystal oscillator may be mixed with the signal from the variable-frequency oscillator by means of a wide-band modulator stage employing a 1N34.

When the WR-39B is employed during the coarse adjustment of a badly detuned circuit, the presence of the crystal markers may make it difficult to identify the pip corre-

sponding to the setting of the variable-frequency oscillator. However, if the 4.5- and .25-Mc crystal oscillators are turned off, and the output of the variable-frequency oscillator is applied to the 1N34 modulator, the resultant output signal will be a rectified wave containing some harmonics. Under certain conditions, one of these harmonics might beat with the local oscillator in the TV set to produce a spurious pip on the response curve thereby making it difficult to identify the main marker. Consequently, the wide-band modulator must also be disabled when the 4.5- and .25-Mc markers are not desired.

Disabling of the 1N34 mixer is accomplished by providing it with a dc bias so that the diode is continuously

streamer, and dealer list-price card. The "Fireball"-Clock Sign is a deluxe clock with a glass-enclosed 8-inch face, uncluttered with copy, and a Telechron sealed movement. A fluorescent sign immediately above the clock face reads "RCA Batteries for extra listening hours."

All RCA battery sales and servicing aids are obtainable, without charge, with purchases of RCA batteries from your local distributor. Specify "RCA BATTERIES ONLY" on your next radio battery order, and ask for the sales aids you want. Eliminate competition from non-radio outlets this season by selling RCA—the radio batteries for the radio trade!



This giant, illuminated "B" battery display will command attention—let them know that you stock RCA portable-radio batteries!



The Fireball-Clock Sign serves as a clever reminder to use "RCA batteries for extra listening hours."

conductive. This is accomplished in the WR-39B (except early models with code numbers 450 and 1149) whenever the phone plug is removed from the MOD IN jack, thereby closing the jack contacts to their normally-closed position.\*

An increase in output will result when the wide-band modulator is disabled. Also, there will be a reduction in harmonic content of the output signal because the 1N34 is continuously conductive so that rectification does not take place, i. e., the output signal is the sinusoidal waveform from the push-pull, variable-frequency oscillator.

When the plug is inserted into J6, the 1N34 conducts in only one direction. The volume control can then be turned to the "MOD ON" position for an internally audio-modulated rf signal at output jack J4; or, the calibrate switch can be turned to either the .25- or 4.5-Mc position for sideband markers.

Any external frequency may be applied at the MOD IN jack to modulate the output frequency of the variable-frequency oscillator. The external signal at the RF OUT jack will be modulated and it can be used to provide additional marker pips.

Therefore, the function of the MOD IN jack is twofold: (1) a con-

ductor for the application of external modulating signals, and (2) a switch for turning on and off the wide-band modulator when its normally-closed contacts are opened and closed, respectively, by means of a phone plug.

The wide-band modulator in some of the early models of the RCA WR-39B (code numbers 450 and 1149) could not be disabled. After the open-circuit jack is replaced with a closed-circuit type and resistor R53 is connected as shown in the schematic diagram, the wide-band modulator will be disabled until a plug is inserted into the MOD IN jack, J6. When making this conversion, check the polarity of the 1N34; the negative terminal should be connected to the RF OUT jack, J4.

**TUBE SUBSTITUTION INCREASES OUTPUT OF WR-39B**

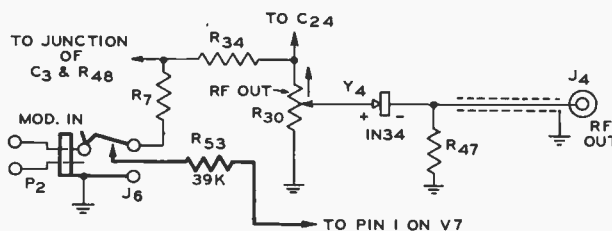
RCA WR-39B Television Calibrators (code number 1149) which employ a 6BE6 as V3, crystal oscillator and detector, will provide greater output if the 6BE6 is replaced by a 6AS6; in this particular circuit, a direct substitution can be made without changing the tube socket or any of the circuit components.

The 6AS6 has the advantage of increased gain which, in turn, will provide a high level of output. The tube should be provided with a weighted tube shield to reduce any tendency toward microphonics and to provide rf shielding.

**Price Notice**

Suggested prices shown in Radio Service News are subject to government ceiling-price regulations.

\*As explained on the schematic diagram in the instruction booklet.



# TV ANTENNA INSTALLATION TIPS

## PART 2

### Antenna Location



Determine the antenna location.



Do not set up the ladder directly in front of a window.

Observe all sides of the house and roof for antenna mounting possibilities. Give consideration to transmission-line run, point of entry, height above ground, obstructions, nearby antennas, and appearance. Bear in mind that, in general, the

chimney bracket offers a number of advantages such as simplified mounting procedure, sturdy support, etc. *Installation should not be made on a peaked roof during extremely high winds or when the roof is wet, or slippery due to ice or snow.*

Before erecting the extension ladder at the chosen location, check its general condition. For safety, the extension ladder should be equipped with SAFE-HI ladder shoes, which are used in accordance with existing conditions, i.e., spiked ends down-

ward on soft surface, and rubber feet placed flat on hard surfaces. An extension ladder should be placed so that the base is extended one-fourth of the ladder length from the object supporting it. Securely lash the ladder—develop the safety habit!

# RADIO·PHONO·TV Tips

### 12-IN. SPEAKERS—CURRENT LINE TELEVISION CONSOLES

Current-line TV console models (not combinations) are using 12-inch speakers requiring different replacement cones.

Presently used speakers with their associated replacement cones are listed in the following table:

Number on Speaker	Speaker Stock No.	Cone Stock No.
92569-11W	74974	74901
92569-11B	74974	75875
92569-11K	74974	75642
92569-11R	74974	76121

### MODEL BX57—FILAMENT DROPPING RESISTOR

The original stock number called

for in the Service Data for this resistor (2,600 ohms, R13) is Stock Number 75148. This resistor has now been superseded by Stock Number 76006, which is of the flat, strip, metal-jacketed type.

### 201D3 YOKE

Before installing the yoke, determine whether the 56- $\mu$ f capacitor in the original yoke is connected from terminal 2 or 7 to 3, or from terminal 2 or 7 to 1. If the capacitor in the 201D3 is connected differently from that of the yoke being replaced, the connections should be changed to agree with the original. Note that in 8-terminal yokes, terminals 2 and 7 are electrically common, and that the capacitor may be connected to either terminal.

### TVI AND THE SERVICEMAN

Servicemen are familiar with the possibility of TVI from diathermy equipment, industrial devices, nearby television receivers, etc. The alert serviceman should recognize these problems as potential service calls, and he should be prepared to meet the challenge! A good working knowledge of effective TVI elimination techniques can be had by referring to the following articles from the bibliography of TVI articles in the Winter and Spring issues of RCA Ham Tips:

- "Radiation from R-F Heating Generators," by A. G. Swan, *Electronics*, May 1946, pg. 162.
- "Interference Traps for Television," by S. N. Finley, *Radio News*, March 1948, pg. 70.
- "Cause and Cure of Spurious TV Receiver Oscillations," by R. T. Cavanaugh, *Tele-Tech*, May 1948, pg. 36.
- "The TV Receiver," by W. Brown, *WIIBK, CQ*, July 1948, pg. 31.
- "Television Receiver Intermediate Frequencies," by P. F. G. Holst, *Electronics*, Aug. 1948, pg. 90.
- "TV Circuits Cause Interference," *Tele-Tech*, Sept. 1948, pg. 39.
- "Shielding Experiments and TVI," by M. Seybold, *W2RYI, CQ*, June 1949, pg. 31.
- "The Service Technician and TV Interference," by H. S. Brier, *W9EGQ, Radio & Television News*, August 1949, pg. 32.
- "Household Radio Interference Elimination," by J. W. Teegarden, *Radio & Television News*, Sept. 1949, pg. 34.
- "TV Interference from Incandescent Lamps," by D. G. Fink, *Electronics*, Dec. 1949, pg. 132.
- "TVI and the Serviceman," by John F. Rider, *Successful Servicing* (John F. Rider

- Publisher, Inc., N. Y., N. Y.), Jan. 1950, pg. 5.
- "Eliminating Broadcast Interference Caused by TV Receivers," by J. Najork, *W2HNI, Radio & Television News*, Jan. 1950, pg. 52.
- "Simulating TV Interference Patterns," by E. G. Louis, *Radio & Television News*, March 1950, pg. 49.
- "Design and Application of High-Pass Filters," by M. Seybold, *W2RYI, RCA Ham Tips*, Fall 1950.
- "TV Interference from Horizontal Deflection Circuits," by D. Lerner & J. Howell, *Radio & Television News*, Sept. 1950, pg. 50.
- "Television Interference on Broadcast Receivers," by M. Mandl, *Radio-Electronics*, Oct. 1950, pg. 22.

### HOW TO GET YOUR COPY OF RADIO SERVICE NEWS

Many inquiries are received at the Editorial Offices about where and how RCA Service News can be obtained, regularly. Here's the answer.

Radio Service News is published bi-monthly by the Editorial Offices of the RCA Tube Department in the interest of radio servicemen and dealers everywhere. It is sent to the trade through RCA Distributors, who give it to their customers either by mail, or over the counter. Ask your RCA Distributor to put you on his regular mailing list or, if he passes it out in the store, to save you a copy.

If you are now receiving a copy from your local RCA Distributor, don't forget to notify him when you change your address.

### RCA TUBE DEPT. VACATION SHUTDOWN ON JUNE 29

All manufacturing operations of the RCA Tube Department will cease at the close of business on Friday, June 29 and will be resumed on Tuesday, July 17.

Note these dates and plan your summer requirements now so that your RCA Distributor can complete his orders and obtain delivery before the vacation shutdown on June 29.

# TELEVISION SERVICE

By John R. Meagher

Television Specialist, RCA Renewal Sales

## PART XII

### Visible Symptoms of Hum Trouble

Undesired hum voltages in a television receiver may produce either visible or audible symptoms, or a combination of both. This article covers the localization of hum troubles that produce visible symptoms in the picture, with or without any accompanying audible effects.

Success in visual analysis of hum troubles depends on the correct answers to the following questions:

1. Do the visible hum symptoms occur at 60 cycles, or at 120 cycles?
2. Are there changes of brightness (one or two cycles of hum bars\*) between the top and bottom of the picture?
3. Is there horizontal pulling (one or two cycles) between the top and bottom of the picture?
4. Are the symptoms in items 2 and 3 both present in the picture?
5. Do the visible symptoms in items 2 and 3 remain in view on the raster, or disappear, when the picture signal is removed?
6. Are the visible symptoms accompanied by excessive audible hum from the speaker?

Each of these symptoms furnishes a definite clue, and the combination of such clues generally points unerringly to a particular section of the receiver. After the trouble has been localized, a routine check of the tubes, (and other components) and voltages in the suspected section will reveal the exact fault.

To become expert in recognizing and isolating the sources of hum trouble, it is advisable for the serviceman to duplicate the conditions shown in the accompanying photographs. The effects of leakage between the heater and cathode of a tube can be simulated by connecting an adjustable resistor from the cathode to the ungrounded heater terminal. This method does not

\*A hum bar is a change in brightness between the top and bottom of the picture or raster. See Fig. 1.

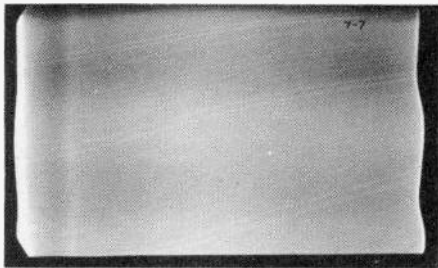


Fig. 1. Two cycles of change in width, and two cycles of change in brightness (hum bars) between the top and bottom of the raster (vertical oscillator running at 60 cycles). The two cycles occur in 1/60th second, indicating that the hum trouble is 120 cycles and that it originates in the B supply. The trouble was caused by open B+ filter capacitors, which resulted in excessive 120-cycle ripple in the B voltage, changing the width and brightness of the raster at a 120-cycle rate. Figures 2 to 9 show examples of 60-cycle hum trouble caused by heater-cathode leakage.

always duplicate the exact effects of emission-type leakage, but it is entirely satisfactory for purposes of study.

For simplicity in this article, it is assumed that the receiver is operated from a 60-cycle supply, in which case the visible hum symptoms occur at either 60 or 120 cycles per second. If the receiver is operated on a 50-cycle supply, which is used in some areas, the hum symptoms will occur at 50 or 100 cycles. When the receiver is operated through an inverter from a dc supply, the rate of any visible hum symptoms depends on the frequency of the inverter output.

### Two Principal Types of Hum Symptoms

One of the first steps in localizing the source of hum trouble is to determine, from an analysis of the visible symptoms, whether the hum is occurring at a 60- or 120-cycle rate.

Hum at a 60-cycle rate generally indicates heater-cathode leakage in a tube.

Hum at a 120-cycle rate usually indicates trouble in the B-supply circuit.

A few exceptions to these general rules are mentioned later.

It is easy to determine whether the visible symptoms are occurring at 60 cycles, or at 120 cycles:

If there is only one cycle of hum bars, and/or one cycle of horizontal pulling, between the top and bottom of the picture, the trouble is caused by 60-cycle hum (usually caused by heater-cathode leakage). If there are two cycles of hum bars, and/or two

cycles of horizontal pulling, between the top and bottom of the picture, the trouble is caused by 120-cycle hum (usually caused by trouble in the B-supply circuits).

### 120-Cycle Hum Symptoms

Most television receivers utilize full-wave rectification in the B-supply circuit. The output of a full-wave rectifier, operating from a 60-cycle supply, consists of 120-cycle pulsating dc. The pulsations are normally smoothed into pure dc by the action of filter capacitors and chokes. However, if there are any serious defects in the filtering circuits, such as open filter capacitors, some or all of the B+ and B- voltages will have excessive 120-cycle ripple, or variation in voltage, which may produce 120 cycle hum trouble in several sections of the receiver.

Open filter capacitors in the B-filter circuit produced the visible hum symptoms shown in Fig. 1, where there are two cycles of change in the amplitude of horizontal deflection (two cycles of variation in the length of the horizontal scanning lines), between the top and bottom of the raster. Also, there are two cycles of hum bars, or graduation in brightness, between the top and bottom of the raster.

When the photograph for Fig. 1 was made, the vertical-hold control was adjusted for the correct vertical-deflection rate of 60 cycles while a TV station was received, and the rf-if gain was reduced until the TV picture became invisible, leaving only the raster in sight on the kinescope. As the gain was reduced, the vertical-hold control was slightly readjusted to maintain the vertical-deflection rate of 60 cycles. There are two cycles of change in width (and also in brightness) in 1/60th second, indicating that the hum voltage is occurring at 120 cycles per second, and that the trouble, therefore, is in the B-filter circuit. If the hum symptoms occurred at 60 cycles, there would be only one cycle of change in width (and brightness) between the top and bottom of the raster.

Excessive hum voltage on some or all of the B-output taps usually affects more than one section of the receiver, and results in some or all

of the following symptoms:

1. Excessive audible hum from the speaker, caused by hum voltage on the B+ or B- leads to the audio amplifier. The intensity of the hum is not affected by turning the audio volume control.

2. 120-cycle hum bars (two cycles of change in brightness between the top and bottom of the raster), caused by hum voltage in the B-supply to the video amplifier. The hum bars in this case are present on the raster with or without a picture. If there is 120-cycle hum on the B-supply to the rf-if amplifiers, but none on the video amplifier, the hum bars disappear when the TV picture is "killed" by removing or disabling one of the tubes in the picture-if amplifier. (It should be noted that faint hum bars can be seen on almost any receiver when the raster is viewed in a darkened room at low-brightness level.)

3. 120-cycle change in width between the top and bottom of the raster, caused by hum voltage in the B-supply for the horizontal-deflection section. The change in raster width is present with or without a TV picture. Under normal conditions, the left- and right-hand edges of the raster are substantially straight and parallel.

4. 120-cycle horizontal picture pulling (two cycles of variation in horizontal-sync phasing), caused by hum voltage in the B-supply for the horizontal-afc section, the sync-separator section, the video amplifier, or the rf-if amplifier.

If the hum voltage is present only in the horizontal-afc or sync-separator sections, the pulling will not be accompanied by hum bars. If the hum voltage is present in the rf-if or video amplifiers, the pulling is generally accompanied by hum bars.

When some or all of the above symptoms are present, it is advisable to check the B-supply filter circuit. A simple check can be made by connecting an external electrolytic capacitor temporarily across each of the suspected filter capacitors, in turn, and noting whether the symptoms disappear.

### 60-Cycle Hum Symptoms

It is well to remember that 60-cycle supply voltage is present only in the power transformer, the power-

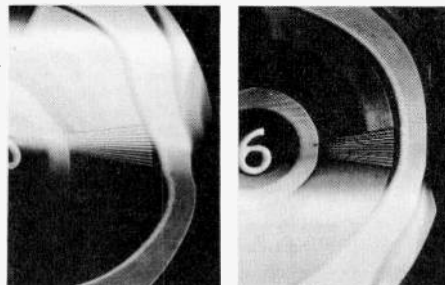


Fig. 2. One cycle of change in brightness (60-cycle hum bars) and one cycle of horizontal pulling, between top and bottom of picture, indicates heater-cathode leakage in the rf, if, or video amplifiers. The trouble in this example was caused by a defective tube in the picture-if amplifier. The 60-cycle leakage current flows through the cathode resistor and modulates the TV signal. The position of the hum symptoms is shifted, as shown above at left and right by reversing the power-cord plug.

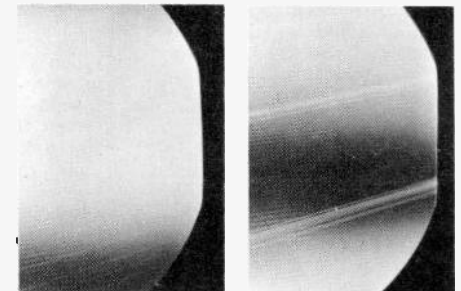


Fig. 3. The presence of 60-cycle hum bars on the raster alone (without TV or other signal) indicates heater-cathode leakage in the video amplifier section, which includes the 2nd detector, dc restorer, and kinescope. Normally, the vertical oscillator tends to sync on the leading edge of the dark bar, as shown above at left. The entire dark bar may be brought into view by adjusting the vertical hold control, as shown above at right. The leakage in this example was simulated by connecting a 1000-ohm resistor from the cathode to the ungrounded heater terminal in a video stage that has a 330-ohm cathode resistor. (Refer to Fig. 5.)



rectifier plate circuit, and the heater circuits. The transformer and the rectifier plate circuit are rarely responsible for producing 60-cycle hum symptoms; a few exceptions are noted later. Visible symptoms of 60-cycle hum can almost always be traced to the heater circuits, or more specifically, to heater-cathode leakage in a tube. Such leakage permits the effect of the 60-cycle heater voltage to get into the television circuits via the cathode circuit of the tube.

Leakage between the heater and cathode of a tube may be caused by (a) faulty insulation between the two elements, or by (b) emission of electrons from heater to cathode, or vice versa, depending on the voltage difference and polarity of the two elements.

Leakage of any type between heater and cathode results in a flow of 60-cycle "hum" current through the cathode circuit during at least a portion of each 1/60th second. Such leakage current may or may not produce audible or visible hum symptoms, depending largely on the value of any resistance or 60-cycle impedance in the cathode circuit. Even a small amount of leakage current is likely to cause hum symptoms if there is a high value of resistance or 60-cycle impedance in the cathode circuit. Conversely, a large amount of leakage current is unlikely to cause hum trouble if there is no resistance or 60-cycle impedance in the cathode circuit.

The above factors (the voltage difference, and polarity, between heater and cathode, and the value of resistance or 60-cycle impedance in the cathode circuit) account for the fact that a particular tube may cause hum trouble when it is used in one circuit of a receiver, but may operate without any sign of hum trouble when transferred to a different circuit.

Diode circuits, such as second detectors, dc restorers, horizontal-sync discriminators, and FM-sound discriminators, usually have a high value of resistance in the cathode circuit, and therefore are easily affected by heater-cathode leakage.

When the visible hum symptoms occur at 60 cycles, which generally indicates heater-cathode leakage, the following information may be

applied in localizing the faulty tube:

1. 60-cycle hum bars, or one cycle of change in brightness between the top and bottom of the picture, as shown in *Figures 2 to 7*, inclusive.

Temporary "kill" the picture by removing a tube from the picture-if amplifier if necessary. If the hum bars remain present on the raster, it indicates that the trouble is in the video amplifier, which includes the second detector, the dc restorer, and the kinescope. Try new tubes in this section.

When a tube with heater-cathode leakage is used in the video amplifier, which has good response at 60-cycles, the hum voltage passes through the amplifier and appears on the kinescope, regardless of whether a signal is passing through the receiver.

If the hum bars disappear when the picture signal is killed, it indicates that the trouble is in the rf or picture-if amplifiers, including the rf oscillator and the converter. Try new tubes in these sections.

60-cycle hum voltage, produced by heater-cathode leakage in an rf or picture-if tube, cannot by itself pass through these amplifiers which respond only to rf or if signals. However, such hum voltage, can and does act to modulate any rf or if signal that is passing through the amplifiers. *For this reason, the effects of heater-cathode leakage in the rf or if amplifiers do not appear on the kinescope unless a signal is being received.* The signal does not have to be from a TV station. It can be "grain noise," FM, or other signals, as shown in *Fig. 4*.

As mentioned previously, there is unlikely to be hum trouble from heater-cathode leakage in stages where the cathode is connected directly to the chassis or B-. This fact can sometimes be used to advantage in isolating a faulty tube. For instance, if the symptoms indicate that the hum trouble is caused by heater-cathode leakage in the rf or picture-if amplifiers, it is possible, in many receivers to temporarily short out the cathode resistor of each stage, in turn. The hum symptoms will disappear when the cathode resistor of the faulty tube is shorted out. This method is useful

only where the normal operation of the stage is not seriously altered when the cathode resistor is short circuited. It is not advisable, in any case to short out a cathode resistor permanently. The correct remedy, after isolating the faulty tube, is to install a new tube.

2. 60-cycle horizontal picture pulling, or one cycle of horizontal pulling between the top and bottom of the picture, as shown in *Figures 2, and 6 to 9*.

When 60-cycle horizontal picture pulling occurs, without accompanying 60-cycle hum bars, as shown in *Figures 8 and 9*, the trouble is most likely to be found in the horizontal-afc and oscillator sections, or in the sync-separator section. Heater-cathode leakage in these sections may produce 60-cycle variation in horizontal-sync phasing, which appears as 60-cycle horizontal picture pulling. *The pulling is present only on the picture, not on the raster, and it disappears when the TV signal is removed.* The remedy is to try new tubes in these sections.

There are many additional reasons for horizontal picture pulling. For further information on this subject, the reader is referred to an article by the author entitled "Horizontal Pulling," which appeared in the March and April 1951 issues of "Radio and Television News."

3. Combination of 60-cycle hum bars, and 60-cycle horizontal picture pulling, as shown in *Figures 2, 6, and 7*.

The effects of hum voltage due to heater-cathode leakage in a tube in the rf, if, or video amplifiers may produce both 60-cycle hum bars and 60-cycle horizontal pulling. The presence of the 60-cycle hum bars indicates that the trouble is ahead of the kinescope (in the rf, if, or video amplifiers). The procedure for localizing the faulty tube is, therefore, the same as given previously under item 1 for "60-cycle hum bars."

Again it is pointed out that the second detector, dc restorer, and kinescope are part of the video-amplifier section—heater-cathode leakage in these tubes produces the same type of hum symptoms as those produced by the amplifier tubes in the video section.

### Stationary and Moving Hum Symptoms

Hum bars and horizontal pulling (resulting from hum trouble in the receiver) may remain stationary or may move slowly or rapidly up or down on the picture. In either case, the effect depends on whether or not the ac line supplies for the receiver and the TV camera are in sync. There is no practical way to control this effect at the receiver.

### "Hum Symptoms" Due to External Interference

External interfering signals with 60- or 120-cycle AM or FM modulation (such as generated by some types of diathermy equipment) may produce visible symptoms similar to internal hum. When the hum symptoms are produced by external interference, they are usually accompanied by a visible beat.

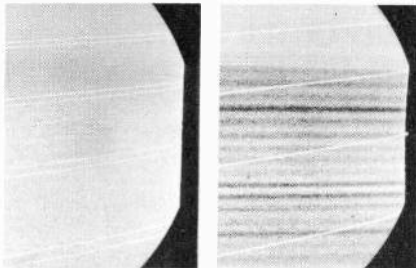
In the case of 60-cycle hum symptoms, a simple and positive check can be made by reversing the power-cord plug. If the 60-cycle hum bars or horizontal pulling are caused by internal hum trouble, such as heater-cathode leakage, the hum symptoms will shift in position by about one-half of the height of the picture whenever the plug is reversed. Reversal of the plug has no effect on the position of "hum symptoms" resulting from external interference.

### A Few Exceptions

1. Visible hum symptoms resulting from trouble in the B-filter circuit normally occur at 120 cycles, but in the rare case where one-half of a full-wave rectifier circuit opens, any resulting hum symptoms occur at 60-cycles.

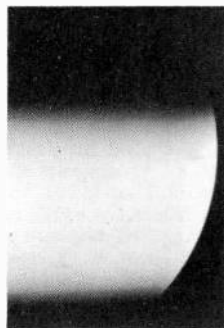
2. The filter capacitor at any one of the output taps on the B supply usually serves to prevent common coupling between the sections of the receiver that are fed from the particular tap. If the capacitor opens, there may be interaction between the sections. For example, an open filter capacitor in the B-feed to the vertical-output section may permit vertical-deflection voltage to set up 60-cycle hum symptoms in other sections. In general, when it is observed that signals in one section are modulating other sections, it is advisable to check the filter capacitors.

(Continued on Page 7, Col. 4)

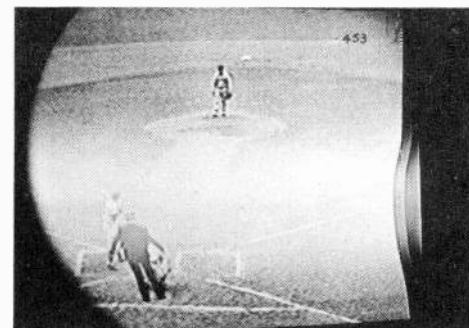
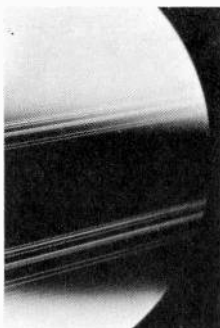


*Fig. 4. Heater-cathode leakage in a tube in the rf or picture-if amplifier modulates any signal passing through these amplifiers, including "grain noise" or "snow" signals, as shown at left, or FM signals, as shown at right. Note that in each case the top portion of the raster is devoid of signal. The leakage current reduces the gain of the stage during the time corresponding to the blank portion.*

The same effect is evident at the center of *Fig. 6*, and the top and bottom of *Fig. 7*. Like many other troubles in electronic equipment, heater-cathode leakage can be intermittent, starting or stopping as the tube warms up. The particular tube used when these photographs were made had intermittent heater-cathode leakage.



*Fig. 5. Same trouble as in Fig. 3, except that the heater-cathode leakage is 400 ohms instead of 1000 ohms; note that the 60-cycle hum bars are more pronounced.*



*Fig. 6. In addition to 60-cycle change in picture brightness, heater-cathode leakage in the rf, if, or video amplifiers may also produce 60-cycle horizontal pulling in the picture. Both effects are evident in this example, which was produced by heater-cathode leakage in a tube in the picture-if amplifier (Refer to Fig. 7 and the note at the end of the caption for Fig. 9.)*

# RCA INSTITUTES OPENS HOME-STUDY COURSE TO TELEVISION INDUSTRY

Specialized, Field-Tested Television Home-Study Program Planned to Increase Efficiency of Existing Manpower Pool.

In a major move to circumvent the rapidly developing shortage of trained television servicemen, RCA Institutes, Inc., one of the nation's oldest electronics training schools, has made available to the industry a highly specialized, field-tested television home-study course for training television servicing technicians.

Developed jointly by the RCA Service Company and RCA Institutes, for use in training RCA Service Company technicians, the course resulted from a 14-month study in the field, according to General George L. Van Deusen, President of RCA Institutes. Revised and amplified, it is now being made available to the entire radio and television industry.

Representing a compilation of practical "how-it-works" information with pre-tested "how-to-do-it" techniques, the course is planned to extend the work potential of the existing man-power pool by supplementing the knowledge and improving the techniques of servicemen now on the job. The course embodies both the RCA Service Company's background of experience in the television service field and the invaluable knowledge gained from application of the course to its own training program during the past 17 months.

The course has been edited and broadened to provide engineering

information and servicing data on all major makes of television receivers. It will be limited to working members of the radio and television industry, but previous service experience is not required. Self-employed independent radio and television servicemen are eligible. Special rates will be available to employers desiring to enroll six or more employees.

Designed to meet the special needs of the servicing industry, as determined by months of on-the-job study with RCA servicemen, this Television Home Study Course emphasizes practical, pre-tested installation and servicing procedures, and pre-supposes that the student is actually working in the industry. Its purpose is not only to make servicemen, but to make better ones.

In addition, the course aids in the rapid conversion of installation men into service technicians, and represents supplementary training which makes practicable the hiring of inexperienced trainees.

Emphasizing the importance today of any medium which offers service agencies the means for improving the over-all efficiency of their operations, E. C. Cahill, President of the RCA Service Company, declared that the service industry must face the fact that it is a "young man's" industry and that

the military draft and the expanding national defense program are siphoning trained technicians out of the manpower pool faster than they are being replaced.

"However, within the industry today there are numerous technicians who, but for the want of specialized training, could be employed to help meet the increase in service requirements and the decrease in the number of available servicemen. By our own application of this Television Home Study Course during the past year and a half, we have discovered the importance of specialized training in helping us meet our increasing requirements," Mr. Cahill declared.

Approved by the New York State Department of Education, the Television Home Study Course consists of 10 lesson units, the first of which is mailed to the student upon enrollment. Each unit contains a home assignment which covers the material presented. Completed by the student and returned to RCA Institutes, the assignment is reviewed and graded by a qualified instructor. The assignment is then returned to the student with appropriate comments and advice, and the next unit is furnished to the student.

Constant re-editing has kept the course up to date with advanced



developments in television engineering and practical servicing techniques. As a result, the Television Home Study Course emerges as an expansion of the program developed by RCA Institutes, and the RCA Service Company for use by the latter's technicians.

Development of the course was begun in the Fall of 1948; for nearly 14 months, study-course engineers of RCA Institutes, Inc., worked side by side with RCA Service Company training specialists and technicians in the company's branch offices, in its work shops, and on the job. From this day-to-day study emerged the essential information and background required to develop a study course that could be integrated with any given technician's professional assignments.

A detailed course outline, together with further information regarding tuition rates and enrollment forms are available on request from the Home Study Division, Room 300, RCA Institutes, Inc., 350 W. 4th St., New York 14, New York.



## INSTRUCTION BOOKLETS ON RCA TEST EQUIPMENT NOW AVAILABLE

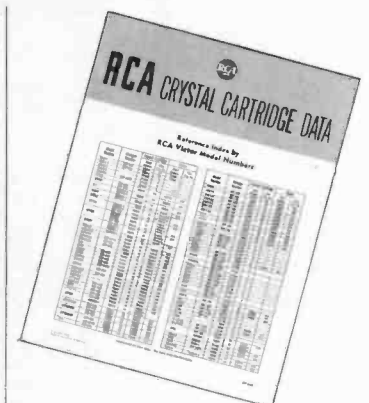
Until recently, instruction booklets on RCA test equipment were supplied only to the purchasers of such equipment. Due to the demand created by consistent and numerous requests for these instruction booklets, booklets on the following current RCA instruments are now available at 50 cents each: WR-

39C, WR-59B, WO-57B, WV-97A, and WO-56A. Instruction booklets on some earlier models of RCA test equipment are available at comparable prices. All orders for these booklets should be sent to Commercial Engineering, Harrison, New Jersey.

## NEW DATA SHEET CONTAINS CRYSTAL-CARTRIDGE REPLACEMENT DATA FOR ALL RCA PHONOGRAPHS

An enlarged and completely revised Crystal-Cartridge Data Sheet (Form No. SP-1010) is now available from your RCA Distributor.

The new data sheet covers all RCA phonographs, radio-phono combinations, and TV-radio-phono combinations which utilize a crystal pickup. Highlighted in the revised data sheet is the simplified model reference for rapid determination of the correct RCA replacement crystal and stylus. For the difficult replacement problem where the model number is unknown, a quick check of the shape of the crystal cartridge against the outline drawings on the data sheet will identify the correct crystal replacement.



**NEW RCA TUBE CAMPAIGN**

*(Continued from Page 1)*

theme is strikingly expressed in a six-color, three-dimensional window display which shows the radio and television service dealer and his co-workers in community welfare, the fireman, policeman, doctor, and nurse. A small version of this display is provided for use on store counters.

To further aid the service dealer in the local promotion, a comprehensive line of sales and servicing aids, which reflect the "Serving the Community" theme, has been prepared. These include a complete direct-mail campaign, and three illuminated signs.

The three signs provide attractive decoration and bright illumination for the service dealer's premises. A "Fireball" floodlight sign, stressing dependable service, is designed as either a nightlight or as a source of illumination to highlight test equipment and merchandise. A plastic-and-metal "Fireglow" sign, with the identification "Television-Radio Service," is designed for the shop window; this sign provides high daytime visibility and a brilliant white glow at night. A "Pin-Up-Lamp," for the wall, corner or shelf, identifies the service dealer as the local outlet for RCA tubes, batteries, and parts.

The direct-mail campaign consists of four two-color, pre-stamped post cards. Copy on the post cards stresses prompt, friendly service, and points to the service dealer as the neighborhood headquarters for radio and television service. A follow-up card serves as a reminder for repeat service business.

A metal plaque, framed in solid oak, displaying the world-famous RCA trademark in red and white, is available for in-store use. The distinctive RCA Trademark Plaque is one of the most popular promotions ever produced by RCA. Handsome, attractive and colorful, this plaque



Also an eye-catcher—this display set focuses the spotlight squarely on the serviceman.

radiates class and good taste, and symbolizes the most famous name in radio and television.

For mounting on walls or doors, there is a distinctive banner decal, in the familiar RCA red-and-white colors, with the legend "Television-Radio Service." This is another lasting kind of promotion that identifies your shop with the unequalled reputation of RCA products.

The RCA 1951 Tube Inventory and Movement Guide is a 16-page booklet designed to provide at-a-glance status of tube stocks throughout the year. With this guide, the service dealer can determine immediately the quantity of each tube

type that he sold during the previous month, how latest sales compare with those of previous months, how many of each tube type should be ordered for a balanced inventory, and how to determine normal tube stock by each tube type.

These sales promotion items are intended to further associate the local service dealer with the RCA brand name, known and respected in every community. Further details on this effective tube campaign are included in a 16-page booklet entitled "Gateway to Opportunity in Radio-Television Servicing"—get your copy from your RCA distributor.

**TELEVISION SERVICE**

*(Continued from Page 5)*

3. If 60-cycle hum bars remain present on the raster when the picture signal is killed, it generally indicates heater-cathode leakage in the video amplifier. In very rare cases, an exception may be found in the presence of a strong 60-cycle ac field from a power transformer located too close to the socket-end of the kinescope. An example of this rare effect is shown on K-3 in the RCA Television Pict-O-Guide\* (Vol. 1).

\*Copyright 1949 Radio Corporation of America



Fig. 7. Same condition as in Fig. 6, except that the position of the hum symptoms has been shifted by reversing the power-cord plug.

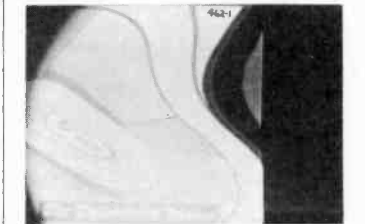


Fig. 8. 60-cycle horizontal picture pulling, without any 60-cycle change in brightness, indicates that the trouble is in the horizontal-afc or oscillator sections, or in the sync separator. The absence of 60-cycle hum bars indicates that the trouble is not in the rf, if, or video sections. The horizontal pulling shown in this example was produced by heater-cathode leakage in a horizontal-afc tube. The pulling is evident only when a TV signal is being received; it is not present on the raster alone. (See the note at the end of the caption for Fig. 9)

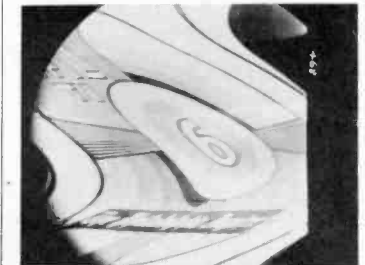


Fig. 9. Severe 60-cycle horizontal picture pulling produced by heater-cathode leakage in a horizontal-afc discriminator. Horizontal picture pulling results from variation in horizontal sync phasing. (Note—In making the photographs for Figures 6, 7, 8 and 9, the picture on the kinescope was intentionally moved toward the left in order to bring the right-hand edge of the raster into view to show that the edge of the raster is straight; horizontal picture pulling does not affect the shape of the raster.)

**RECORD ATTENDANCE AT TV SERVICE MEETING SPONSORED BY RCA DISTRIBUTOR**



F. C. Hayer Co., Minneapolis distributors, enjoyed the largest turnout in their series of TV service meetings when 260 dealers and servicemen came to the final meeting on Jan. 15. Because of the expected large attendance, the meeting was held in the main ballroom of the Nicollet Hotel in Minneapolis. Max Owensby, RCA factory representative, and E. D. Wood, F. C. Hayer Co. service manager, conducted the clinic. Plans are now being drawn for a new series of special meetings on alignment procedures with attendance limited to 25-30 per meeting, so that actual tests may be made by each person attending.

**VOL. V OF RCA VICTOR SERVICE DATA IN STOCK**

*(Continued from Page 1)*

Available for immediate delivery, Volume V is priced at \$5.00 per copy; Volume VI for 1950 is now in preparation. All RCA Victor Service Data Books may be obtained from your RCA Distributor.

POSTMASTER: If undeliverable for any reason, notify sender, stating reason, on Form 3547, postage for which is guaranteed.

From

RCA TUBE DEPARTMENT  
HARRISON, N. J.

RCA Batteries are  
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**RADIO SERVICE NEWS**

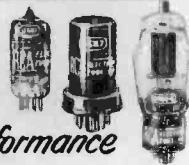
RCA Radio Service News is published by the RCA Tube Department in the interest of radio servicemen and dealers everywhere. It is distributed free of charge to members of the radio-service fraternity through the courtesy of RCA and its tube, battery, test equipment and parts distributors.

**"SERVING THE COMMUNITY"**  
YOUR NEIGHBORHOOD RADIO-TELEVISION TECHNICIAN



We use **RCA TUBES**

for long life and dependable performance



*Let's talk about you...*

You're the radio and television serviceman up the street or around the corner who helps the show go on. The full importance of your services is not recognized until somebody's receiver goes bad. Then you're needed . . . just as a policeman or a doctor or a fireman is needed when the occasion arises. You're that important to your community.

We think people ought to be told about you. So, we decided to talk about you in a full-color display you can

place in your window and on your counter . . . to remind folks that you—the radio and television technician—recognize and live up to your responsibilities as a member of the community.

We owe it to you—and you owe it to yourself—to sell your community on your services. Your local RCA Tube Distributor has a complete packaged promotion built around the Community Service theme. See him today.

*Keep informed—keep in touch with your RCA Tube Distributor.*



**RADIO CORPORATION of AMERICA**  
ELECTRON TUBES  
HARRISON, N. J.