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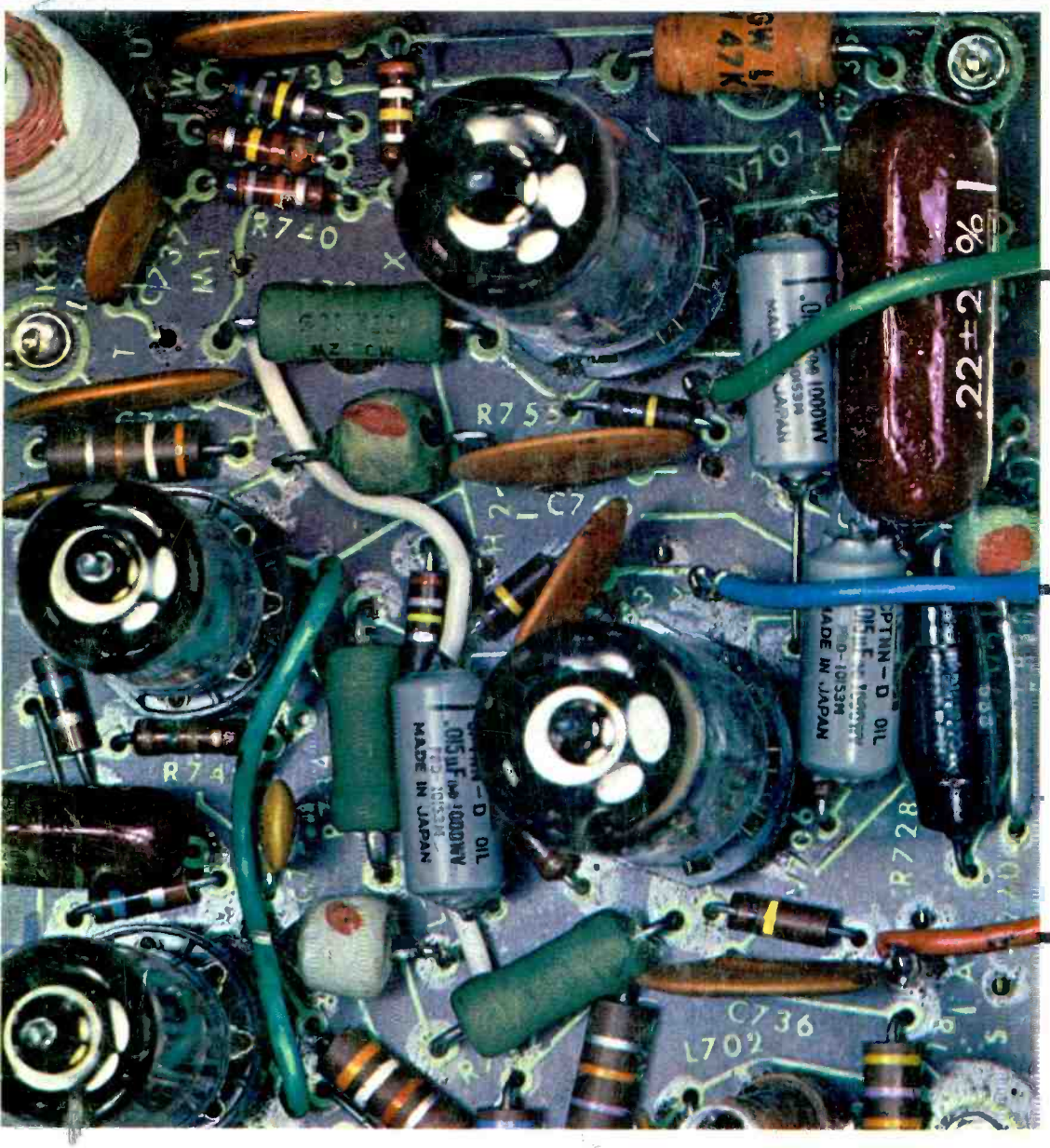
MAY 1966/50¢

PF Reporter™

PHOTOFACT

the magazine of electronic servicing



XYZ CIRCUIT REPAIR

- Chasing Troubles in Stereo-On Indicators
- Locus of the Focus
- Keyed AGC
- Leave Those Parts in the Circuit
- New Tube and Transistor Data
- Stereo-FM Station Guide

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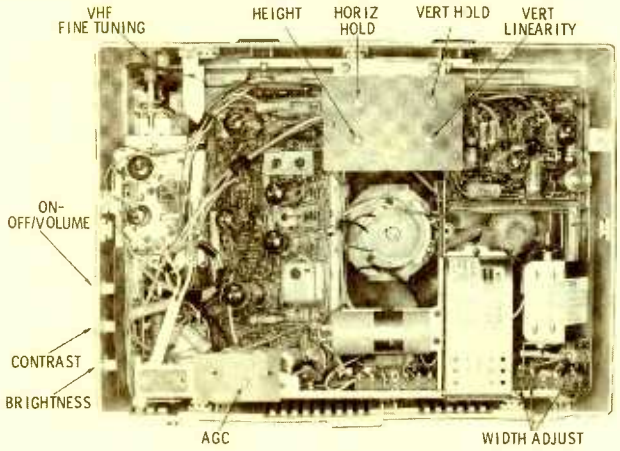
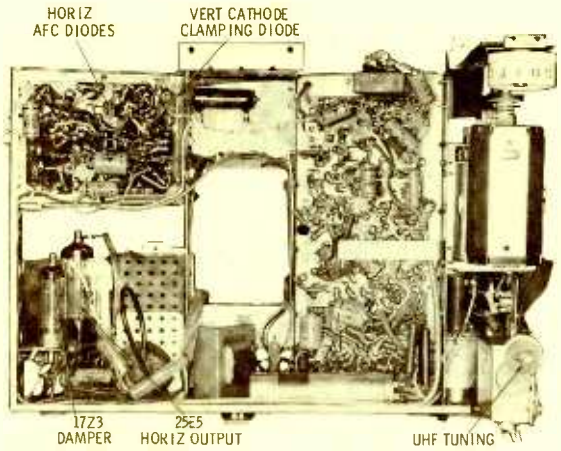
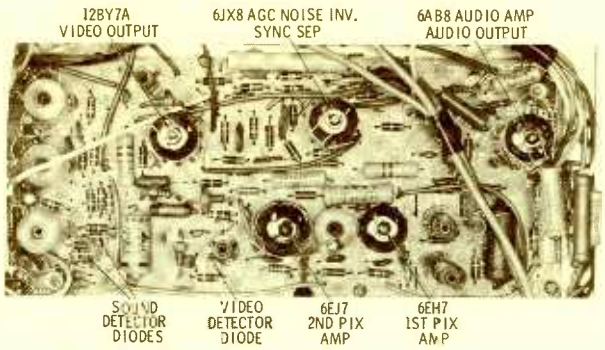
Circle 1 on literature card

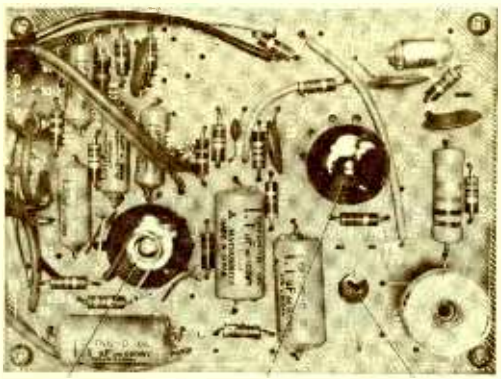
.....PREVIEWS of new sets

Arvin









Arvin Model 65K28
Chassis—1.87803

Here is a late-production version of Arvin's 16" B-W portable. Manufactured in Japan by Matsushita, the set contains an AW40-12 picture tube and two vertically mounted circuit boards. A total of 12 tubes and 10 semiconductors are used including four transistors.

A horizontal oscillator circuit change has placed the horizontal frequency centering adjust in series with the horizontal hold control. Both controls are now connected between the AFC cathode and the oscillator grid.

The transformerless low-voltage supply uses two silicon rectifiers to develop B+. A 1.6-amp line fuse provides protection for the low-voltage supply and the series filament string. A 4.7-ohm fusible resistor provides additional surge protection for the rectifiers.

Focusing is accomplished by connecting the lead from pin 4 of the picture tube to one of four taps on the left side of the sweep circuit board. A jumper arrangement for adjusting the horizontal width is located on the lower right side at the rear of the set.

The VHF channel selector and fine tuning control are located on the left side of the cabinet top. The VHF fine tuning uses a separate control which adjusts the slug of each oscillator coil through a belt-driven gear shaft. The VHF tuning control is located on the front bottom left of the cabinet. Brightness, contrast and on-off/volume are situated on the bottom left side of the cabinet. Height, vertical hold, horizontal hold, and vertical linearity controls are grouped together at the top rear of the set. AGC control is also located on the rear of the set.

PF REPORTER, May, 1966 Vol. 16. No. 5 PF REPORTER is published monthly by Howard W. Sams & Co., Inc., 4300 W. 62nd, Indianapolis, Indiana 46206. Second-class postage paid at Indianapolis, Indiana. 1, 2 & 3 year subscription prices; U.S.A., its possessions and Canada: $5.00, $8.00, $10.00. Other countries: $6.00, $10.00, $13.00. Current single issues 50¢ each; back issues 65¢ each.

G.E. PREVIEWS of new sets

General Electric Model M1937ACL
Chassis—CTCA428

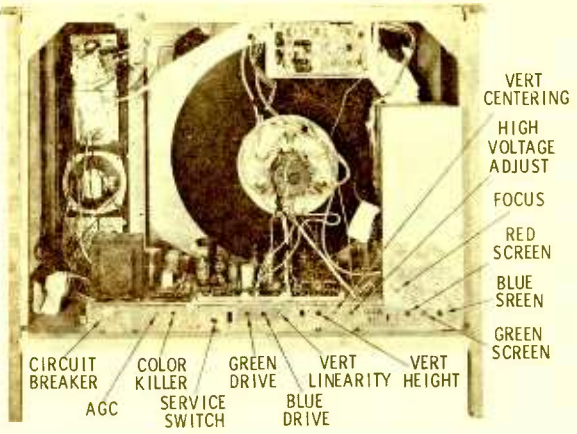
The 21" color console pictured here employs a 21FJP22 picture tube and a transformer-powered chassis which has changed little from previous color chassis. The number of tubes used on the main chassis has been reduced to 20 by the use of five compactrons.

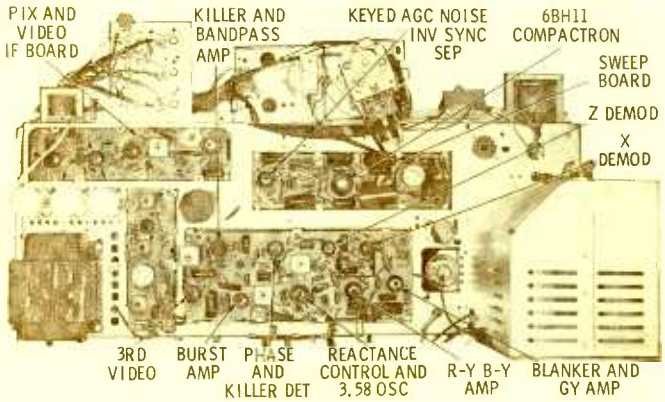
A 6BH11 double-triode-pentode compactron serves the horizontal oscillator, reactance, and discharge circuits. Another compactron, a double-pentode 6AL11, is used in the sound demodulator and audio-output stages. The vertical-oscillator and vertical-output stages share a double-triode 6FM7 compactron. Other compactrons used are a 3AT2 as the high-voltage rectifier and a 6BE3 diode in the damper circuit.

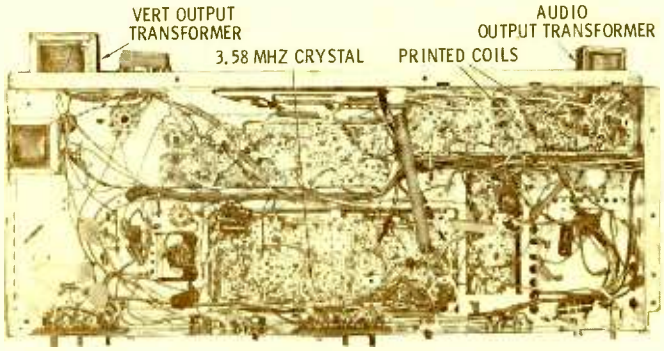
A 6LF8 triode-pentode is used in the first and second video amplifiers in place of a 6AW8A triode-pentode. The horizontal output tube has also been changed, with a 6JS6A pentode replacing the 6HF5 pentode previously used. The 6JS6A suppressor grid is grounded externally instead of connected internally to the cathode, as in the 6HF5.

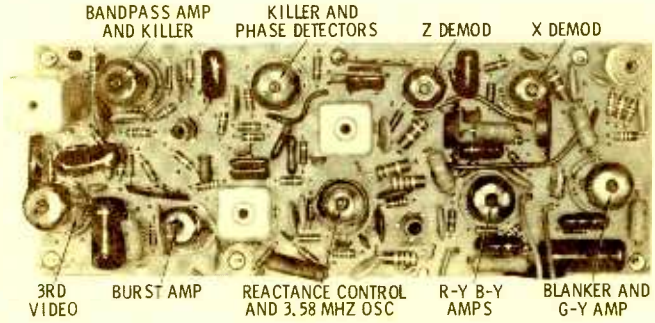
A full-wave voltage doubler is used in the low-voltage power supply. A reset-type circuit breaker provides B+ overload protection. The main parallel filament string is protected by a fuse wire.

A zener diode, mixer diode, and transistor oscillator make up the solid-state UHF tuner. An all-channel tuning system provides illuminated channel indication for both VHF and UHF channels and in addition, features a single control for VHF fine tuning or UHF tuning. VHF fine tuning involves pulling the spring-loaded knob outward and turning it. The knob returns to its original position when released and is then used for UHF tuning.

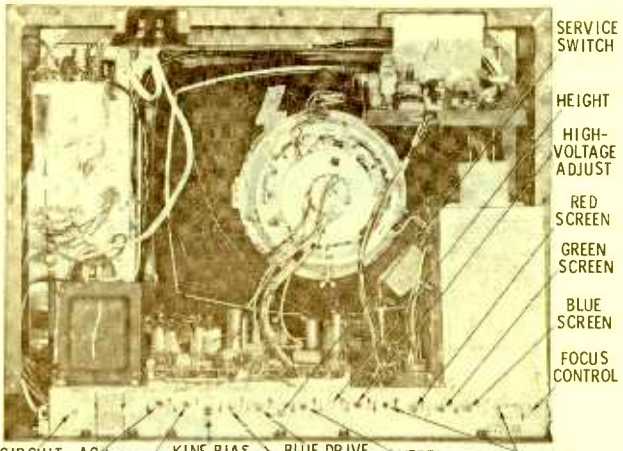


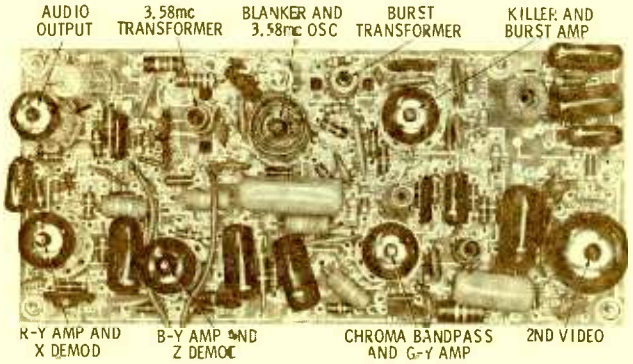


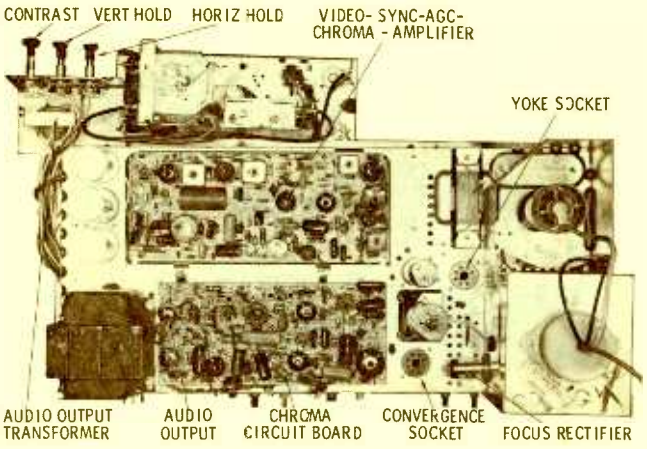


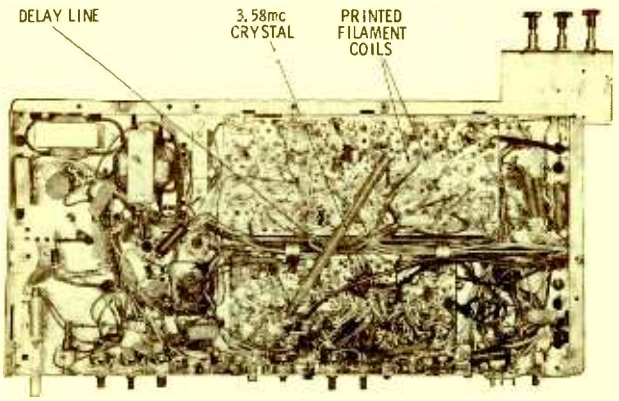


RCA









RCA Model—FG525E, W
Chassis—CTC19A

The 19″ table model color set shown above is housed in a vinyl-covered metal cabinet and uses a 90° rectangular 19EYP22 picture tube. Two circuit boards and a total of 23 tubes are used in the new compact chassis.

6GH8A triode-pentodes are used exclusively for all functions in the chroma circuits. The triode section of one 6GH8A is used as the first video amplifier, with the color and sync signals taken off the grid/cathode circuit of this stage and fed to the pentode section of the same 6GH8A, which serves as the sync, AGC, and chroma amplifier.

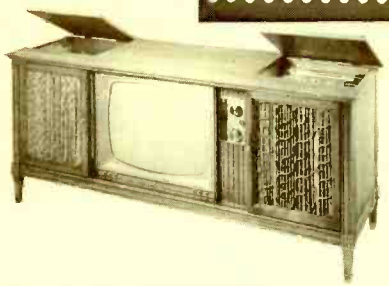
A new tube type, a 6KM6 pentode, is used in the horizontal-output stage. Other tube changes involve the replacement of the 6EW6 pentode normally found in the sound IF with a 6JC6 pentode, and the use of a 2AV2 as the focus rectifier and a 6BS3 in the damper circuit.

The low-voltage power supply is a full-wave bridge circuit using four silicon rectifiers. A reset-type circuit breaker provides protection for the B+ line, and a wire-link fuse is used in the main filament line.

The VHF tuner has four stages and employs a 6DS4 *nuvistor* triode in the grounded-cathode RF stage. A 6KE8 triode-pentode serves as the mixer/oscillator. Two concentric tuning knobs operate both the VHF and transistorized UHF tuner. The VHF tuner has 13 detent positions, plus a UHF-IF position. VHF fine tuning is accomplished by pushing in on the large outer knob. The UHF tuner is mechanically linked to the VHF fine-tuning shaft and is engaged unless the tuning knob is pushed in.

Sylvania

PREVIEWS of new sets



Sylvania Model 258C83

Chassis— DO2-6

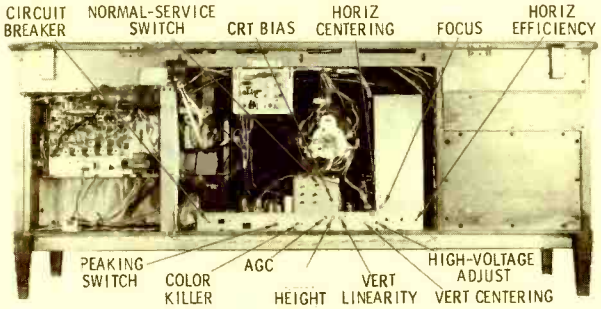
The photo above shows Sylvania's 25″ color model TV with AM-FM/-FM stereo radio/phono combination. Except for the larger picture tube, a rectangular RE25CP22, and a few circuit and tube changes, the TV chassis is not drastically changed from previous 21″ color models.

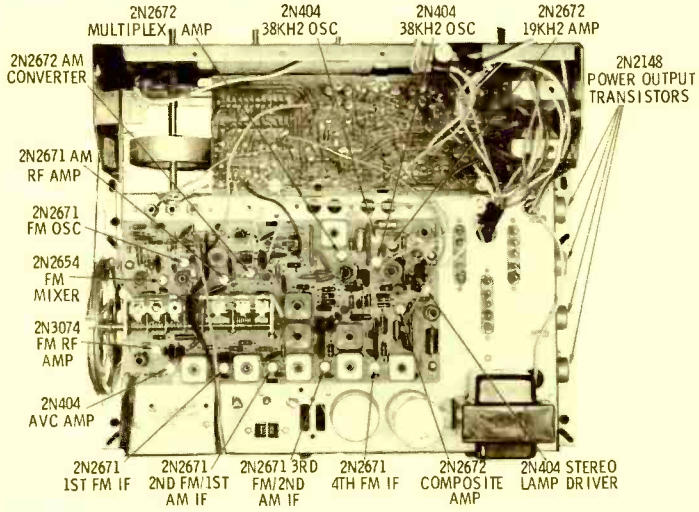
One tube type has been changed: The vertical oscillator/vertical output stage now uses a 6LU8 triode-pentode in place of the 6GF7 dual-triode previously used. The pentode section is used in the vertical-output stage.

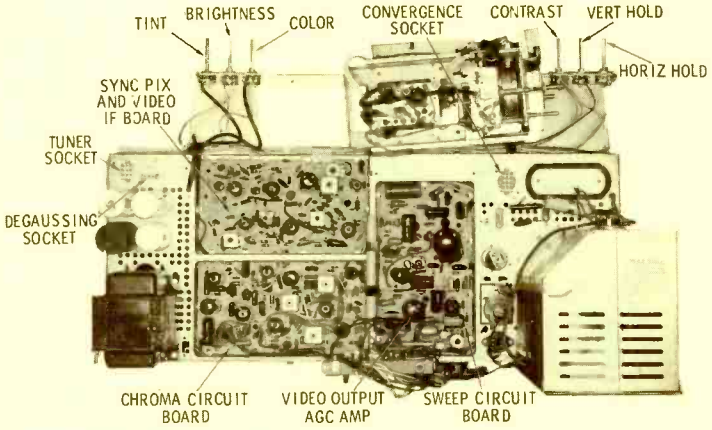
Two transistors and 16 solid-state diodes are used in the main TV chassis and UHF tuner. One transistor, a 2N306, is employed in the grounded emitter noise-gate circuit. The other transistor is used in the RF-oscillator stage of the UHF tuner.

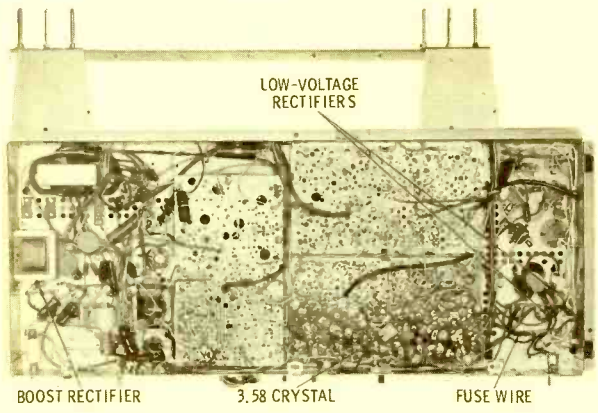
The low-voltage power supply employs two silicon rectifiers in a full-wave voltage doubler. Overload protection is provided by a reset-type circuit breaker with the main filament string protected by a fuse wire.

The AM/FM tuner, stereo amplifier, and power supply circuits are transistorized and combined on one chassis. The tuner consists of a seven-stage FM circuit using a four-stage IF, and a four-stage AM circuit with two IF's. FM multiplex, AFC, and AVC facilities are also included. The stereo amplifier channels contain a preamp, driver, and power-output stages. Two separate transformer-powered rectifier circuits make up the power supply. One, a full-wave circuit, provides operating voltages for the tuner and power amplifier. The other, a half-wave circuit, produces 4.5 volts for the stereo-indicator circuit in the tuner.









SEE PHOTOFACT Set 746, Folder 3

Mfr: Magnavox

Chassis No: C/U45-01-00 thru C/U45-04-00

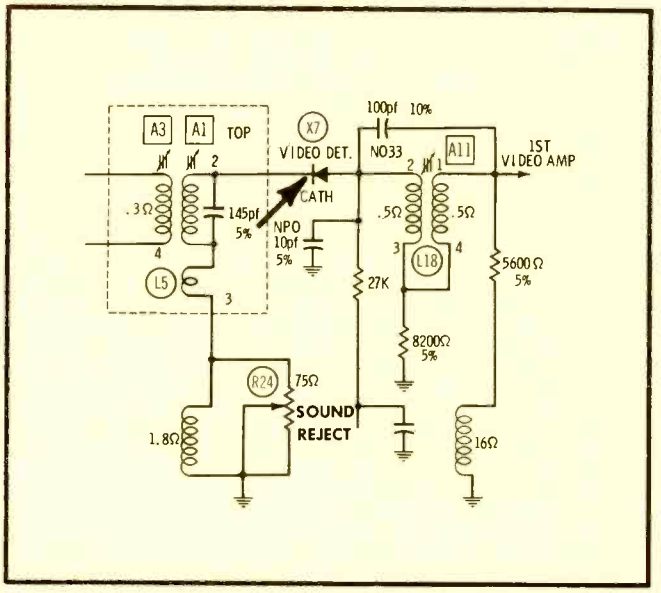
Card No: MAG 45-1

Section Affected: Pix.

Symptoms: Video overload; cannot be remedied by reducing video signal with contrast control.

Cause: Defective video detector.

What To Do: Replace video detector X7.



Mfr: Magnavox

Chassis No: C/U45-01-00 thru C/U45-04-00

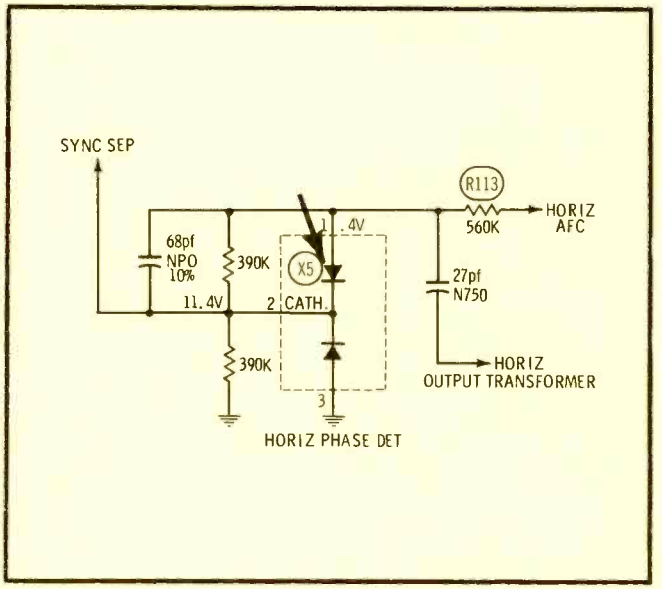
Card No: MAG 45-2

Section Affected: Sync.

Symptoms: Unstable horizontal sync.

Cause: Defective or unmatched dual-diode section in horizontal-phase detector circuit.

What To Do: Replace horizontal-phase detector unit X5.



Mfr: Magnavox

Chassis No: C/U45-01-00 thru C/U45-04-00

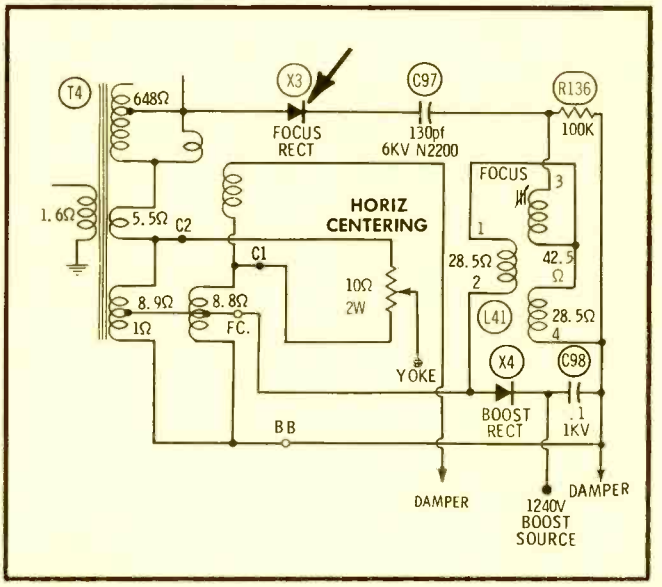
Card No: MAG 45-3

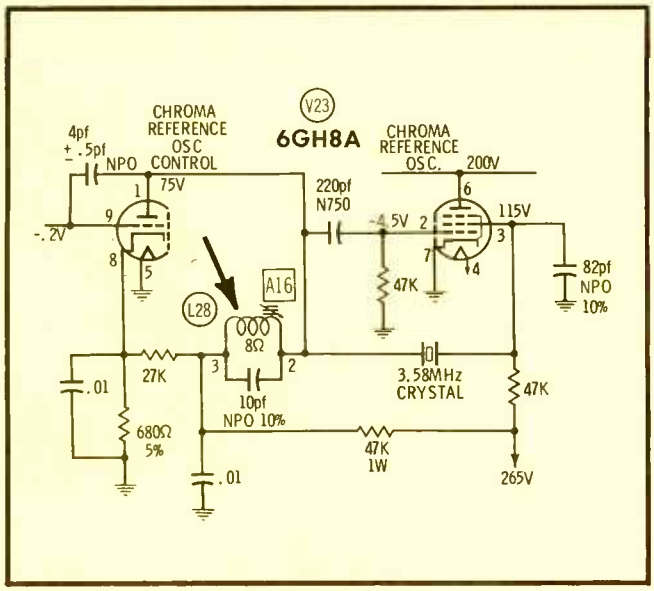
Section Affected: Raster.

Symptoms: Raster out of focus.

Cause: Open focus rectifier.

What To Do: Replace focus rectifier X3.





SEE PHOTOFACT Set 746, Folder 3

Mfr: Magnavox

Chassis No: C/U45-01-00 thru C/U45-04-00

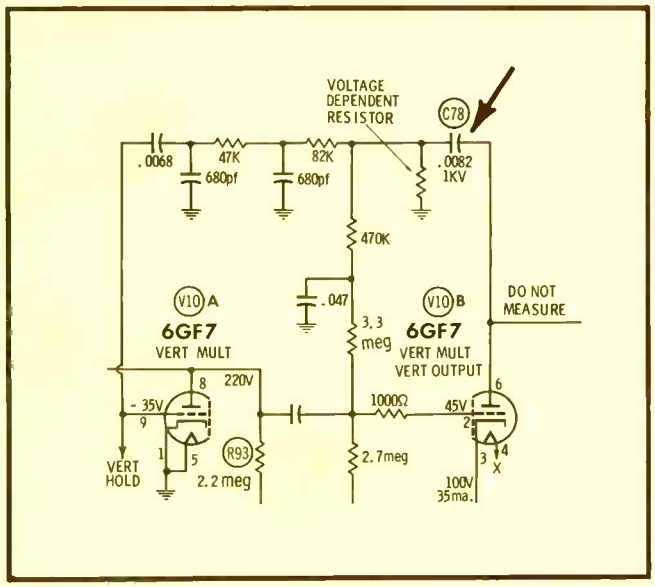
Card No: MAG 45-4

Section Affected: Pix (color).

Symptoms: Color fades in and out; cannot be properly adjusted.

Cause: Poor soldered connections in reactance coil.

What To Do: Resolder all leads in reactance coil L28.



Mfr: Magnavox

Chassis No: C/U45-01-00 thru C/U45-04-00

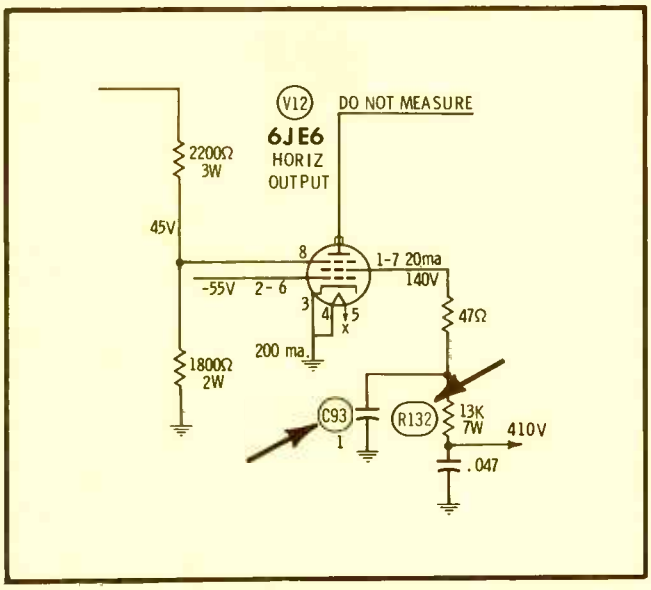
Card No: MAG 45-5

Section Affected: Raster.

Symptoms: No vertical sweep; low voltage at pin 8 of vertical multiplier.

Cause: Open feedback capacitor.

What To Do: Replace C78 (.0082 mfd, 1KV).



Mfr: Magnavox

Chassis No: C/U45-01-00 thru C/U45-04-00

Card No: MAG 45-6

Symptoms: Narrow or reduced width.

Section Affected: Raster.

Cause: Screen-grid resistor in horizontal-output tube circuit has changed value.

What To Do: Replace R132 (13k, 7w), and C93 (.1 mfd).

SEE PHOTOFACT Set 640, Folder 3

Mfr: RCA **Chassis No:** CTC12A, B, etc.

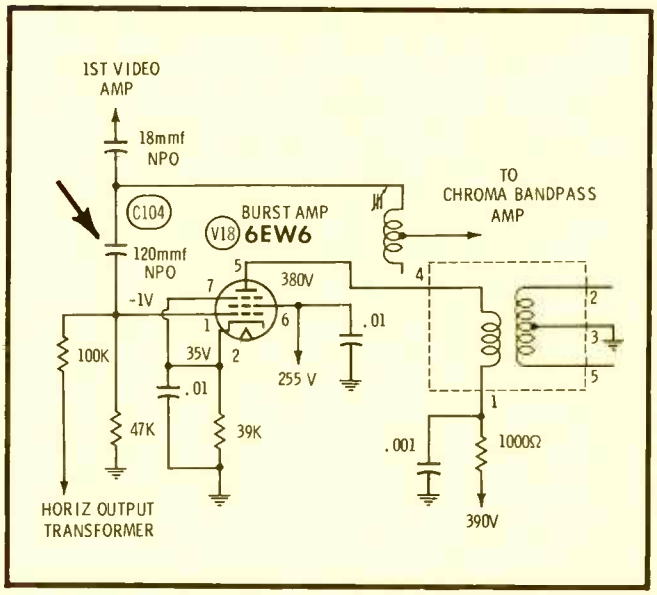
Card No: RCA CTC12-1

Section Affected: Color.

Symptoms: B-W pix not affected; all channels operating; no color signals coming through. Normal color hash on screen when tuning off-channel not present.

Cause: Coupling capacitor to grid of burst amplifier open, causing color information to be lost at this point. Voltages on tube normal.

What To Do: Using color-bar generator, signal trace back from chroma-bandpass amplifier to burst amplifier. Faulty stage will be localized when color signal is applied to first video amplifier. Replace C104 (120 mmf).



Mfr: RCA **Chassis No:** CTC12A, B, etc.

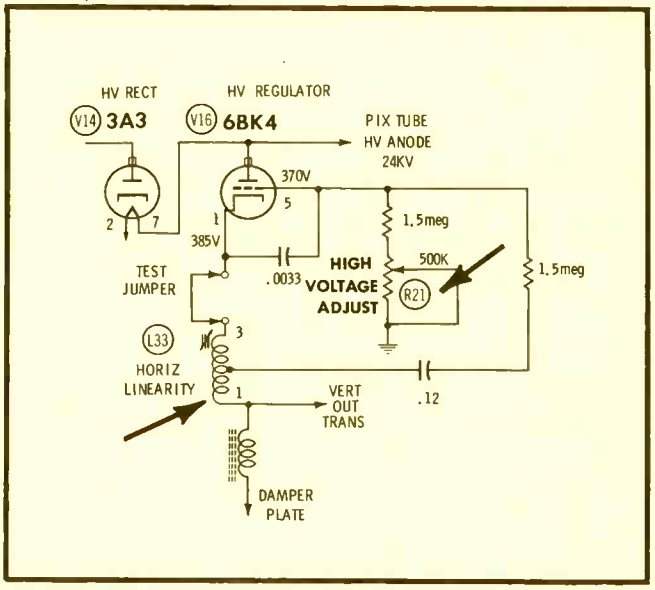
Card No: RCA CTC12-2

Section Affected: Pix.

Symptoms: When brightness is varied pix blooms and defocuses. Regulator tube burns out periodically. Excessive high voltage (correct value, 24KV). Cathode current in horizontal-output tube high (should be 210 ma). Cathode current in shunt regulator low (should be 850 μa).

Cause: Incorrect high-voltage adjustments.

What To Do: Perform high-voltage adjustment



Mfr: RCA **Chassis No:** CTC12A, B, etc.

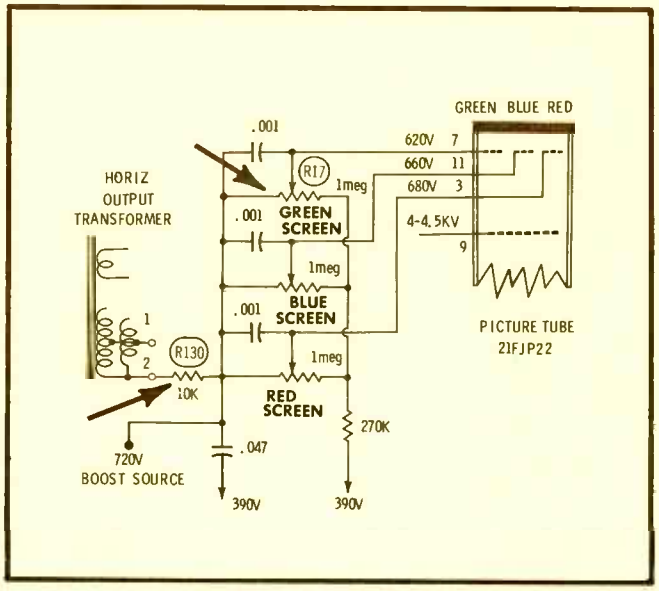
Card No: RCA CTC12-3

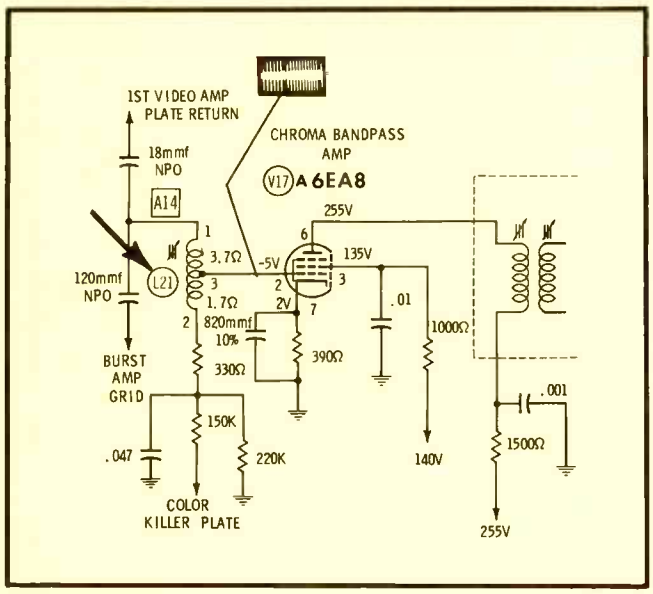
Section Affected: Raster.

Symptoms: No raster. Boost B+ supply resistor R130 overheats; reads short to ground on one side.

Cause: Green screen control shorted to ground through case of control causing boost and B+ voltage to short to ground. Supply resistor R130 in boost B+ supply burning. Focus rectifier possibly damaged due to overload. Screen controls must be removed from circuit to find faulty control.

What To Do: Replace shorted green screen control R17 and R130 (10K). Check focus rectifier and replace if necessary.





SEE PHOTOFACT Set 640, Folder 3

Mfr: RCA **Chassis No:** CTC12A, B, etc.

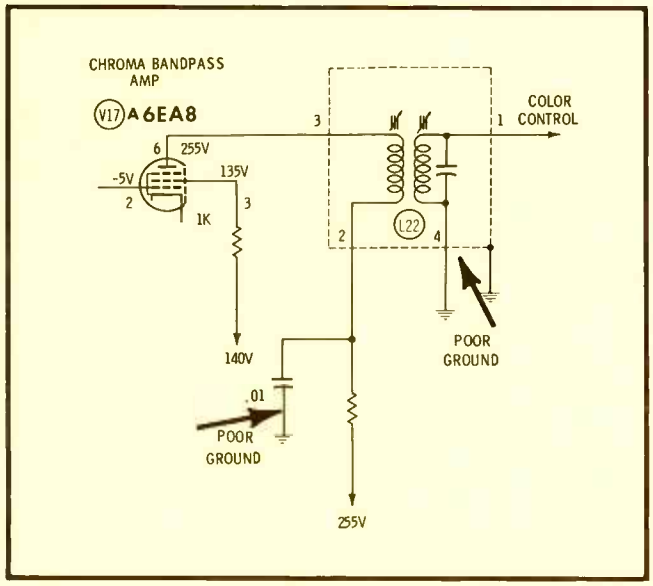
Card No: RCA CTC12-4

Section Affected: Color.

Symptoms: No color pix. B-W pix normal. All set functions are normal. Dot-bar color signal present at control grid of chroma-bandpass amplifier; signal does not appear at output of burst amplifier.

Cause: Open chroma-takeoff coil.

What To Do: Check resistance of chroma-takeoff coil L21; if open, replace or resolder.



Mfr: RCA **Chassis No:** CTC12A, B, etc.

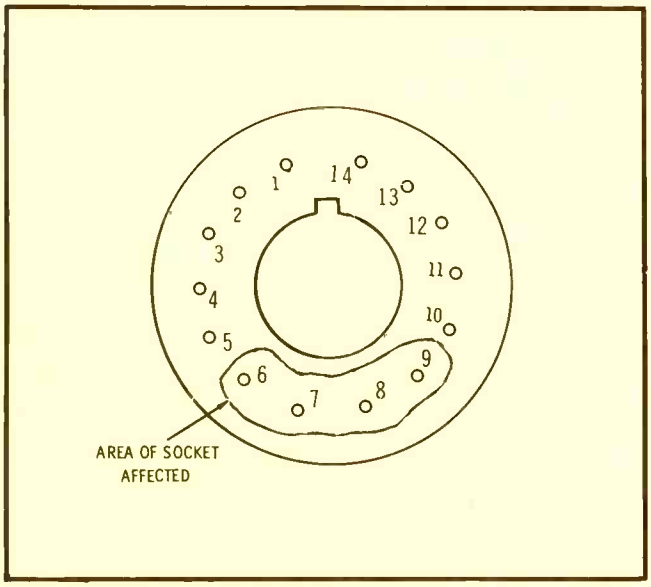
Card No: RCA CTC12-5

Section Affected: Color.

Symptoms: Color and B-W signals good, but become intermittent after set plays for 15 to 30 minutes.

Cause: Poorly soldered ground point on printed-circuit board.

What To Do: Let receiver heat up for one or two hours. A resistance check and mechanical stress of the printed-circuit board will reveal defective ground points; resolder.



Mfr: RCA **Chassis No:** CTC12A, B, etc.

Card No: RCA CTC12-6

Section Affected: Raster or Pix.

Symptoms: No raster, or poor focus when raster is present. Low focus voltage, reduced high voltage; when focus-supply voltage is disconnected from CRT socket, focus and high voltage return to normal.

Cause: High resistance leakage in CRT socket between pins 6, 7, and 9 causing low focus voltage and reduced high voltage.

What To Do: Replace CRT socket. Opening old socket will reveal carbonization.

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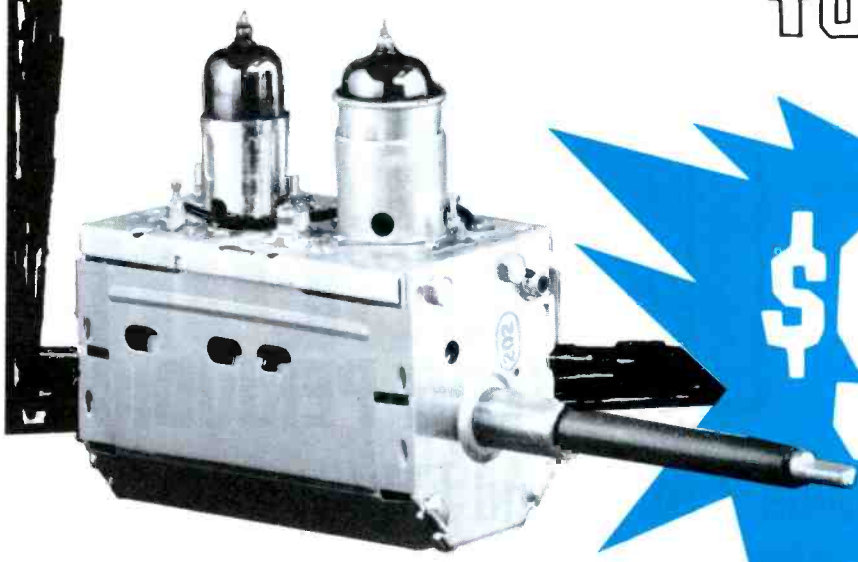

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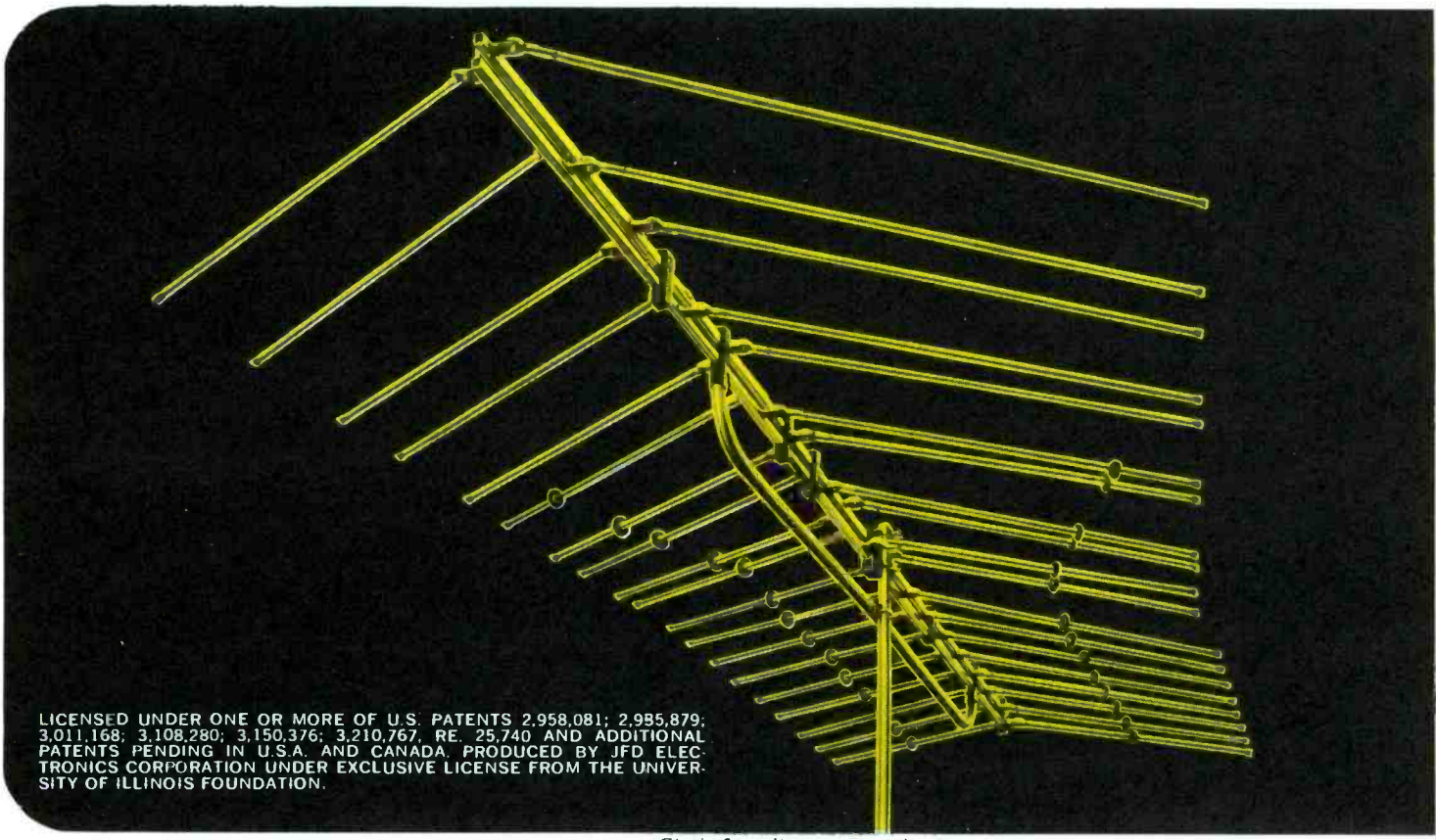
the remarkable new

JFD® LPV®-TV COLOR LOG PERIODIC

for channels 2 to 13 and FM/Stereo



LICENSED UNDER ONE OR MORE OF U.S. PATENTS 2,958,081; 2,985,879; 3,011,168; 3,108,280; 3,150,376; 3,210,767, RE. 25,740 AND ADDITIONAL PATENTS PENDING IN U.S.A. AND CANADA. PRODUCED BY JFD ELECTRONICS CORPORATION UNDER EXCLUSIVE LICENSE FROM THE UNIVERSITY OF ILLINOIS FOUNDATION.

Circle 3 on literature card

WIFIJECH

While our LPV-TV series was undergoing development in Champaign, Ill., it was assigned the code name: WIFIJECH.

For good reason.

Its performance objectives were to surpass every competitive make—model for equivalent model—in gain, directivity, response, V S W R, & F/B ratio.

Did the new LPV-TV come through?

—All the way! Its performance is the proof!

Now at your JFD LPV distributor.

Seven LPV-TV models to choose from — meet any location or budget needs!

Write for LPV-TV brochure 1039.

ADVERTISED IN LIFE

JFD Color Antenna

BY FAR—the best antenna for VHF COLOR performance because it combines...

- The electronic perfection of the patented frequency independent Log Periodic concept of the University of Illinois Antenna Research Laboratories.
- New capacitor-coupled Cap-Electronic elements that respond on the third harmonic mode for highest effective gain. More harmonically resonant elements mean higher signal-to-noise ratios, better ghost rejection, sharper directivity on high VHF band—where it's most needed, especially in color.*
- True dual-band directors separately tune to high and low bands for added gain and directivity on all channels.
- Flat frequency response (± ½ db across entire channel) for studio-quality color regardless of channel tuned.

New LPV-TV Log Periodic antenna series incorporates new capacitor-coupled element concept for improved response, especially in color, on channels 2 to 13.

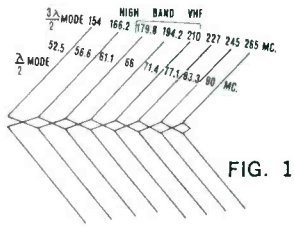


FIG. 1

Fig. 1 shows how a VHF log periodic with eight conventional V-dipoles might look. The resonant frequencies of the dipole elements in the low VHF band are indicated near midpoint of each dipole. The 3/2 wavelength resonant frequencies are indicated near the ends of each dipole. (Note that only three dipoles resonate at frequencies in the high VHF band.)

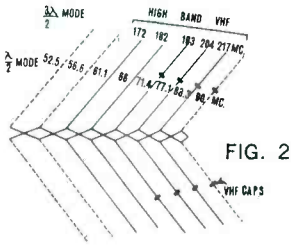


FIG. 2

However, by introducing parallel plate capacitors into the dipoles and by carefully adjusting the value of this capacitance and its position on the dipole, as shown in Figure 2, the resonant frequencies of the dipole can be shifted in the 3/2 wavelength mode. In this way, the dipole can be made to resonate at two desired frequencies: e.g., 88 and 216 mc.

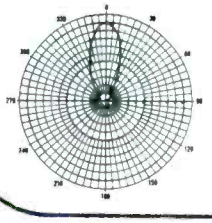


FIG. 3

Result: the active region in the high band extends over five of the eight original dipoles instead of three, as in Fig. 2, with a performance improvement of 66⅔%. The new capacitor-coupled dipoles also present more capture area on the low band than ordinary dipoles. Thus LPV-TV antennas offer, on both bands, higher and more uniform gain, lower side-lobe levels, narrower beamwidths, for vastly improved ghost rejection (see Fig. 3).

VHF – up to 50 miles
FM – up to 30 miles
Model **LPV-TV3**
3 Cell System (single-crossarm)
With electronic "ghost-killing" trap
$14.95 list

VHF – up to 75 miles
FM – up to 40 miles
Model **LPV-TV5**
6 Active Cell & Director Cap-Electronic Element System
$23.95 list

VHF – up to 100 miles
FM – up to 50 miles
Model **LPV-TV7**
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VHF – up to 125 miles
FM – up to 50 miles
Model **LPV-TV10**
10 Active Cell & Director Cap-Electronic Element System **$41.95** list

VHF – up to 150 miles
Model **LPV-TV13**
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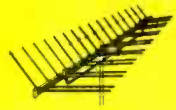
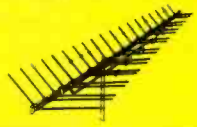


VHF – up to 175 miles
Model **LPV-TV16**
16 Active Cell & Director Cap-Electronic Element System **$59.95** list



VHF – up to 200 miles
Model **LPV-TV19**
19 Active Cell & Director Cap-Electronic Element System **$79.95** list

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JFD International, 64-14 Woodside Ave., Woodside, N.Y. 11377

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Subscription Prices: 1 year—$5.00, 2 years—$8.00, 3 years—$10.00, in the U. S. A., its possessions and Canada. All other foreign countries: 1 year—$6.00, 2 years—$10.00, 3 years—$13.00. Single copy 50¢; back copies 65¢

Indexed in Lectrodex.
Printed by the Waldemar Press Div. of Howard W. Sams & Co., Inc.

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PF Reporter™

PHOTOFACT

the magazine of electronic servicing

VOLUME 16, No. 5 MAY, 1966

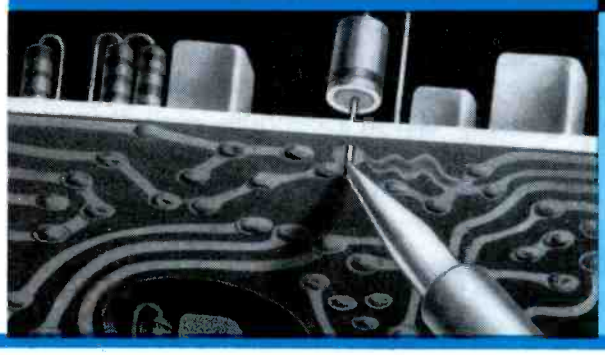
CONTENTS

About the Cover

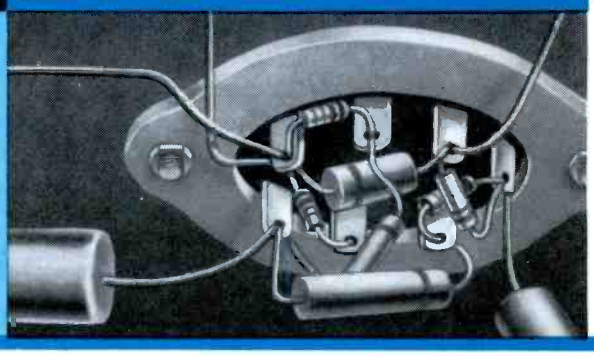
Our cover this month simplifies the process which takes ploce in the color demodulators of a color receiver. Any service technician who has touched a chroma circuit board or viewed a cyan screen knows that color is not as easy as ABC, or XYZ for that matter. The article beginning on page 25 in this issue provides some valuable information on these critical circuits.

Did you ever...

...lift a wire-lead component from a printed wiring board for testing ?



...test or replace a capacitor or resistor on a crowded tube socket ?

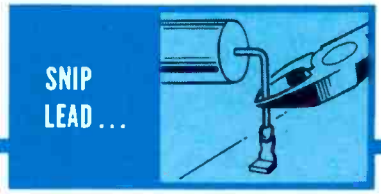


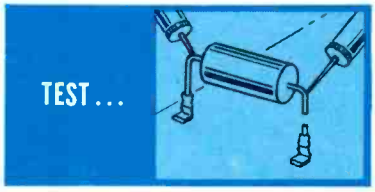
CUT YOUR TIME IN HALF with KWIKETTE* Soldering Aids ...the revolutionary connectors that practically let you do "in-circuit" component testing!

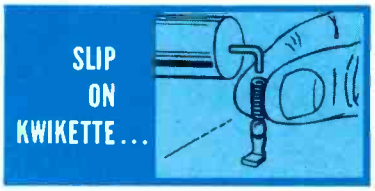
(six times actual size)

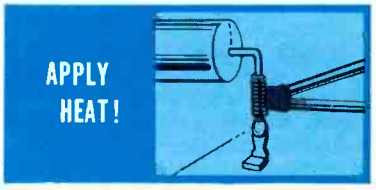
The KWIKETTE SOLDERING AID is not just another wire spring connector! It has a Copperweld wire inner core, an intermediate layer of flux, and an outer jacket of solder . . . *all you need is heat!*

KWIKETTES are now being packed with Sprague Atom® Capacitors *at no extra cost to you!* Whenever you need tubular electrolytics, insist on pre-packaged Sprague Atoms from your parts distributor and you'll automatically get your KWIKETTE component connectors . . . the biggest boon to the service technician since the soldering gun!









FREE TRIAL PACKAGE!

10 free KWIKETTE Soldering Aids are yours for the asking! Simply send your postcard request to KWIKETTE Center, Sprague Products Co., 105 Marshall Street, North Adams, Mass. 01247. Don't forget to include the name of your Sprague Distributor.

* trademark

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THE MARK OF RELIABILITY

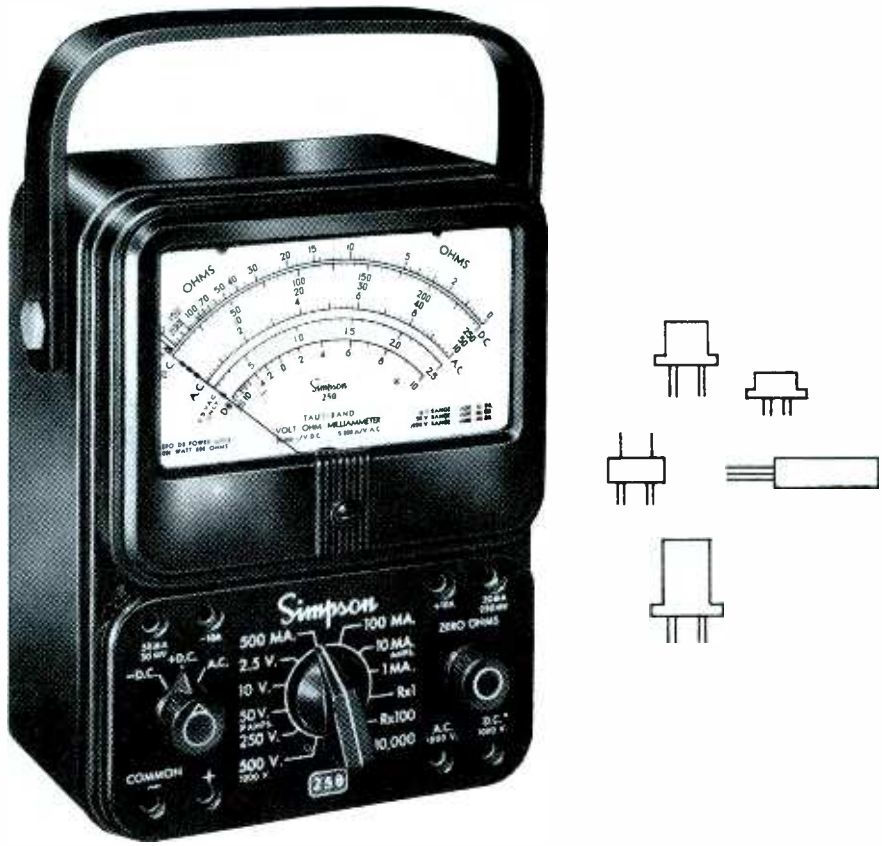
WORLD'S LARGEST MANUFACTURER OF CAPACITORS

Circle 4 on literature card

THIS VOM WON'T FOOL YOU ON TRANSISTOR CIRCUIT CURRENT

Low 50-Millivolt drop on current ranges gives accurate measurements

Now, you can make transistor current measurements with a VOM . . . and with 0.05 volts or *less* change in operating conditions. ■ This new, self-shielded, taut band member of Simpson's famous 260® family of VOMs is made for use in transistor circuits. Regular VOMs often give wrong current readings because their high resistance actually changes the operating conditions by as much as 300 millivolts. ■ Model 250 also has provisions for using Simpson "Add-A-Tester" adapters and all other 260-family probes and accessories. Sensitivity is 20,000 ohms per volt DC, 5000 ohms per volt AC. Accessories include three DC high voltage probes, an AC high voltage probe, plus several styles of leads and carrying cases — eleven accessories in all. If your work includes checking current in transistor circuitry, call your electronic distributor for fast delivery of a Simpson Model 250. Complete with test leads and operator's manual **$59.95**



RANGES

DC VOLTS: 0-0.050; 0-0.250; 0-2.5; 0-10; 0-50; 0-250; 0-500; 0-1000
AC VOLTS: 0-2.5; 0-10; 0-50; 0-250; 0-500; 0-1000
DC MICROAMPERES: 0-50 (Both 50 and 250 MV Drop)
DC MILLIAMPERES: 0-1; 0-10; 0-100; 0-500 (50 MV Drop)
DC AMPERES: 0-10 (50 MV Drop)
DB SCALE (1MW-600Ω): −20 to +10; −8 to +22; +6 to +36; +20 to +50
RESISTANCE RANGES: R X 1 0-2000Ω (12Ω center); **R X 100** 0-200kΩ (1200Ω center); **R X 10K** 0-20 megΩ (120KΩ center)

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0-50 MV; 0-250 MV; 0-2.5 to 0-1000 V DC: ±2% F.S.
0-50 MICROAMPERES: ±1% F.S.
0-1 MA to 0-10 A DC: ±2% F.S.
RX1: ±2.5° of Arc
RX100, RX10,000: ±2.0° of Arc
0-2.5 to 0-1000 V AC: ±3% F.S.

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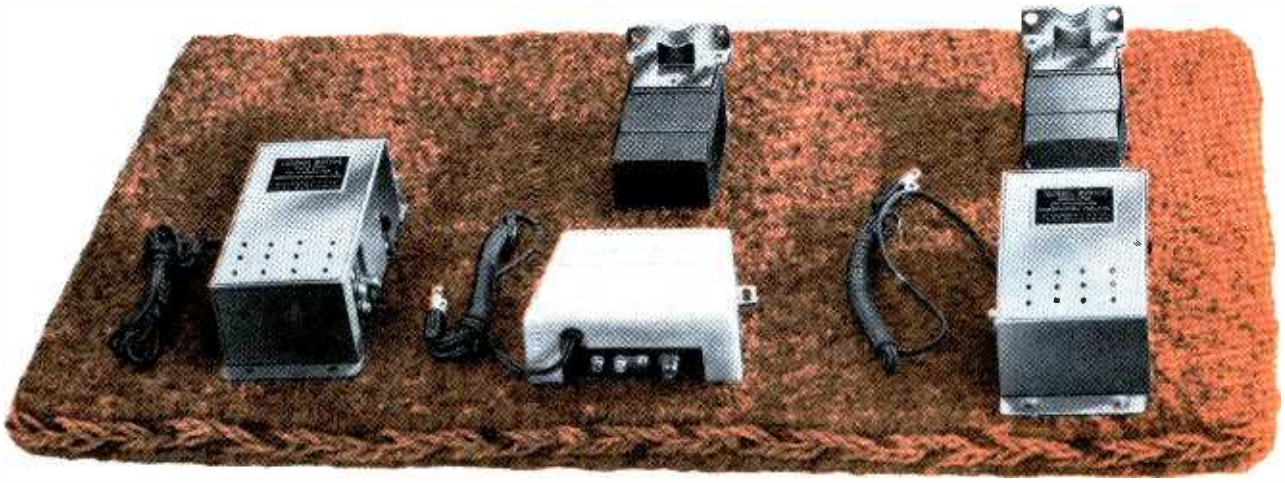
WORLD'S LARGEST MANUFACTURERS OF ELECTRONIC TEST EQUIPMENT

Circle 5 on literature card

Small homes are saying "Yes" to big MATV business.



Walk right in with one of our 5 brand-new Channel Master MATV Amplifiers*

(They're priced fantastically low).

The color explosion has given birth to a gigantic new market. One that's left the door to multi-set homes wide open for big business opportunities.

When a family buys a color set, they don't throw the old black-and-white console away. They keep it. Chances are they also own a portable and even an FM set or hi-fi.

All this means one thing: Every one in your neighborhood who has, or buys, a color set becomes a hot prospect for the unique room-to-room flexibility offered by a Master Antenna Home System.

Here's where you cash in with our big line of Channel Master MATV amplifiers. They let you accommodate the **exact** need. For instance: Our new solid state VHF/FM Color Amplifier (Model 7035) provides 15 db across the entire band, flat color response, 1.5 volt output capability, plus a 75 ohm or 300 ohm input or output. It could be perfect for a home with a number of outlets in a weak to medium signal area.

Or the situation may call for one of our two new 75 ohm coaxial boosters: the single transistor Telstar VHF/FM (Model 0043); or the 2-transistor Twinstar VHF for areas with overload problems (Model 0041). Both models provide especially high gain (15 db) and low noise figures—and are the **only** coaxial amplifiers with both a 75 ohm and 300 ohm output.

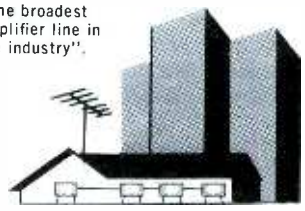
Motels and garden apartments? Use our new outstanding 30 db VHF/FM Color Tandem Amps (Models 7041, 7043). Consists of mast-mounted preamps of models 0041 and 0043 cascaded with Model 7035 (contains power supply for pre-amps).

We have other amplifiers, including several for medium and large commercial systems. But the important thing is our flexibility. You're backed by the broadest MATV amplifier line in the business.

Like we said: The welcome mat is out. What are you waiting for?

Write for the facts!

* MODEL	GAIN	NOISE FIGURE		MAXIMUM INPUT SIGNAL IN MICROVOLTS		OUTPUT CAPABILITIES		LIST PRICE
		LOW BAND	HIGH BAND	LOW BAND	HIGH BAND	LOW BAND	HIGH BAND	
7035 Color Amp	15 db	2.5	5.4	300,000 total		1.5v total		Only $34.95
0043 Telstar	15 db	2.2	3.0	15,000	30,000	100,000	135,000	Only $34.95
7043 Color Tandem	30 db	2.2	3.0	15,000	30,000	1.5v total		Only $64.95
0041 Twinstar	15 db	2.5	3.7	150,000	190,000	850,000	600,000	Only $44.95
7041 Color Tandem	30 db	2.5	3.7	60,000	100,000	1.5v total		Only $74.95



CHANNEL MASTER

ELLENVILLE, NEW YORK

Circle 6 on literature card

Letters to the Editor

Dear Editor:

This for me is a first–writing to an editor. Only infrequently do I get a feeling of genuine personal, down-to-earth involvement in a magazine article. However, I must admit it occurs more and more frequently in your PF REPORTER.

The October '65 issue contains a letter from a name withheld about the merits of your publication (with which I agree) and also included two problems (page 14). I accepted the challenge but did not get very far with it. What caused my reaction to this is that I have always had much difficulty setting up equations that will be completely true to the facts on the situation. I sincerely am concerned about why I cannot clearly see through problems of this type.

The letter and your comments started some deeper than usual thinking for me; this occurs only occasionally and is in itself a high recommendation of the caliber of your magazine.

It is my earnest hope to learn more about why I have difficulty setting up (or seeing how to set up) basic equations. I have had basic and advanced algebra in high school and a review by correspondence course since. However, very little practice was given on how to set up a group of facts. Much necessary time and effort is spent on solutions of equations, and I believe I have a fair ability in solving them once they are set up. It seems to me that most courses stress the *how* without explaining the *why*. I have had much practice on how to solve $x + (x + 12) = 46$ but very little on where this originates. Your letter hits it right on the head and brings out why the equation was formed in the first place. I suspect a great deal of my trouble is due to not enough experience with math.

You close the solution to the problems with "why then don't these same intelligent technicians use such logic in their everyday work?" I do have difficulty almost daily in solving problems, as an electronic technician doing general repair. And I could not solve the two problems. "How well related are the two?" I asked myself.

You say logical procedure is the way to do it. I like to think I solve my electronic problems logically, yet I could not reason out how to do the problem. Thus, I may not understand this "logical procedure" thing. So I thought it out further and here is what I came up with:

Logic—

Electronic troubleshooting is basically the use of logic. To properly understand this the meaning of logic must be known.

Webster defines it as "a connection of facts, events, and inferences in a rational way leading to a conclusion that makes arguments useless." Thus if $2x+12=46$, then $2x=46-12$, $2x=34$, and $x=17$. There is no argument about this assortment of facts being true logical conclusions. Any procedure whereby a step-by-step gathering of facts leads to a positive conclusion may not always be completely true due to an unknown factor or an unknown result from a combination of factors. The percentage of true conclusions will be increased in proportion to a person's knowledge and experience in application.

Assume two people graduate from high school together. One goes immediately to work at a skilled trade and ceases to study. The other continues studying in college. The first becomes quite proficient at certain operations involving mechanical skills and has certain (usually quite definite opinions) in matters of intellect (natural from a narrower viewpoint). The second may not be much good at similar mechanical skills at first but will gain an intellectual ability enabling him to understand and reason out many more problems. Thus, in a short while, the second will be able to accomplish any task the first man can perform, with few exceptions, then easily go on to others. The second will have more ability to create, simplify, perfect, and enlarge upon more and more things as his knowledge increases. Of the two, one can see which should be the more logical thinker, or performer, in most situations. The first would be more the type to remember that the last repair of a "no-vertical-sweep" problem was made by replacing the vertical output transformer, therefore, the same repair should fix this one too. The second man would be more apt to understand and realize there are six or eight things other than the output transformer to cause this trouble. He would apply a logical approach to determining what area held the problem.

So I think I have answered my own questions—I'm sort of in the category

• *Please turn to page 86*

The Electronic Scanner

news of the servicing industry

Industry at New Peaks in 1965

Culminating a decade of growth, output of the home entertainment products of the electronics industry attained new peaks in 1965 with further gains forecast through 1970, the **Electronic Industries Association's** Marketing Services Department reported.

Color television leads the latest upward surge, EIA points out, but radical improvements have instilled a new life in the radio and phonograph markets as well. In addition, new electronic consumer products such as tape recorders and electronic organs have opened other fields for expansion.

The domestic market absorbed 11.6 million television receivers last year, including one million imported receivers.

Despite the soaring popularity of television, demand for radios reached an all-time high of 41 million sets in 1965 compared with 14 million in 1955. A sharp reduction in prices of portable radios, the introduction of stereophonic radio broadcasting during recent years, and the resurgence of FM no doubt contributed heavily to this phenomenal increase, according to EIA. One out of every four radios produced was for use in autos.

The market for phonographs reached a new record of 6.5 million sets in 1965—more than double the sales in 1955. Technological improvements, stereophonic sound reproduction and a new generation of portables were factors chiefly responsible for this growth in consumer demands.

Sales of tape recorders increased from a negligible amount in 1955 to 4 million units last year. Most of these were imported, but a number of U.S. manufacturers began production during the year, while others broadened their product lines and output.

The sale of color TV sets last year, according to EIA's final tabulations, practically doubled within one year to reach 2.7 million sets. The public demand for black-and-white TV, with a heavy accent on portables and small screen sizes, rose to 8.9 million during 1965—over a million more than in 1955.

EIA's Marketing Services Department foresees a continuing strong rise in color television sales during the next five years as the demand for black-and-white sets may begin to taper off.

The upsurge of electronic consumer products is expected to be accompanied by increased factory employment, as new plants open to supply the growing market, as well as by a corresponding expansion in retail and service operations throughout the United States, according to EIA.

Tuner Company Formed

An agreement has been reached between Electro-Netic Steel and Industrial Electronic Hardware Corp. to form a new company, **Electro-Netic Products Corporation,** which will purchase the present VHF Tuner Division of Electro-Netic Steel and the UHF Tuner Division of Raypar Electronics, Inc., a wholly-owned subsidiary of Industrial Electronic Hardware Corp.

The new company will produce and sell a complete line of TV tuners for black-and-white color sets.

New Labs

Hewlett-Packard Company has announced the consolidation of its advanced research and development activities into a new organization known as HP Laboratories.

Located in Stanford Industrial Park, the new organization is engaged in several advanced research activities.

HP now has 16 product divisions, each with its own line of instruments and supported by its own product-development group.

A primary objective of HP Laboratories is to provide these groups with a reservoir of advanced scientific knowledge and techniques.

When appropriate, HP Laboratories also will make its research capabilities available to outside agenceis.

5.5 Million Color TV Receivers Forecast For 1966

The **Radio Corporation of America** raised its forecast of 1966 industry color television receiver sales by one million sets to a total of 5.5 million units, reflecting increases in both consumer demand and production capacity.

The new estimate, double last year's sales total, will result in retail sales of nearly $3 billion, thus equaling for the first time the total consumer dollar volume of all other home entertainment products, according to Raymond W. Saxon, Vice President, RCA Victor Home Instruments Division.

Citing as an example of the speed with which the industry is building new facilities to meet the booming consumer demand, Mr. Saxon said their new television receiver plant in Memphis, Tenn., is expected to start turning out black-and-white receivers in May, fewer than five months from the start of construction. The $20 million Memphis facility will free space at RCA's Bloomington, Ind., plant for more color production.

"Color television has stimulated the economy to such a degree that we now foresee a total consumer electronics industry dollar volume of more than $6 billion this year," Mr. Saxon said. "This will be nearly twice the dollar volume of the entire home instruments industry as recently as 1964."

"Even with the revised production estimates, the snowballing consumer demand for color sets will continue to outstrip industry manufacturing capacities for some time to come."

The new Memphis TV receiver plant, which eventually will manufacture color as well as black-and-white sets, is part of a $65.6 million expansion program. The first phase of that program, a $13.3 million expansion of existing plants in Bloomington and Indianapolis announced last June, is now nearing completion.

Mr. Saxon said industry color sales for the first eight weeks of 1966 are running 69 percent ahead of last year's rate. This rate is expected to climb as more sets become available through industry's new production facilities.

Supporting his optimistic outlook, RCA estimates place the average expenditure per household for home entertainment products at $101 in 1966, compared with $61 per household two years ago.

Sylvania Electric Products Inc. announced it is building a multimillion-dollar facility on a 125-acre site in Smithfield, N. C., to increase production space for color television sets and other electronic entertainment products.

Gene K. Beare, President of Sylvania, said construction would begin immediately on a 221,000-square-foot initial unit of the plant, and that the company will "substantially increase its output of color television sets in 1966 over 1965. This will be made possible partially by the transfer of stereo and radio production from the 430,000-square-foot Batavia plant to Smithfield to make room for increased color and black-and-white TV production at Batavia."

Westinghouse Electric Corporation has already completed major phases of a multimillion-dollar expansion program that will quadruple its color television manufacturing capacity by the third quarter of this year.

The program is based on an extensive expansion at the TV-Radio Division, Metuchen, N. J., coupled with the start-up of color TV tube production at the Electronic Tube Division, Elmira, N.Y. This tube production will cover part of the Company's requirement.

Full production is expected to be achieved late this summer. Over the long term, the TV-Radio division will have a potential capacity of nearly 500,000 sets a year with the facilities that will be in operation this summer.

exchange of stock with Acme's shareholders.

Howard W. Sams, Chairman, commenting on this latest expansion move, stated, "This is our third technical school acquisition, the second within nine months. Negotiations with other schools are currently underway."

Present STI Centers are at peak enrollment with 1050 resident students at Indianapolis, 357 at Evansville, and 350 in Dayton by this Fall.

Sams also announced the introduction of a Home-Study Program in Electronics.

Move To Maryland

Polytronics Laboratories, Inc., a subsidiary of Vitro Corporation of America, will move to a new location adjacent to the Vitro Electronics Division's facility in Silver Spring, Maryland. The new location will give Polytronics access to the fabrication and assembly facilities contained at Vitro Electronics, enabling them to draw on the research, technical, and other staff facilities of the parent company when required.

Chip Production Up

To meet growing demand for integrated Circuits, **Raytheon Company** will expand production at Mountain View, Calif. and establish a new integrated-circuit production facility at Santa Ana, Calif.

The new integrated-circuit facility at Santa Ana will be in a 20,000-square-foot area of the Raytheon Computer Operation plant. This facility is expected to be operational early this summer. Some 200 persons now working on transistor assembly at Mountain View are also being trained for integrated-circuit work. ▲

Zenith Radio Corporation announced plans for a new $3,000,000 manufacturing facility to be built in Sioux City, Iowa, by its subsidiary, the Wincharger Corporation.

The new Wincharger plant will total some 220,000 square feet for manufacturing, engineering, and general offices.

The new plant will permit Wincharger to increase production of Zenith radio receivers, and enable them to begin production of electronic components for Zenith consumer products.

Wincharger originally produced wind-driven generators ("Winchargers") that were a familiar sight on American farms 30 years ago. Because of declining demand as a result of Rural Electrification, production ended in 1958.

$3,000,000

Setchell-Carlson, Inc., 32-year-old manufacturer of home-entertainment and communications equipment, has signed a purchase agreement for sale of all of the company's outstanding stock to Marquette Corporation of Minneapolis for $3,000,000 in cash and notes.

Marquette, principally a manufacturer of battery chargers, welders and diagnostic engine analyzing equipment and a marketer of private brand major appliances, entered the entertainment field for the first time in 1965 with the introduction of a line of stereo and stereo-TV combination units manufactured by Setchell-Carlson.

Among Setchell-Carlson's contributions to electronic entertainment were the industry's first practical automobile radio, top-tuning television receivers, and a system to eliminate high current surges during the initial warm-up of a television picture tube, thus prolonging the life of the tube.

Acquires Dayton School

Howard W. Sams & Co., Inc., announced the acquisition of Acme Institute of Technology, Inc., Dayton, Ohio, by

Shop Talk

KEYED—AGC

Find your way through these gain-control circuits

by Allan F. Kinckiner

Keyed AGC is one of the most poorly understood circuits employed in TV receivers. It shouldn't be! Not only is the means by which the negative voltage develops less complicated than that in simple, peak, or supplemented AGC, but the method of controlling the magnitude of developed voltage is far less complex than that used in amplified AGC. By employing several analogies, circuit operation can be so simply explained that virtually every TV technician can understand it.

Analogy No. 1: Every TV technician is familiar with the circuit in Fig. 1A. It is the first stage of a half-wave voltage doubler used to supply B+ in many receivers. Even technicians not familiar with this rectifier circuit are aware of certain conditions normal to it; the circuit as shown will produce DC voltage at point A, but if X1 were removed (or open) no DC voltage would be measured at point A. If X1 were reversed, as in Fig. 1B, the DC voltage would also be reversed, now being negative (assume C1 is a non-polarized unit rather than the polarized electrolytic usually employed). If X1 in Fig. 1B is replaced by a vacuum tube, as in Fig. 1C, a negative voltage will be developed on the plate just as a negative voltage was developed on the anode of X1. If we change the type of voltage fed through capacitor C1, a negative voltage will still be produced on the plate of V1, although the amplitude will vary according to the make-up of the signal or voltage applied to C1. The value of C1 should also be changed as the frequency of the signal applied is changed. With the circuit in Fig. 1A operating at 60 Hz, C1 must be over 100 mfd for efficient operation. With the circuit in Fig. 1C used as a simulated keyed AGC stage fed by a high-frequency narrow pulse, little increase in DC plate voltage can be realized by increasing the value of C1 above .001 mfd. However, a sharp decrease in the value of C1 below .001 mfd will cause a proportional drop in the DC plate voltage.

A more theoretical analysis of these circuits indicates that the DC voltage is the result of the charge retained by C1. But a technician does not concern himself with this facet of operation of the keyed AGC stage, any more than he concerns himself with this facet of operation in the rectifier circuits. In summary, the analogy used with Figs. 1B and 1C answers the question, "Where does the minus voltage come from on the plate of a keyed AGC tube?"

The second most common question concerning keyed AGC is, "How is the amount of AGC voltage controlled?" There is no ready-made analogy to answer this question, but one can be manufactured.

Anaolgy No. 2: If the lead to ground in Fig. 1A, or preferably 1B, is opened and a variable resistor inserted, as is R1 in Fig. 2A, the magnitude of DC voltage developed will vary inversely with resistance. At higher values of R1, lower DC voltages will be produced; at lower values, higher DC voltages will result. Likewise, if the cathode return lead of V1 in Fig. 1C is opened and a variable resistor inserted, as is R2 in Fig. 2B, the DC plate voltage will also vary inversely with resistance. Increasing the resistance of R2 will produce a lower DC voltage at the plate of V1; decreasing R2 will produce maximum DC voltage. It is no secret that introducing R2 into the circuit merely biases the tube. However, by showing that the similar use of a resistor in a diode circuit produces the same result, it becomes obvious that the conductance or internal resistance of the tube can also be controlled. The important thing is, however, that the magnitude of AGC voltage on the plate of any keyed AGC tube is determined by the amount of grid-to-cathode bias.

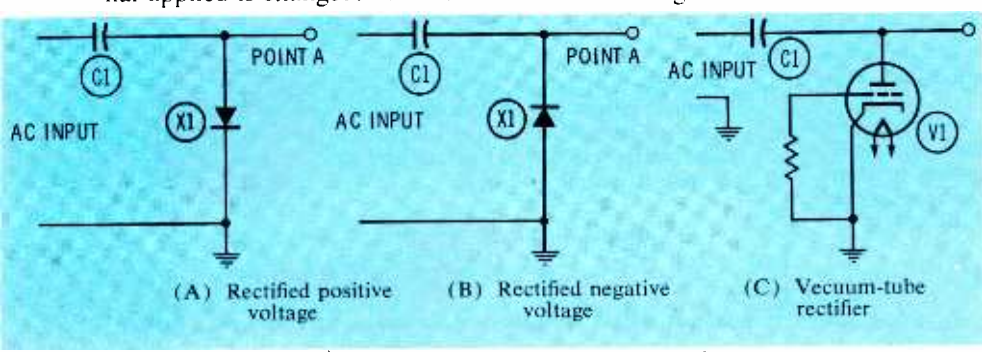


Fig. 1. Analogy of keyed AGC tube.

Control Circuits

Bias for controlling a keyed AGC tube is obtained from other receiver stages; most frequently a video amplifier is used. A typical early (and still very common) design is shown in Fig. 3. Here's how it operates: Under no-signal conditions, the cathode resistors R1 and R45 solely determine bias for V8 and set its plate current at approximately 10 ma. This plate current produces a drop of about 50 volts across R46, producing about 110 volts on the plate and also at the top of R46. This 110 volts is applied through isolation resistor R48 to the grid of V9, the AGC tube. With 110 volts on its grid and 160 volts on its cathode, V9 is so highly biased it does not conduct; no AGC voltage will be developed from the pulses applied to its plate.

Under signal conditions, the video detected by V7 consists of negative DC components at levels relative to the composite signal levels. These negative DC components form the grid signal of V8. Being of negative polarity and direct coupled to the grid, they decrease the plate current and reduce the voltage drop across R46. The resulting higher voltage at the plate end of R46 also places a higher voltage on the grid of V9; the bias applied to V9 is reduced, causing it to conduct and devolp a negative AGC voltage (from pulses applied to its plate) in direct proportion to the bias.

The presence of a high DC potential on the cathode of the keyed

AGC tube is one of the major disadvantages of the circuit in Fig. 3. In many cases it necessitates the use of an ungrounded filament source connected to a B+ source to reduce the possibility of cathode - to - heater breakdown in the tube. Although many recent designs use circuits employing high DC voltages applied to the keyed AGC cathode, in most cases the tubes used have cathode-to-heater insulation capable of withstanding high DC voltage differences. Some manufacturers prefer, however, to use circuits in which the cathode operates at a reasonably low DC potential.

The circuit shown in Fig. 4 is a typical application in which the keyed AGC tube operates with a low DC potential on its cathode. The cathode voltage is adjustable from zero to a maximum of 65 volts. The voltage present at the plate end of R26, the video-amplifier load resistor, is coupled to the grid of V4B through a voltage divider network consisting of R60 and R61. Thus, the grid voltage will vary exactly as it did in Fig. 3, causing the AGC tube to conduct and develop AGC voltage in proportion to the strength of the received signal.

The circuit shown in Fig. 5 operates the cathode at ground potential to prevent cathode-to-heater breakdown. The conduction of the AGC tube is controlled by applying to its grid a negative voltage that is proportional to the negative potential present on the grid of the horizontal output. This negative voltage is fed to the AGC grid through voltage dividers R9 and R56 and opposes a positive voltage from the video-amplifier plate circuit applied through resistor R54.

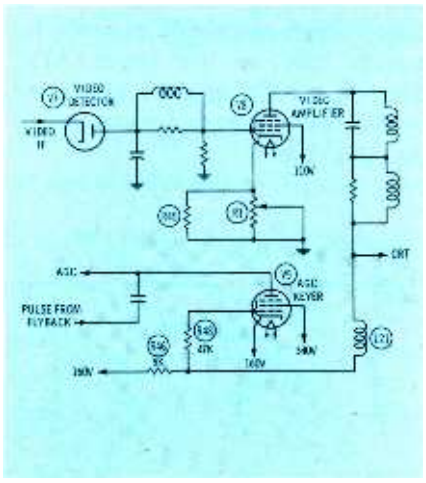


Fig. 3. Source of AGC tube bias.

A variation of the basic design is shown in Fig. 6. Operation is identical to that of the basic design with one exception. V6B is in the DC signal path between the video amplifier and the keyed AGC tube. V6 has two functions; it operates as a horizontal sync separator with sync pulses taken off at its plate. It also operates as a buffer between the video-amplifier plate and the grid of the keyed AGC stage. In the latter function, V6B operates as a cathode follower and any voltage variation at its grid produces a similar variation at the cathode. Therefore, the cathode voltage of V6B varies in step with the DC potential on the grid of the video amplifier. Since a portion of the cathode voltage of V6B is directly coupled through R7 and R49 to control conduction of V8B, AGC voltage will be developed in proportion to signal strength.

This circuit also has its share of cathode-to-heater shorts, this time in V6B. When a short occurs, it always results in a change in the resistance of R73. Thus, when a tube corresponding to V6B in these circuits is found to have a cathode-to-heater short, repair cannot be considered complete unless R73 or its equivalent is checked, even though replacing the shorted tube restores receiver operation.

Troubles

There are three distinct types of troubles common to keyed AGC systems: (1) Troubles due to poor filtering of the control voltage. (2) Troubles associated with incorrect distribution of the control voltage. (3) Troubles connected with incorrect levels of AC voltage. We will discuss only the third type.

In Fig. 7, a series of photos show the effects of incorrect AGC voltages. Fig. 7A is the result of extremely excessive AGC, Fig. 7B shows more than normal AGC, and Fig. 7C shows the absence of AGC. This range of various AGC voltage levels can be simulated in some sets by varying the AGC control. In many sets, however, the range of the AGC control is not this great. Actually, the more the contrast can be overloaded by adjustment of an

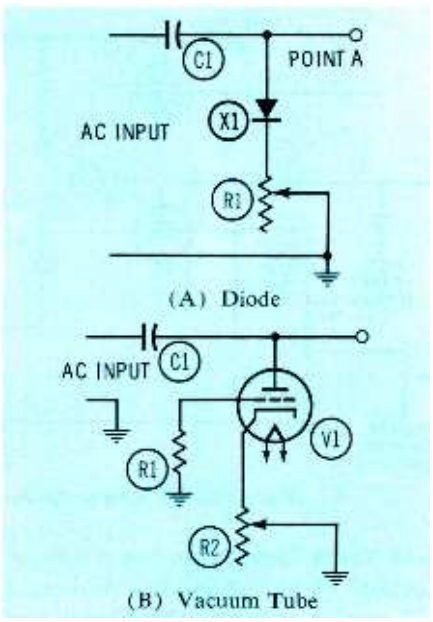


Fig. 2. Control of rectified voltage.

AGC control, the greater is the gain of the signal stages. If the more severe conditions (negative picture or whiteout) cannot be attained in some sets, a weak tube in the RF, IF, or video amplifier is indicated.

Because keyed AGC systems involve other stages in the receiver and depend upon the horizontal-deflection system, an AGC defect can produce abnormal operation in the associated stages. It is more probable that a defect in any of these stages will produce AGC troubles. The video amplifier is the stage most often responsible for improper operation of a keyed AGC circuit. Many AGC troubles would more accurately be called video-amplifier trouble if it were not true that it is easier to recognize abnormal AGC voltages than abnormal voltages on a video-amplifier stage.

Many cases of an open series-peaking coils, corresponding to L21 in Fig. 3, produce a dead, blanked-

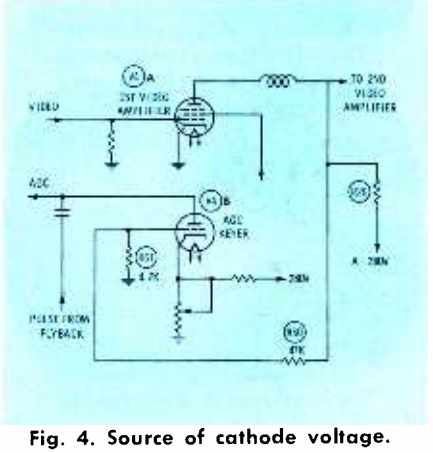


Fig. 4. Source of cathode voltage.

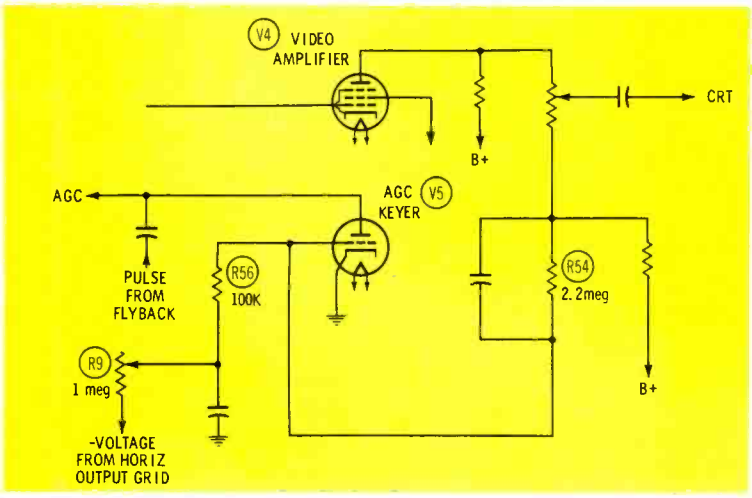


Fig. 5. Circuit with grounded cathode.

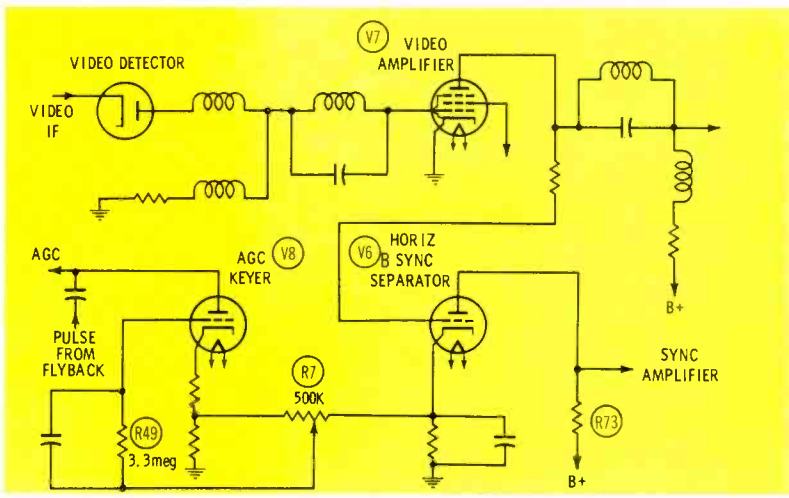
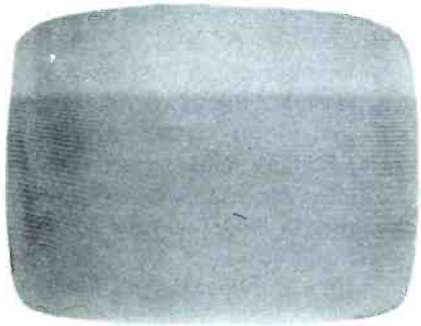


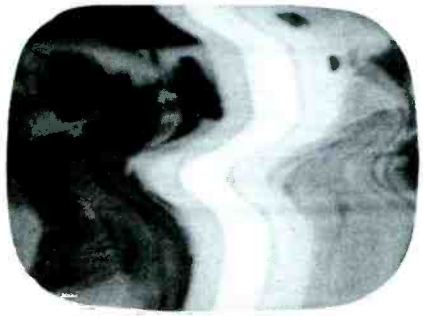
Fig. 6. Use of buffer and amplifier.

out raster identical to the condition caused by an excessively overbiased IF section. When a VTVM indicates about —50 volts on the AGC line, it is accepted as further proof of AGC trouble. But with additional checking, it will be found that the video-amplifier plate has zero volts while the plate end of the video-amplifier load resistor has as much voltage as is found at the B+ end. Furthermore, it will be found that both the grid and the cathode of the keyed AGC tube have identical voltages, thereby producing maximum conduction and maximum AGC voltage.



(A) Excessive AGC voltage

(B) More than normal voltage



(C) Absence of AGC voltage

Fig. 7. Visual AGC symptoms.

Just as common is the condition in which the contrast control, connected similarly to R1 of Fig. 3, opens. Symptoms are exactly like the preceding case; a blanked-out dead raster and excessive AGC voltage. Here again the excessive AGC is likely to be discovered before the open contrast control is pinpointed as being the trouble source.

Considering this last condition, a fairly recent circuit uses this principle in its motor-tuned channel-selector version (Fig. 8). While the station selector is in motion, the cathode of the video amplifier is ungrounded, muting sound and producing a blanked-out raster, because the AGC supplies excessive AGC to the IF and RF stages. When the selector stops on a station, the video cathode returns to ground, restoring normal AGC to IF and RF stages, and producing normal picture and sound.

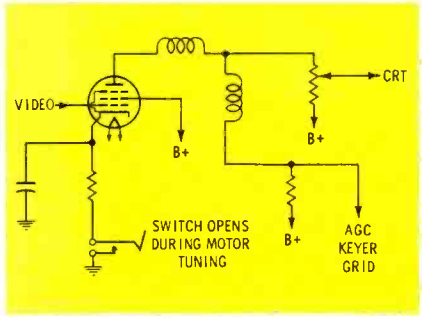


Fig. 8. Cathode lead opened during automatic tuning.

One case of washed-out contrast with poor sync looked suspiciously like an AGC defect, and suspicions were stronger after it was found that the AGC voltage was about twice its normal value. When voltages on the AGC tube seemed about right for the amount of AGC voltage developed, the signals to the video amplifier were scoped. At the output of the video detector, point A in Fig. 9, excessive signal levels with clipped sync were found. But at the grid of the video amplifier, point B, the scope showed the same signals greatly diminished. An ohmmeter was used in the circuit to check L23 and R36. After the meter showed these components were good, V6 was replaced, eliminating the trouble. Obviously the control grid of V6 had some unusual characteristic, and if the picture had been merely washed out without the clipping it would have been suspected more quickly.

In addition to troubles originating from defects in the stage preceding and controlling the keyed AGC stage, which invariably produce incorrect bias on the keyed AGC tube, other AGC troubles are caused by the other voltage parameters of the AGC tube.

• *Please turn to page 57*

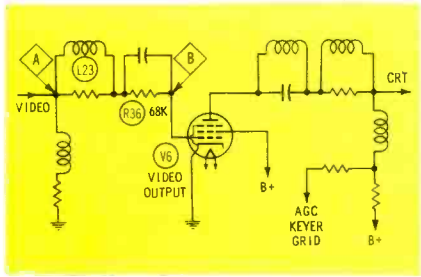


Fig. 9. Bad V6 produced odd symptom

The Locus of the FOCUS

The "Visiting Hot Shot" remembers some basic principles.

by Jack Darr

I walked into my Little Buddy's shop one afternoon, and right away he yelled, "Hey! I got one for you! It'll make a dandy article!" People are good to me, always bringing me things for material. (Actually, I get enough dogs in my own joint, but no matter.) Anyway, this was an Admiral 25H6 color chassis, and it had about the worst defocused picture I'd ever seen; nothing but great white blobs of light. Since they did move, you could tell they were parts of a picture, but that's all.

"O.K.," I said, in my best 'Visiting Hot-Shot' voice. "Check the focus rectifier tube."

"Did. It's O.K."

"Substitute a new one?"

"Yep. No difference." (End of Diagnosis No. 1. It was only a little Tentative Diagnosis anyhow. Now for No. 2.)

"How about the focus control?"

"Makes no difference at all." (Diagnosis No. 1 woke up, stirred, and waved for No. 2 to take over.)

"Well! Maybe it's open. How's the focus voltage?"

"Dunno. Didn't check it."

"Let's see. Gimme that meter. Aaah—pin 9 on this tube, isn't it?"

"Yeah. This is a 25FJP22."

I check on pin 9. Hmm. Nothing. We looked at one another, and Diagnosis No. 2 sat up and smiled heartily, feeling better all the time.

"Well, well. How's the high voltage?" This was on general principles; at this time I didn't think there was anything wrong with it. After all, I could see some fairly bright blobs on the screen.

"Didn't check it yet."

"Let's. Hand me that HV probe, huh?"

He had the doghouse open, so I touched the probe to the 3A3 socket-cup. "Hey! Look at this! 15,000 volts."

"Well, that's good." said LB.

"Good? Whoa! This is a color set! How about getting it back up to 25,000 volts where it belongs?"

"Oh. I forgot."

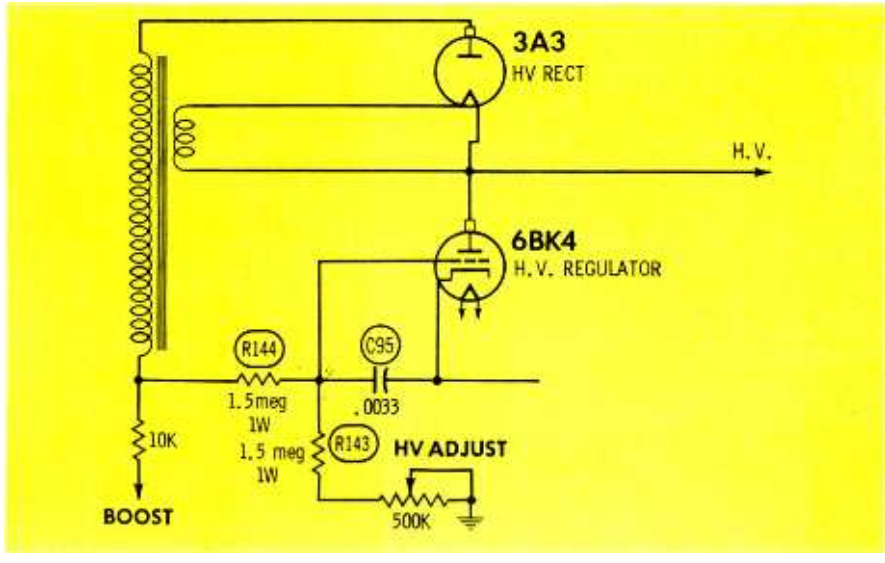
"Well, stop forgetting. How about the regulator current? And the regulator tube?" (Diagnosis No. 2 sighed and sat down again. Diagnosis No. 3 got up, stretched and got ready to take over.)

"Pull the cap off that 6BK4, and turn the set on," I said, holding the HV probe where it was. He reached for the tube cap, hit the HV lead, used some simply shocking language, and finally managed to get the 6BK4 plate disconnected. He sat back on his heels and looked at me." "Hey, y' know what? I just remembered. When I turn this thing on, a picture comes on, just for a couple of seconds, then it goes all fuzzy like that!"

"Well, turn it on now and let's see what happens."

He did. The tubes warmed up, and sure enough, a fairly good, slightly green picture came on. Then "Zap! Zap! Zap!" Big fat blue sparks shot back and forth everywhere in and around the flyback. We both grabbed at the cheater cord, and finally got it pulled out. In the midst of the melee, I noticed that the HV meter had slapped against the peg at 30,000 volts. (Diagnosis No. 3 brightened up and appeared to gain weight.)

We looked at one another. "Well, that takes care of the high voltage," I said. "Looks like that's high enough! OK, unhook the cathode of the 6BK4." He picked up the soldering iron and unhooked the yellow wire. We clipped the meter in the circuit, set on the 1.2-ma scale. (Diagnosis No. 3 tapped me on the shoulder and reminded me about vacuum tubes and their grid bias under certain conditions. So I reached over and set the meter up to the 12-ma scale, just in case. Of course, it was *his* meter, but I could never stand to see a grown man cry.) After clearing a good solid ground where one of the alligator clips had



slipped and replacing the 6BK4 plate cap, we turned it on again. Oh, ho! Sure enough, the picture did come on for about 2 seconds, then went fuzzy. When it did, the 6BK4 plate current rose gently to about 3.0 ma!

"Turn the HV adjust control," I said. He did. Nothing happened. Diagnosis No. 3 thickened a little around the waistline. "Well, well. Turn it off and let's look underneath this thing."

He did this, and we located the bias resistors, a pair of one-watt 1.5-meg types on a terminal strip. "OK. Check 'em," I said, handing him the meter leads. "One of 'em ought to be open, or away off-value, or something." Diagnosis No. 3 nodded and smiled happily.

"O.K.," he said, turning the VOM to "Ohms X 100." "Hey R143 is open!"

"Good!" I said happily. Diagnosis No. 3 beamed approvingly over our shoulders. "Now check R144 just for luck."

He did. "Reads about a half-meg."

"Well, well. OK, pull 'em loose and let's see about putting in some that will be a little bit closer to the schematic value, huh? That's it. The bias is so far off that the regulator tube is pulling the HV way down." Diagnosis No. 3 patted me on the head.

He unhooked the junction of the two resistors. I handed him the meter probes again, and said "Let's check 'em again just to make sure we didn't have any parallel paths in there." Actually, I couldn't think of any in that circuit, but I felt like being sure. He touched the prods to the resistor, and then stood there with a very funny look on his face. "It's OK! Reads exactly 1.5 megs!"

"What? Are you sure?"

"Try it yourself," handing me the prods. I got down on the prayer bones and did. Sure enough, R143 now read a solid 1.5 meg, right on the nose. So did R144. Diagnosis No. 3 looked a bit sheepish.

"Check the ohmmeter!" I said, in desperation. He gave me a nasty grin, and handed me a 1% one-meg resistor I'd given him some time ago just for this purpose. I checked it, and sure enough, it was one meg right on the nose. Hmmm. The Visiting Hot-Shot looked pretty bad at the moment. So, just to have something to do, I checked the resistors again. Oh, oh. "Hey! Now look. This reads completely open!"

"You got a bad connection," he said.

"Nope, look at it. Tight and firm. Now, let's try the other one." I moved the prods, and gulped; it read 1.5 meg. Back to the first one, which now also read 1.5 meg. Light dawned; I shorted the meter prods, and grinned. "Look, Maw—no continuity!"

When I wiggled the meter leads the reading 'came and went!' Investigation showed that not one but both test leads were broken inside the insulation! After some pungent comments, we pulled the wires out, trimmed them back and resoldered them. Now, back to work.

Both resistors read 1.5 megohms, just as before. Diagnosis No. 3 gulped, and got a lot thinner and sort of airy-looking; in fact, you could see right through it in places. To look busy, I checked on the terminal board where the resistors had been hooked. There wasn't anything there but C95, a little ceramic capacitor with a piece of fishpaper on its leads. All of a sudden, Diagnosis No. 3 jumped up, and hit me smartly on the top of the head. I was getting a low reading from both ends of the thing! As it was now (cathode lead open, and all resistors taken loose) I shouldn't be getting *any* resistance readings!

Little Buddy looked at me inquiringly, as if he wanted to know why I had that funny look on my face. Pulling my diagonals out of my pocket, I haggled off the ends of the leads and took the capacitor completely out. Now, there wasn't any resistance at all on the terminal board!

Hooking the ohmmeter leads across C95, it turned out to be an RC network consisting of a capacitor in parallel with about a 5,000-ohm resistor! Since the schematic showed it differently, I felt better, and Diagnosis No. 3 was looking positively smug.

"Got a double-0-3 ceramic?" I asked.

"Sure," he said, scrabbling in a drawer. "Here." I stuck the resistors back in place, then put the bit of fishpaper on the new capacitor leads. (This was put on there to space the leads so that they'd work as a spark gap in case of catastrophe.) Soldering it in place, I got up off my knees, painfully.

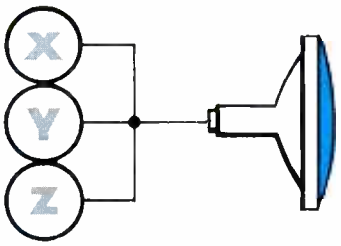
Turning the chassis down, we hooked the meter into the 6BK4 cathode again, leaving it on 12-ma scale just for luck. I sneered at Diagnosis No. 3, which was looking most insufferably smug, crossed my fingers behind my back, and turned the thing on.

The meter came up to about 2.0 ma as a fairly well focused raster and picture came on. Setting the HV adjust, we got just a bit over 1.0 ma for an average raster, and the HV now sat nicely at about 24,000 volts. Diagnosis No. 3 chortled happily in my ear. LB said, "Hey! That looks more like it! Thanks a lot!"

"Nothing to it," I said, in my most obnoxious 'nothing that any good high-grade genius couldn't have done' voice. I left, with Diagnosis No. 3 trailing after me, burbling in glee and ignoring my mental plea to 'Aw, shut up, willya?'

The moral to this story: make up a diagnosis on each job, based on the observed conditions (Notice I didn't say 'observed facts'? There aren't any facts at this stage of the game; not until you have made some tests.) Diagnosis No. 1, of course, was a bad focus rectifier tube. No. 2 was trouble in the focus circuitry, but it didn't last long after we found that taking the HV regulator tube out of the circuit brought back the high voltage with a bang (literally). So, No. 3 was the HV regulator drawing too much current and overloading the output. By upsetting the proportions between HV and focus voltage, we got the badly defocused raster. The first suspect was the bias resistors. This was complicated by the test leads being intermittent. Which, by the way, was the reason that we read no voltage on the focus connection on our first test.

So, check your diagnosis as you go, being ready to change them at any time the facts don't support them. Also, make a habit of checking your test equipment, to be sure that *it* isn't bad, instead of the set! ▲



REPAIRING THE X-Y-Z color circuits

Typical troubles that can occur in these critical circuits.

by Homer L. Davidson

Have you ever had a color receiver screen change to a green or red color just five minutes before the set was to be delivered? You can bet that we have. So we like to fire up all of our new color sets for at least eight hours before delivery, though sometimes this plan doesn't work out. We also try to let a repaired set run for several hours before it is returned to the customer's home.

One new color set we recently worked on had a nice green cast to the black-and-white picture. Just about pea green. The back was taken off and a new R-Y amplifier tube inserted. We knew that the red was missing from the picture, so if it was tube trouble, the R-Y amplifier or X demodulator tube was at fault. We thought we were in luck as the original black - and - white picture popped in place.

The picture stayed white for about ten minutes and then turned to red. So we changed the G-Y and B-Y amplifier tubes, and the picture seemed to be good again.

At this moment a color broadcast was on the air so we switched to the local color station. The picture was predominantly blue and green with very little red, if any. Once in a while a light trace of red could be noticed with the tint control turned counter-clockwise.

It looked like the chassis would have to be pulled, but first a voltage check was made. We remembered when a CTC9 chassis gave us this trouble. Then the coupling capacitors from the plates of the X and Z demodulators to the output amplifier grid circuits had either shorted or had a high leakage. So the VTVM was placed on the grid of the R-Y amplifier of this new set, and sure enough, a B+ voltage of 205 volts was present. The voltage at this point should be −1.5 volts with no signal.

All three .01 mfd coupling capacitors to the grids of the R-Y, B-Y, and G-Y amplifiers were replaced. Although this set was brand new, we couldn't risk this trouble recurring on a demonstration in the customer's home. The lack of red in

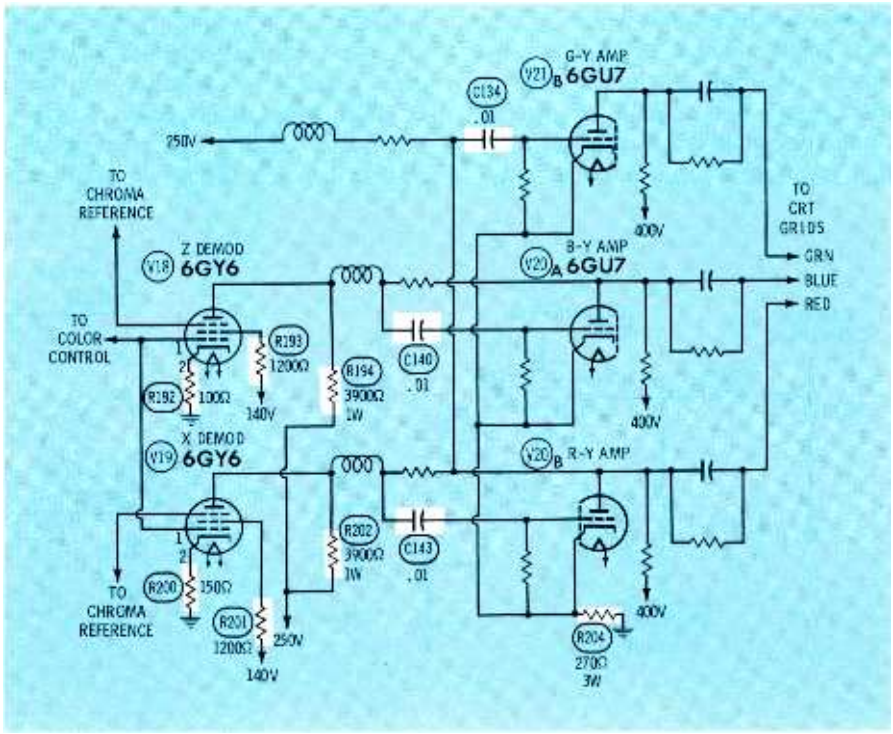


Fig. 1. RCA CTC17 circuit with most troublesome parts indicated.

the color program was due to a burned plate-load resistor, R202, in the X demodulator stage. The circuit is shown in Fig. 1. A heavy current had flowed through the resistor and the shorted coupling capacitor C143. As a result, there was no amplification in the X demodulator circuit and very little red on the screen.

The Black-and-White Picture

Let us take a new color set and actually see what happens when a few tubes are pulled in the XYZ circuits. Look at Fig. 1 and follow along. Disable the R-Y amplifier, V20B, by shorting the grid to the cathode. The screen turns cyan or bluish green. Put the R-Y amplifier back in operation and disable the B-Y amplifier tube, V20A. Of course, the blue is missing and the screen is close to chartreuse.

Now pull out the X demodulator then the Z demodulator tube, both type 6GY6. You will notice that the demodulator tubes affect only the color picture, not the black and white. This is good to remember when working on the XYZ stages.

The black-and-white picture may be upset by tubes, shorted capacitors or changing value of resistors in the R-Y, G-Y and B-Y circuits. Shorted or open elements in the color picture tube should also change the color of the black-and-white picture. When the color picture tube ages a few years, the black-and-white picture can change when the set is first turned on. This is due to one or more guns not coming up to full brightness when the set is cold. After the set warms up, the black-and-white picture may not be too bad. A good color picture tube tester can be used to check the condition of the picture tube. If one of the guns is intermittent, generally a few light taps on the end of the picture tube cap will change the black-and-white picture.

Illustrative Cases

In an Admiral 24E2 color chassis there was very little blue in the color picture. The black-and-white picture was fairly good. So we pulled the Z demodulator tube, Fig. 2, and inserted a new one. Still there was no blue in the color picture. We checked the old 6GY6 demodulator tube and found it badly shorted. Just in case the new 6GY6 was defective, another was inserted in its place. Still no blue. R178, a 6,200-ohm resistor, had gotten quite warm and had decreased to 1000 ohms. Undoubtedly, when the 6GY6 had shorted, the increased current burned the plate-load resistor.

An RCA CTC10 chassis came in the shop with a completely red screen. Both grid coupling capacitors on the R-Y, B-Y amplifiers were shorted and the common cathode bias resistor was burned. The trouble cleared up when the R-Y, B-Y amp tube was replaced along with the defective parts. In the newer TV color chassis the common cathode resistor of the R-Y, G-Y, and B-Y amplifiers is a 3-watt type. Generally, this resistor will hold its value even if the grid capacitors do leak or short. Most newer color receivers have disc ceramic coupling capacitors as originals. These do not break down as easily as molded ones.

In a brand new RCA CTC16XL chassis, the screen would become extremely red like an overdriven picture. This reddish color would still be in the picture when the tint control was turned to the extreme end of rotation. Another serviceman had changed the coupling capacitors and plate-load resistors in the X and Z demodulator circuits. We checked all previous wiring and parts replacements and everything seemed to be in place.

The capacitors, plate-load resistors, and X and Z tubes were all brand new. After voltage and resistance checks were made, we found the problem to be the cathode resistor of the X demodulator. This was supposed to be 150 ohms, but had decreased to 15 ohms. Replacing this cathode resistor returned the set to normal operation.

In Fig. 1, the XYZ circuits of a RCA CTC17 color chassis are shown with the most troublesome parts indicated. Good tube testers, VTVMs, and scopes are a must when servicing these circuits. When there is a loss of one color or a weak color, the scope will easily isolate the defective stage.

Color-Fidelity Circuits

In some of the newer color TV receivers a color-fidelity control has been installed to change the tint of the black-and-white picture. In many of these new receivers, the color-fidelity control is a potentiometer on the front of the TV receiver, while others use a switch to change the

• *Please turn to page 74*

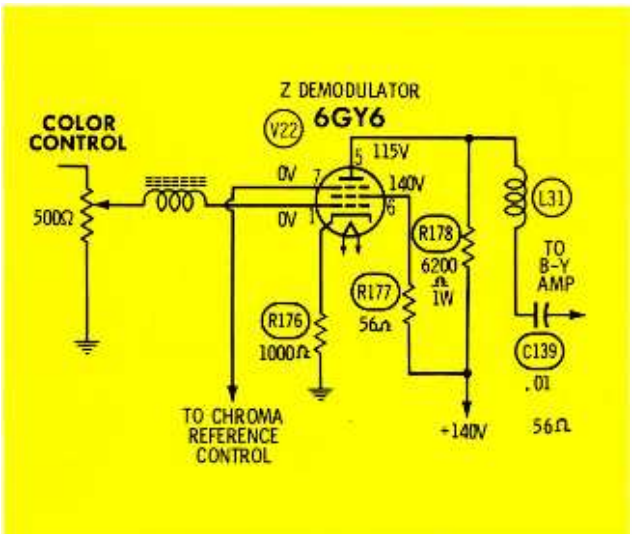


Fig. 2. Admiral 24E2 Z demodulator circuit.

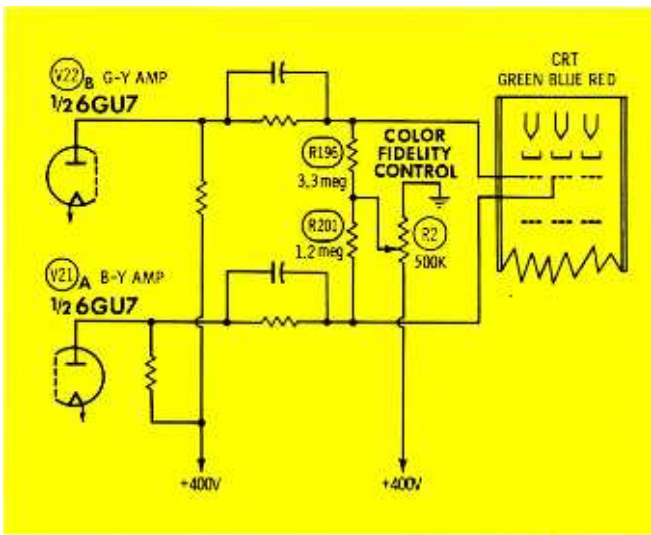


Fig. 3. Admiral G1263-1 color-fidelity circuit.

TUBE and TRANSISTOR DATA

RECEIVING TUBES

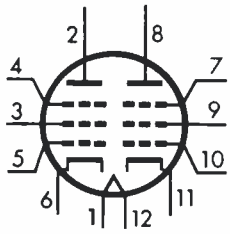
3AV2
High-Voltage Rectifier
Fil.—3.15V @ 0.35A
PIV.—38KV @ 2.2ma

12EW

2BJ2
High-Voltage Rectifier
Fil.—2.3V @ 0.3A
PIV.—20KV @ 1.0ma

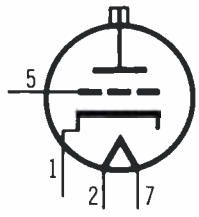
9RT

8AR11
TV-IF Amplifiers
Fil.—8.4V @ 0.6A (11 sec)



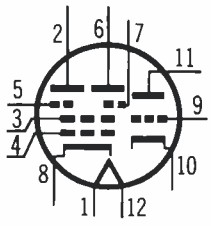
12DM

6BK4B
High Voltage Regulator
Fil.—6.3V @ 0.2A
Higher plate dissipation than 6BK4A



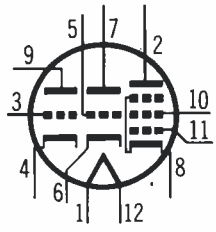
8GC

8BA11
Pentode—Sync Separator
Triode—Vertical Oscillator
Fil.—8.4V @ 0.45A (11 sec)



12ER

14BL11
Pentode—Video Amplifier
Triodes—General Purpose
Fil.—14.2V @ 0.45A (11 sec)

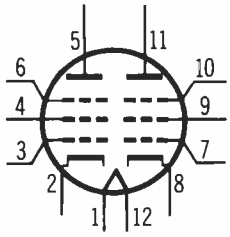


12GC

3BF2
High-Voltage Rectifier
Fil.—3.6V @ 0.225A
PIV.—35KV @ 2.2ma

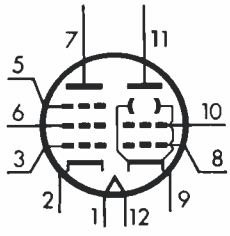
12GQ

6BN11
TV-IF Amplifiers
Fil.—6.3V @ 0.8A



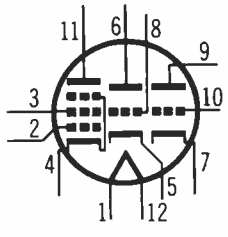
12GF

12BF11
Pentode #1—Audio Output
Pentode #2—Audio Detector
Fil.—12.6V @ 0.6A (11 sec)



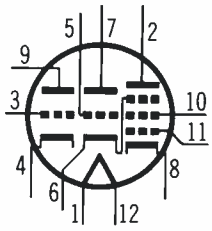
12EZ

14BR11
Pentode—Video Amplifier
Triodes—General Purpose
Fil.—14.2V @ 0.45A (11 sec)



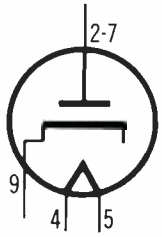
12GL

11BT11
Pentode—Video Amplifier
Triodes—General Purpose
Fil.—10.7V @ 0.6A (11 sec)



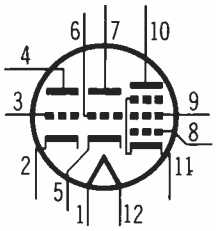
12GS

6CH3
Damper
Fil.—6.3V @ 2.5A
PIV.—6KV @ 350ma



9HP

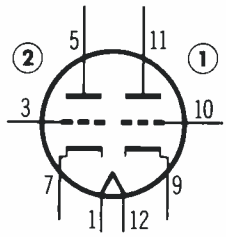
8BU11
General Purpose
Fil.—7.8V @ 0.6A (11 sec)



12FP

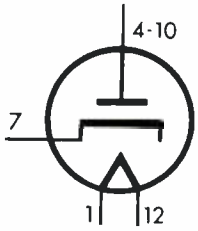
NOVAR

11FY7
Triode #1—Vertical Oscillator
Triode #2—Vertical Output
Fil.—11.0V @ 0.6A (11 sec)



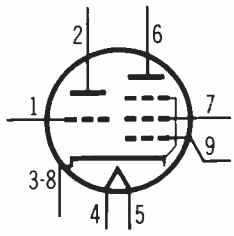
12EO

17BZ3
Damper
Fil.—16.8V @ 0.45A (11 sec)
PIV.—4.5KV @ 200ma



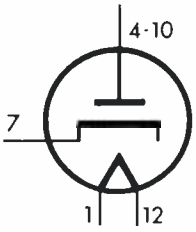
12FX

5GS7
VHF Converter
Fil.—5.4V @ 0.45A



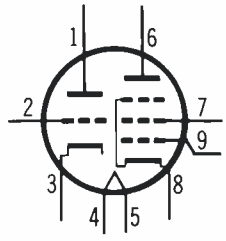
9GF

6CG3
Damper
Fil.—6.3V @ 1.8A
PV.—5KV @ 350ma



12FX

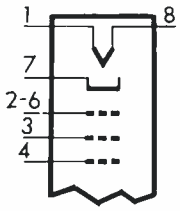
18GV8
Pentode—Vertical Output
Triode—Vertical Oscillator
Fil.—18.0V @ 0.3A



9LY

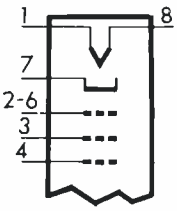
CATHODE-RAY TUBES

19ENP4A
Protection—tension band
Deflection—114°
Filament—6.3V @ 0.45A (11 sec)
Grid 2—50V



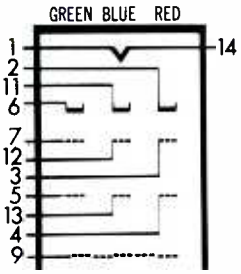
8HR

19EUP4
Protection—tension band
Deflection—114°
Filament—6.3V @ 0.6A (11 sec)
Grid 2—400V



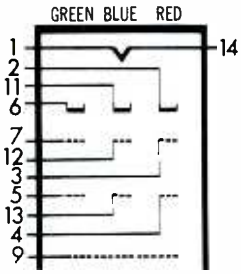
8HR

19EXP22
Protection—none
Deflection—90°
Filament—6.3V @ 0.8A
Grid 2—400V
Rare-earth phosphor



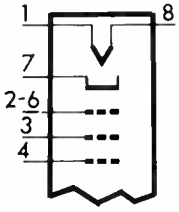
14BE

19EYP22
Protection—bonded glass
Deflection—90°
Filament—6.3V @ 0.8A
Grid 2—400V
Rare-earth phosphor



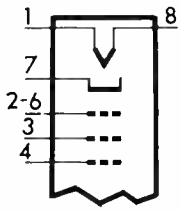
14BE

19FEP4A
Protection—tension band
Deflection114°
Filament—6.3V @ 0.45A (11 sec)
Grid 2—30V



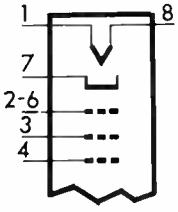
8HR

19FTP4
Protection—tension band
Deflection—114°
Filament—6.3V @ 0.45A (11 sec)
Grid 2—400V



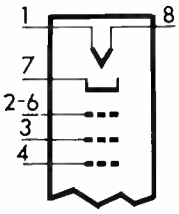
8HR

21FZP4
Protection—tension band
Deflection—114°
Filament—6.3V @ 0.45A (11 sec)
Grid 2—400V



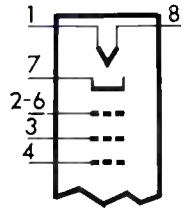
8HR

23EWP4A
Protection—tension band
Deflection—114°
Filament—6.3V @ 0.45A (11 sec)
Grid 2—400V



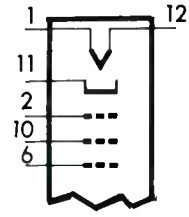
8HR

23FKP4
Protection—bonded glass
Deflection—94°
Filament—6.3V @ 0.6A (11 sec)
Grid 2—500V



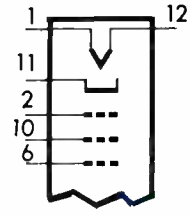
8HR

23GKP4
Protection—filled rim
Deflection—92°
Filament—6.3V @ 0.6A (11 sec)
Grid 2—300V



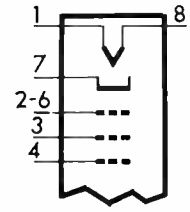
12L

23GRP4
Protection—filled rim
Deflection—92°
Filament—6.3V @ 0.45A (11 sec)
Grid 2—300V



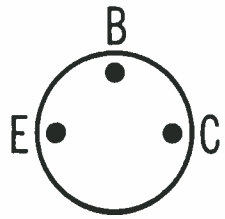
12L

23GSP4
Protection—tension band
Deflection—110°
Filament—6.3V @ 0.6A (11 sec)
Grid 2—300V

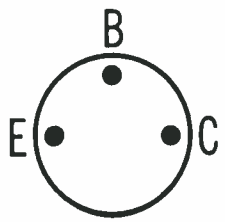


8HR

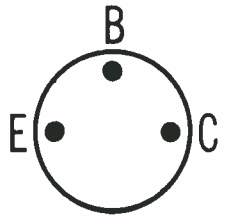
2SB75B
Audio Amplifier
PNP—Germanium



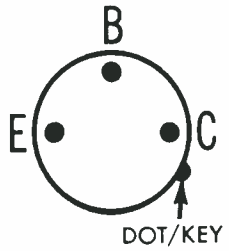
2SB185
Audio Amplifier
PNP—Germanium



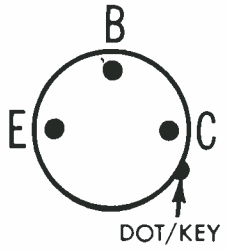
2SB77V
Horizontal Driver
PNP—Germanium



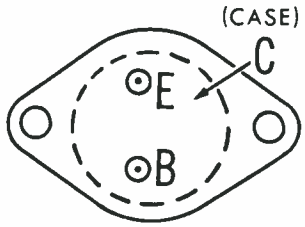
2SB187
Audio Amplifier
PNP—Germanium



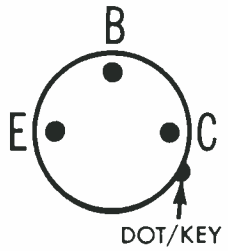
2SB135
Audio Amplifier
PNP—Germanium



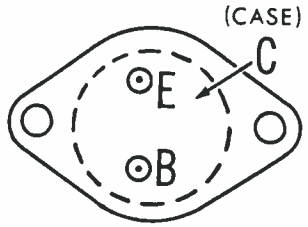
2SB217
Audio Amplifier
PNP—Germanium



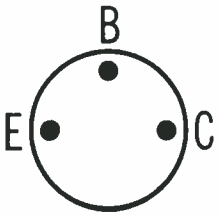
2SB171
Audio Amplifier
PNP—Germanium



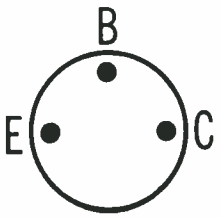
2SB274V
Vertical Output
PNP—Germanium



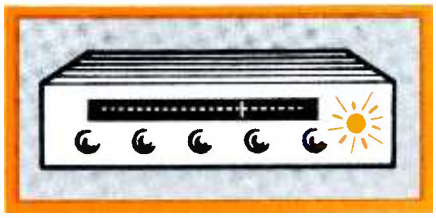
2SB176
Audio Amplifier
PNP—Silicon



2SB365
Audio Amplifier
PNP—Germanium



chasing troubles



in stereo-on indicators

Repairing those troublesome indicators

by Jack Gamble

Modern FM stereo tuners employ various devices to indicate that the received signal is a stereo transmission. Neon bulbs, low-voltage AC pilot lamps, and meters are used as stereo-on indicators. Most of these devices are activated by the 19kHz pilot signal, which is a necessary part of the detected stereo signal. This article concerns the type of stereo-on indicator circuits in which a component failure will not effect stereo separation.

One circuit of this type utilizes a simple neon bulb and isolation network placed across the 19kHz or 38kHz tuned circuit in the decoding section of the receiver. The large AC voltage across the parallel tuned tank is more than sufficient to ignite the bulb. Should the indicator fail to ignite, troubleshooting would be confined to the bulb or the resistive isolation network, provided stereo separation was not affected. Other components could prevent the bulb from igniting; however, they would also affect stereo separation.

There is one other possible trouble related to the neon bulb which should not be ignored. The ignition of the neon bulb can create noise. Since the neon indicator is normally mounted on the control panel, care should be taken to ensure that the leads to the bulb are not placed too close to the preamplifier circuits or function switch. Lead dress could produce noise in one channel or both. Of course this source of noise would be present only when the indicator showed stereo-on. This trouble can be isolated by disconnecting the neon bulb while the noise is present.

The circuit shown in Fig. 1 is a popular, solid-state indicating circuit, using a No. 49 lamp as the stereo-on indicator. Transistor Q12 is employed as the 19kHz detector and transistor Q13 is a DC indicating amplifier. The supply voltage for both transistors is 6.3 VAC provided by a winding on the power transformer which is also used for the instrument pilot lamp. The 6.3 VAC is rectified by diode X10.

The desired result of the circuit is to forward bias Q13 when a stereo

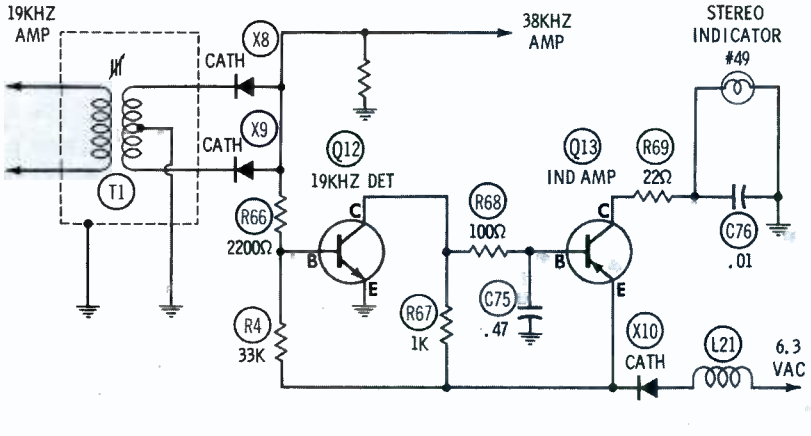


Fig. 1 Schematic Magnavox R204 EP chassis.

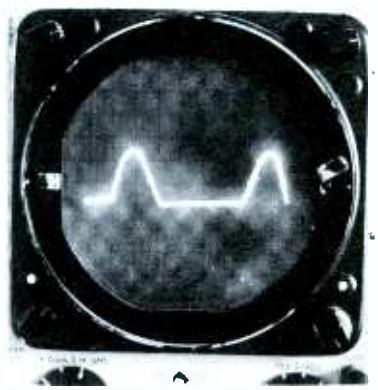


Fig. 2 Base waveform at Q2.

signal is being received. Stated another way, we want the base of Q13 to go less positive when the 19kHz pilot signal appears across the secondary of T1.

During monaural reception, both transistors offer high impedance through their emitter/collector circuits, limiting current flow to a negligible value. The 19kHz signal applied to the base of Q12 will cause current flow from emitter to collector through R67 to the power supply. The voltage drop across R67 causes the collector of Q12 to be less positive. This change causes the base of Q13 to become less positive, forward biasing it. With forward bias, the collector/emitter resistance of Q13 is lowered. Current will flow through the indicator lamp, resistor R69, transistor Q13, to the power supply.

Now for trouble analysis in this circuit: Suppose the indicator does not show stereo-on, and stereo separation is normal. Check the DC amplifier (Q13) portion of the circuit. An open component in the current path of the indicator lamp would prevent its working. The indicator lamp itself could be at fault; also resistor R69, transistor Q13, diode X10, or coil L21.

Here is a quick way of checking all components in the amplifier circuit: As you recall from our previous discussion, a decrease in collector/emitter resistance of Q12 forward biases Q13. We can simulate this condition with a resistor from the collector of Q12 to ground. Use a resistor about one fifth the value of R67, or about 200 ohms. Another way to forward bias Q13 is to place a 100 ohm resistor across capacitor C75. If all components in the amplifier circuit are working the indicator will show stereo-on with Q13 forward biased.

Incidently, this quick component check may be an answer to another possible service problem: A leaky C75 will keep the indicator reading stereo-on at all times.

The components most likely to open in the amplifier circuit are the indicator lamp and diode X10. The diode can be quickly checked by shunting a good diode across it. If the diode is shorted, the stereo-on indicator will be excessively bright on a stereo station. Keep in mind that a shorted diode may possibly cause repeated failure of the indicator lamp. In addition, with diode X10 shorted, the 6.3 VAC would approach 18 volts p-p and possibly damage the transistors.

The sensitivity and possible repeated failure of the indicator lamp are dependent on resistor R69. Initial production versions of this circuit used a 22 ohm resistor for R69. On later versions, the resistor was increased to 39 ohms. Approximately 50 mv of antenna signal are required for operation of the stereo-on indicator.

We mentioned previously that a leaky C75 could keep the stereo-on indicator glowing at all times. This capacitor is a necessary filter for the base voltage of transistor Q13. An open C75 could prevent the stereo-on indicator from working. Fig. 2 shows the normal scope pattern at the base of Q13 with the scope set to the line frequency. If C75 were open, 19kc would also be present at this point.

The base of Q12 has a positive .23 volts during monaural reception, and the collector has 6.3 volts. With a 19kHz signal of approximately 1.5 volts p-p on the base, the emitter/base junction acts as a diode detector. Thus, when 19kHz is present, the base voltage changes to zero and the collector to 1.9 volts. Resistor R4 is used to supply the base voltage and R67 supplies the collector voltage. While resistor failure in this circuit may affect its operation, the most likely component is the transistor itself.

Leakage between collector and base would lower the collector voltage during monaural reception and keep the stereo-on indicator operating. An emitter/base short of Q12 will prevent the stereo indicator from lighting during stereo operation. Should the emitter/base junction open, the voltage on the base would remain at .23 volts during stereo reception, and the indicator would not light. With the base/collector junction open, the base voltage will go to zero during stereo operation; however, the collector voltage will remain at 6.3 volts and the stereo indicator will not register stereo-on.

Fig. 3 shows another stereo-on indicator circuit. The 28 volt lamp is in parallel with Q2, the switch transistor. In this circuit Q2 is forward biased during monaural reception and reverse biased for stereo. During monaural reception the collector/emitter resistance of Q2 is low and acts as a shunt across the lamp. The collector voltage measures —3.6 volts and the emitter —3.39 volts. This leaves only about .3 volts across the lamp during monaural operation. When Q2 is reverse biased during stereo operation, the collector/emitter impedance is high; however, 20 to 25 ma. of current will now pass through R1, the indicator lamp, and R2. The voltage at the collector of Q2 changes to —18 volts, placing about 15 volts across the lamp—sufficient voltage for illumination.

Q2 is reverse biased by the con-

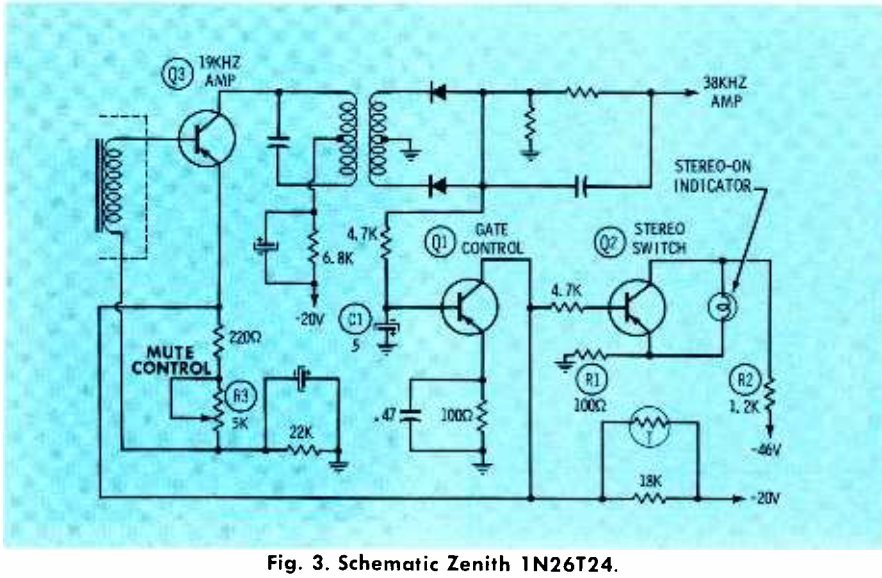


Fig. 3. Schematic Zenith 1N26T24.

duction of Q1, the gate-control transistor. Q1 is dependent on a 19kHz signal of sufficient amplitude to start Q3, the 19kHz amplifier, conducting. The sensitivity of Q3 is controlled by the setting of the mute control R3.

Both the collector and base of the gate-control transistor are driven negative by conduction of the 19kHz amplifier. The base control for the gate transistor is taken from the 38kHz doubler circuit. The 38kHz negative pulses are filtered by capacitor C1, a necessary filter for proper operation of the stereo-on indicator.

Summarizing the operation, Q2 is forward biased for monaural operation and reverse biased for stereo. This is in contrast to Q1, which is reverse biased for monaural and forward biased for stereo operation.

Let's look at Q2 and its circuit. Transistor problems such as open elements or base/emitter shorts would keep the stereo indicator on at all times, provided R1 and R2 have proper values. Difficulties within the transistor could be diagnosed effectively by checking voltages.

The stereo indicator switch-circuit can be checked by placing a 100 ohm resistor from base to ground. This will zero bias the transistor, and the indicator should light if collector circuit components are okay.

Q1, the gate-control transistor, must be forward biased in stereo operation. Approximately 1.7 volts p-p on the anodes of the 38-kHz doubler diodes is coupled to the base of Q1. The signal is filtered by C1, resulting in a —.4 volts on the base. Q1 base voltage measures zero for monaural operation. A shorted C1 would keep the base voltage at zero and prevent the stereo indicator from showing stereo-on.

If the base voltage of Q1 changes from zero to —.4 when tuning from monaural to stereo, the emitter voltage will change from zero to —.2 volts. If the emitter voltage does not follow this pattern, check the 100 ohm emitter resistor and bypass capacitor. If the resistor and capacitor are good, change the transistor. In the foregoing, we have assumed a negative voltage on the collector; otherwise the stereo indicator would be on.

Fig. 4 is the schematic of an indicator circuit using a 1K ohm meter movement. Even though this system is dependent on proper stereo separation before the meter reads stereo-on, several components can keep the meter indicating stereo-on during monaural reception.

Before discussing the possible trouble spots, let's have a quick review of circuit operation. A signal from the 19kHz amplifier stage is coupled through stereo-threshold adjustment R4 to the base of Q14, a 19kHz switching amplifier. From the collector of Q14, the 19kHz signal is R-C coupled to the base of Q15. Q15, another 19kHz switching transistor, is reverse biased for monaural operation and forward biased during stereo operation by a negative 19kHz voltage on its base.

The —.7 volts reverse-bias voltage for Q15 is developed by a voltage-divider network consisting of resistor R79 and diode X28. The diode is used to stabilize the voltage to a —.7 v.

During stereo operation the current through Q15 causes the voltage at point A to change from —20 volts to approximately —5 volts. The voltage at point A is also the collector supply for the 38kHz oscillator transistor. When the voltage at point A is lowered (or swings in a positive direction), the oscillator starts and injects a 38kHz signal to the demodulator circuits, resulting in stereo separation. The function switch on the control panel must be in the *FM Stereo* position to complete the emitter circuit of the oscillator. The stereo-indicator meter functions at all FM positions of the function switch, and when Q15 is forward biased, the indicator will read stereo-on.

Shorted or leaky capacitors C15, C16, and C25 can cause the meter to show stereo-on at all times. If the guilty capacitor is C15, the base voltage of Q15 will read negative during monaural reception, as opposed to a normal reading of zero volts. If the voltage at the base of Q15 is zero, check voltages at points A and B. If these voltages are equal, C16 should be suspected. (Remember that the oscillator emitter circuit is disabled when the function switch is not in the FM Stereo position.) If the voltage at point B is less negative than point A, check capacitor C25.

A shorted diode X28 would change the meter sensitivity and cause it to indicate on noise pulses during monaural operation. Remember, the emitter voltage of Q15 should read —.7v at all times. A shorted X28 could be found by a voltage check at this point. Of course an open R79 would also create the same problem. (Resistors are not mentioned too frequently because surveys show that they constitute less than 5% of the defective components in most solid-state products.)

If diode X28 were open, a high negative voltage would appear on the emitter of Q15, reverse biasing the stage to such a degree that the stereo meter would not work. An

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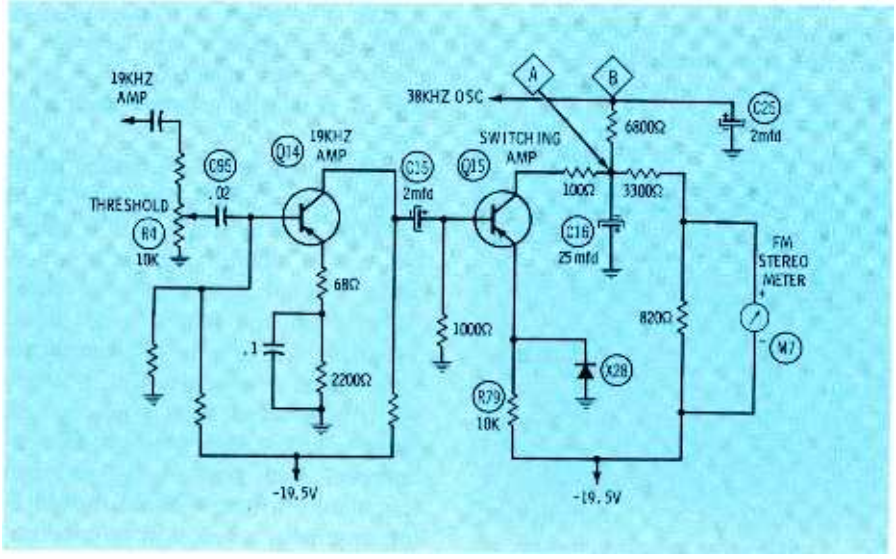

Fig. 4 Schematic Magnavox R201-05 chassis.

Leave those parts in the circuit

Forget that soldering iron for a while.

by Larry Allen

I had hardly settled down on the stool next to Jim when he suddenly grunted "Ouch!" and jerked his left hand away from the chassis he was working on. Stuck to the back of his hand were three small put painful splotches of solder—solder that had splattered there when a resistor lead finally responded to his heating and tugging.

Jim's painful little accident brought to mind something I've seen in shop after shop: resistors, capacitors, coils, transformers—practically every kind of part—being needlessly clipped out or unsoldered from the circuit for testing. Since my reason for being at Jim's shop was to teach him and his bench men some tough-dog troubleshooting tricks, I picked this occurrence as the starting point for a lengthy lecture on how to test components without doing so much soldering and unsoldering. You can't test everything in the circuit, but it's a good practice to test whatveer parts you can without heating up your soldering gun (and all the parts around it).

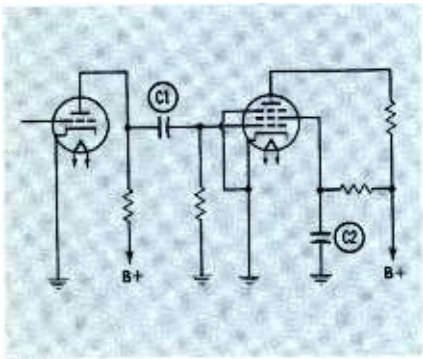

Fig. 1. Small-value coupling and bypass capacitors in a typical R-C amplifier.

Importance of Test Equipment

Naturally, the more test equipment you have, the easier your troubleshooting should be. And it might presumably follow that much fancy test equipment would make it easier to test parts in the set, once you've pinned down the trouble to a specific area. That's not necessarily so! Simple test instruments can give you a lot of information if you use them properly and know what they're telling you.

You might think it is easier to clip parts out of the circuit, slap them on a component tester and then try to put the good ones back in where you found them, than it is to bother hooking up your basic test instruments. The truth is: You ought to have them hooked up anyway, if you're serious about doing a good job in reasonable (and profitable) time.

What do I mean by basic instruments? You should have a VTVM (a VOM is okay if it's 20,000-ohms-per-volt or better), an oscilloscope, and a signal generator—all three warmed up and ready at all times. To settle for less is to complicate your work unnecessarily, because with these three units you can test almost any component you'll encounter. And, best of all, you can test many of them without unsoldering anything; a few will require unsoldering one lead.

It's important to remember that you'll often make two or three tests on a particular component. Use first the tests that require the least unsoldering, and whichever instrument is quickest or surest. Most of the tests will be conducted with your VTVM and scope. For some, you'll need the signal generator.

Remember, too, that each of these tests is possible because of a component's characteristics and the way it is used in the circuit. If you don't know the principles of parts and their circuits, you may need to bone up a little before you can understand some of these tests. I'm going to show you the *what* and let you figure out the *why*. In every case, I'll point out how to take shunt paths into consideration, for they are very important in evaluating the results of in-circuit parts testing.

Small-Value Capacitors

Think of capacitor testing in terms of the three faulty conditions you are most likely to encounter: open, leaky, or shorted. For Jim's men, I divided my capacitor discussion among those three faults.

Seldom can you spot a faulty capacitor visually, unless a lead has broken off externally. You will use test instruments in one way or another. Depending on the capacitor value and type, the tests you make may be for all three possible conditions; sometimes a single test will suffice. Certain tests are good for

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one condition and certain component values, while another test may be more meaningful for that same condition with other component values.

Capacitors are connected either for coupling or for bypassing (decoupling). The latter units almost always have one end returned to ground or to B−, occasionally through a larger electrolytic. Certain tests prove more effective for particular circuit usages; pay attention to which test you should use for each circuit connection.

Open Capacitors

Probably the most difficult capacitor condition to diagnose is an open. Generally, one of the leads has separated from the foil inside the case of the capacitor. Testing isn't difficult or complicated, although there are several ways to find an open capacitor. First, let's consider coupling capacitors (C1 in Fig. 1).

If the capacitor is greater in value than .001 mfd, connect your ohmmeter leads (set turned off, of course) across the suspected unit. Unless there's a fairly low-resistance (5000 ohms or less) shunt path—through the grid resistor, ground, power-supply electrolytic, and plate resistor—you'll see a slight kick of the meter pointer; quickly reverse the ohmmeter leads and you should see another slightly greater kick. If the pointer remains at some resistance value, a shunt path is preventing your using this particular test. To eliminate this problem, unsolder one lead of the capacitor and make the test again. If there is absolutely no deflection with the ohmmeter connected either way, chances are the capacitor is open.

Another effective way to check a coupling capacitor for an open is by using the scope with a signal generator. You don't have to unsolder anything, and the test is effective for *any* value of capacitor, even below .001 mfd. The set is turned off and the generator connected to the input end of the capacitor. Generator frequency depends on the capacitor; Table 1 shows frequencies suitable for various values. Connect the scope directly to the generator lead and note the amplitude of the output waveform on the scope screen (the scope's sweep frequency is not important, since we are interested in signal *amplitude*). Next, move the scope probe to the other end of the capacitor. Unless the capacitor is open, there should be almost no reduction in the amplitude of the waveform. If the amplitude is reduced even half, the capacitor is bad.

A variation of this last test is possible without the generator. Leave the set turned on and check at both ends of the capacitor with your scope. If the normal signal going through the set is significantly reduced on the output end of the capacitor, the capacitor is faulty.

Testing for open bypass capacitors (C2 in Fig. 1) is slightly different. Connect the scope and generator leads together and note the amplitude of signal; then, with the set off, connect both leads—still connected together—across the bypass capacitor. If the capacitor is good, and the generator frequency is set according to Table 1, the amplitude will be reduced to half or less. If the amplitude on the scope screen remains the same, with or without the capacitor across the leads, the capacitor is open and the signal is not being bypassed. (A variation of this test is to check across the bypass capacitor with only the scope while the set is operating, but it is difficult to decide just how much signal is normal—some bypass capacitors aren't intended to bypass all signals that are present.)

Table 1.

10 pf	3kHz
100 pf	300 Hz
1000 pf	3 mHz
.01 mfd	300 kHz
.1 mfd	30 kHz
1 mfd	30 mHz

Leaky Capacitors

Testing a leaky capacitor can be a bit difficult if the leakage is very slight or if the capacitor is used in a bypass configuration. Clipping an ohmmeter across the unit is not a good test. At the low voltage furnished by an ohmmeter, the capacitor may refuse to leak even slightly. On the other hand, your ohmmeter may not be sensitive enough to show slight amounts of leakage; you know how crowded most ohmmeter scales are at the high end.

Because of the nature of leakage, the best test is usually the *open-end* method, which requires unsoldering one end of the capacitor. Try this: If the capacitor is in a B+ circuit, such as C1 and C2 in Fig. 1, unsolder the end *not* connected to B+ (the grid end of C1 or the ground end of C2). With the set on use your VTVM (a VOM may not be sensitive enough) to measure DC voltage on the free lead. If any DC voltage is indicated at all, the capacitor is leaky. This open-end method is the most sensitive leakage test you'll ever need for a capacitor.

If the capacitor is not in a B+ circuit, you can still check it by this method if there is some DC voltage handy. If there is none, then leakage isn't likely to be much of a problem anyway; however, if you feel leakage might cause trouble in a critical application, you can break the don't-take-it-out rule and remove the capacitor from the circuit, tack one lead to a B+ source, and make the open-end test that way. The sensi-

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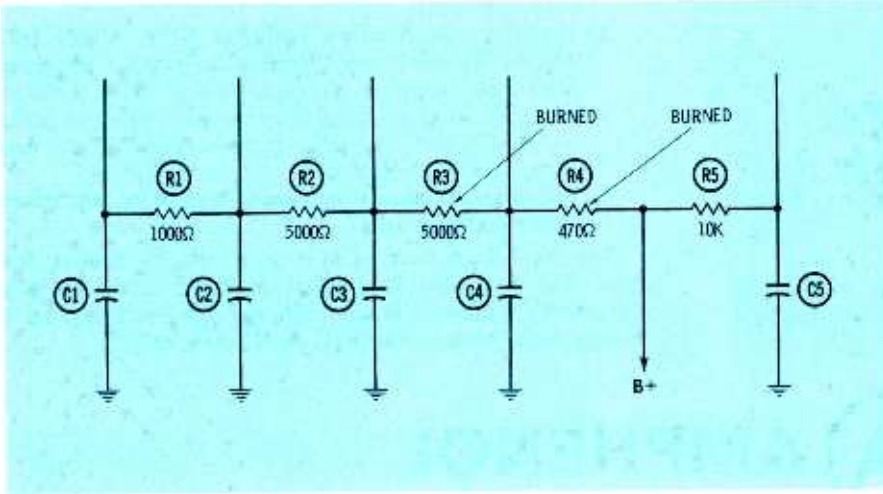

Fig. 2. Ohmmeter tests in this B+ feeder string quickly pinpoint exact fault.

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Here are oscilloscope photographs from the outputs of two typical competitive color generators, one transistorized and one tube type, and the B&K Model 1245. The detailed analysis with each photograph shows a few of the reasons why you'll save time and effort with B&K.

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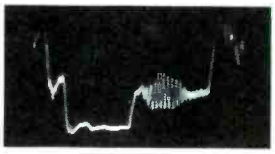
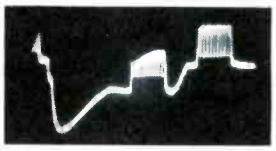


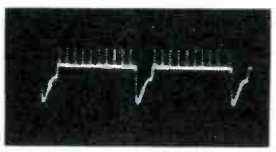
One horizontal sync pulse with its color burst.

Two lines showing horizontal sync pulse with black and white tv signal.

TRANSISTORIZED B&K MODEL 1245

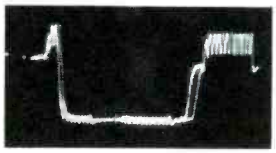


Good duplication of station signal including back porch. If the set won't sync, the set is defective.

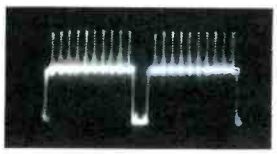


Well defined back porch on horizontal sync pulse permits accurately setting color killer and almost eliminates need to adjust brightness and contrast.

TRANSISTORIZED GENERATOR A



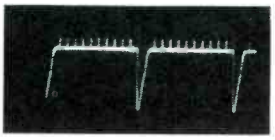
No back porch causes unstable color sync. Burst amplitude compression may permit sync on wrong color bar.



Square wave horizontal sync pulse with no back porch and poor dc coupling forces adjustments of brightness, contrast & fine tuning to obtain usable pattern.

GENERATOR B

No back porch; color information on top of sync-pulse makes sync difficult on some sets.



Complete absence of any back porch necessitates readjustment of brightness, contrast and fine tuning to obtain a usable pattern.

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Circle 11 on literature card

Notes on Test Equipment

analysis of test instruments . . . operation . . . applications

by T. T. Jones

Industrial Scope

The instrument in Fig. 1 is a recent addition to Waterman Instrument Corporation's line of pocket-size oscilloscopes. Though very small in size, this is truly a professional instrument with full-size performance.

The scope has a frequency response which limits its use in television (see specs.). We did try it on a color set and found there were many tests we could make, though the horizontal pulses were somewhat rounded, and burst pulses completely missing on the back porch.

WATERMAN OCA-11A SPECIFICATIONS

VERTICAL CHANNEL:
Response; DC to 22 kHz ∓ 1db usable trace to 200 kHz.
Sensitivity; compensated 12-step attenuator measures signal from 10 mv to 50 volts p/p per division. Impedance—1 megohm shunted by 30 pf.

HORIZONTAL CHANNEL:
Duplicate of vertical channel

Z—AXIS INPUT:
None

SYNC INPUT:
Automatic leveling, 1V to 50V. Impedance—1 megohm + 60 pf.

INTERNAL SWEEP:
4 decades plus vernier gives continuously variable sweep 3 Hz to 30 kHz, free-runing or triggered.

OTHER FEATURES:
Horizontal expansion system 2.5 x and 5 x. Beam-deflection system swings beam off screen during retrace. Maximum input voltage above ground 600 V peak including DC component. Chassis ground may be isolated from signal ground with 10 megohms shunted by .47 mfd, 400 V cap.

SIZE:
(HWD) 7¼ x 3½ x 13 5/32"

WEIGHT:
9 lbs.

PRICE:
$269.

Fig. 1. Small and useful.

However, this scope was never designed for TV. It's an industrial scope, and in these applications it does very well. The triggered sweep is quite stable and locks down on very complex waveforms. In most industrial maintenance jobs, the equipment is so large that the repairman must bring his tools to the job. The OCA-11A is small and rugged enough to be carried anywhere. Some typical applications are shaker systems, welding equipment, servos, etc.

The internal construction of the scope is of very high quality. The display tube, type 3RP1 has an integral magnetic shield, and a viewing area 1¾ x 2⅜ inches. There are no vernier controls on the vertical and horizontal gain. However, the step attenuators have closely spaced steps which give adequate gain control. We measured the frequency response and found the scope to be flat within ± 1 db out to 22 kHz and 6 db at 70 kHz. Sine waves were visible at 600 kHz, though much attenuated. With the sweep rate at maximum and the 5 x horizontal expansion, it is possible to display one cycle of a 150 kHz waveform.

A companion model, the OCA-11B, has all of the features of the OCA-11A with exception of the time base which is continuously variable from 10 seconds to 1 millisecond.

For further information circle 72 on literature card.

Tube Tester

One piece of test equipment that gets a lof of mileage around the shop is the tube tester. Most of us hate to take it out of the shop though, because it is either too big, too heavy, or too fragile.

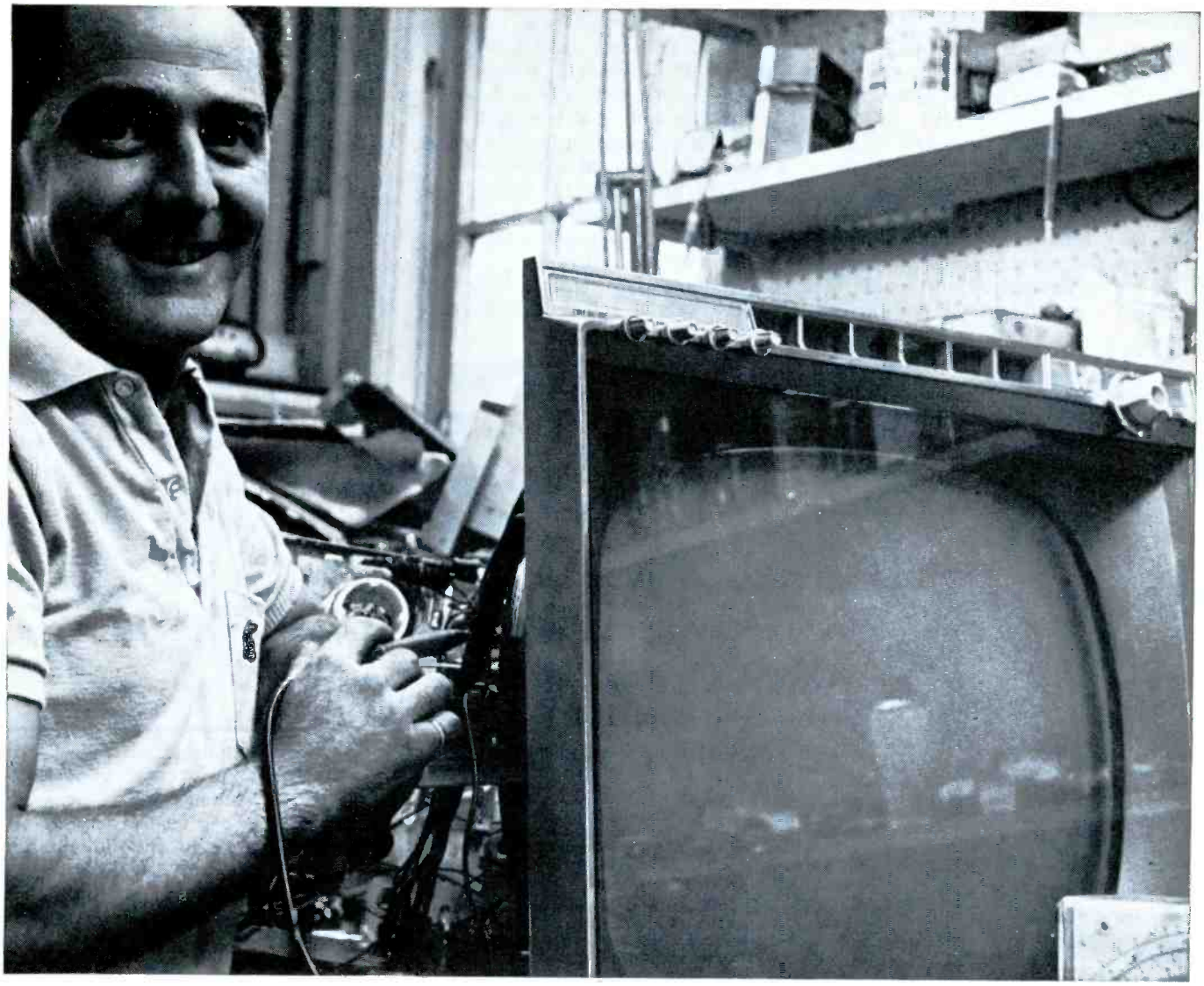
SENCORE has developed a fourth generation of their portable tube tester. Dubbed the "Mighty Mite IV," the model TC 136 continues the tradition of a small, rugged yet capable tester suitable for outside work as well as the bench.

The TC136 uses the proven circuits of the previous models, together with some refinements for added coverage of special type tubes. The index booklet has been revised and now has a latching device for one hand operation. The type is quite large and readable.

The Model TC136 checks all modern tube types from Nuvistors to Novars, including the new 10 pin types from Amperex and Mullard. The index gives data for the special tubes in

Fig. 2. Checks all modern tubes.

Island-Wide gets the Action-People*. Do you?



"Yellow Pages made my business zoom," says Paul S. Fusco, Island-Wide Servicing, New Dorp, Staten Island, N.Y. "Before I started advertising in the Yellow Pages, my business was nothing. Now, I can barely keep up with it. I'm sold on Yellow Pages."

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Display ad (shown above reduced) runs under TELEVISION SERVICE. Call your Yellow Pages man to plan your program. Find him in the Yellow Pages under: ADVERTISING — DIRECTORY & GUIDE.

*The 3 out of 4 busy Americans who shop the Yellow Pages way.

Circle 12 on literature card

the 4-digit series and also foreign tubes, including Japanese.

The manual gives simple instructions how to use the tester for types too new to be covered by the index.

In use, the tester is fast and efficient. There are only four set-up switches.

The circuit is a type of VTVM. Cathode emission is measured by applying AC voltage to the grid of the tube under test, and measuring the pulsating DC at the cathode. The tubes are tested at or near their normal cathode current ratings.

The grid emission is measured by applying −40 volts to all elements of the tube except the grid, which is tied to ground through a 10-meg resistor. Any voltage present across this resistor is measured by the VTVM circuit. Grid emission current of .5 μa will produce a reading in the "bad" area of the meter. This is in the order of 100 megohms grid leakage.

Further information on the meter circuit can be found in the November, 1965 PF REPORTER. In that issue we tested the SENCORE TC131 bench-type tube tester, which has essentially the same metering circuit.

Like the earlier "Mighty Mite III," the new TC136 is housed in a sturdy black wrinkle-finish steel cabinet with a detachable hinged cover. A compartment at the bottom contains the power cord and top cap lead. Throwing the function switch to the off position dampens the meter. These features and more add up to a rugged reliable instrument, equally capable in field or bench work. ▲

For further information circle item 73 on literature card.

SENCORE Model TC136 Specifications

Tube sockets:
- 7, 9, and 10 pin miniature
- 8 pin octal
- 8 pin loctal
- 9 pin Novar
- 12 pin compactron
- Nuvistor

Tests performed:
- Cathode emission
- Grid leakage (sensitivity over 100 megohms)
- Shorts between elements (sensitivity up to 180-K ohms)

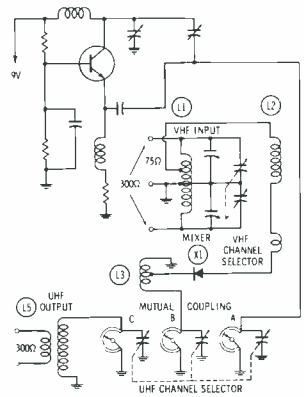
Test settings:
- Filament
  - 1 to 50 volts AC in 12 steps
- Load
  - 9 ranges of cathode current from less than .5ma to over 50ma.

Power Requirements:
- 105-125 volts AC, 50-60 cps, 7 watts.

Size: (HWD)
- 4″ x 10¾″ x 10½″ with cover installed

Weight:
- 9 lbs

Price:
- $74.50



ERRATUM

In the April "Notes on Test Equipment" item describing the Lectrotech Model U-75 (page 46), the incorrect illustration was used for Fig. 2. The correct illustration appears above.

Fig. 2. Complete schematic reveals method used in converting VHF to UHF.

For window-size blow-ups of this message, send 10¢ to Sprague Products Co., 105 Marshall St., North Adams, Mass., to cover handling and mailing costs.

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YOUR INDEPENDENT TV-RADIO SERVICE DEALER

65-110-63

Circle 14 on literature card

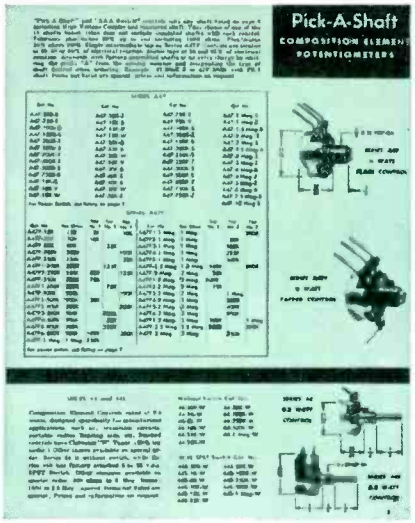
BOOK REVIEW

Radioman's Guide (AUD-3A); Edwin P. Anderson, revision by David E. Hicks; Theodore Audel Co., Division of Howard W. Sams & Co., Inc., Indianapolis, Indiana, 1964; 448 pages, 6½" x 4½", hardbound; $5.00.

This text is a complete revision, including new illustrations, of the previous edition which included television theory. The new edition covers component and radio theory only. Included in the coverage are: wave propagation, characteristics of sound, magnetism, structure of matter, electricity, resistance, inductance, capacitance, transformers, vacuum tubes, semiconductors (including transistors), speakers and microphones, electronic circuits (power supplies, amplifiers, oscillators), transmitters, receivers, antennas, and electrical measuring instruments. One complete chapter is devoted to the testing of radios, including repair and alignment. A separate final chapter contains trouble pointers in the form of questions and answers.

Throughout the text, the use of math has been kept to a minimum, but for interested readers appendices are included which contain tables, nomographs, and formulas. ▲

NEW-32 PAGE



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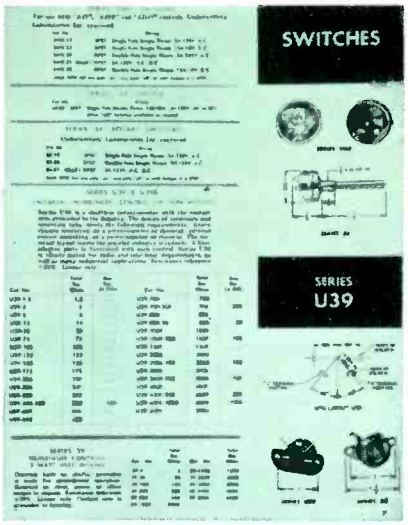
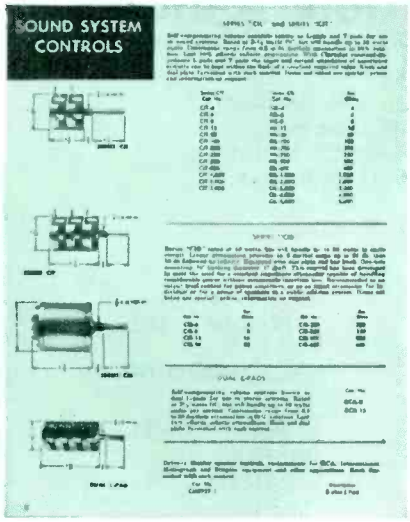
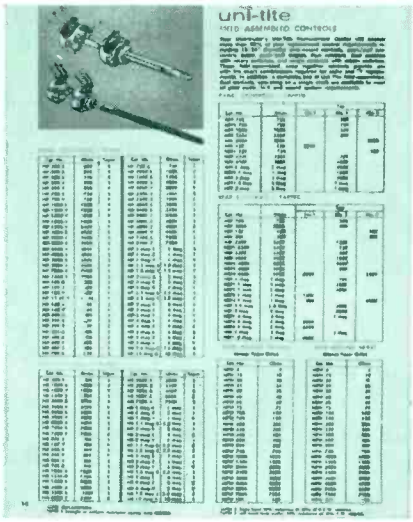


WITH ANSWERS



TO ALL YOUR



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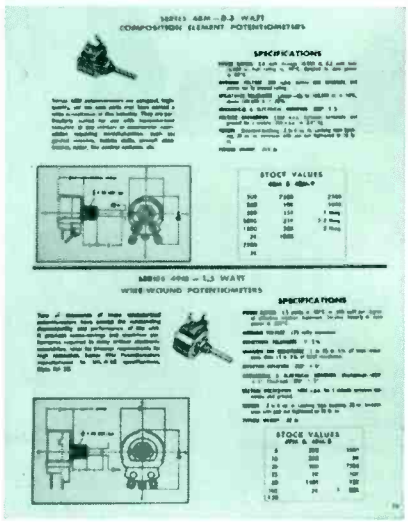
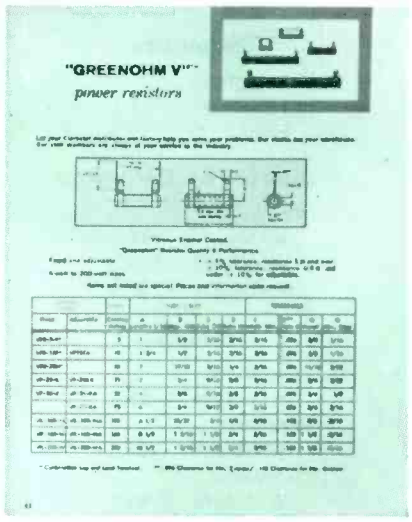


REQUIREMENTS



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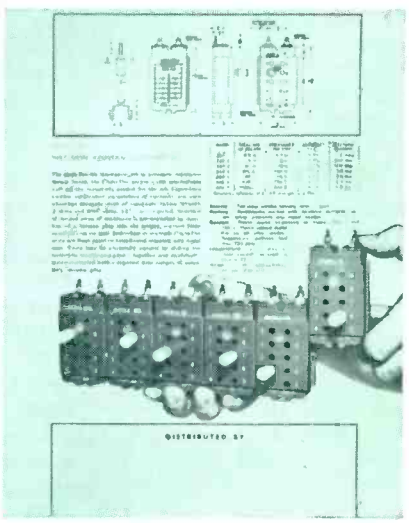

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Circle 17 on literature card

stereo FM station guide

The information in this directory was taken from the Howard W. Sam publication North American Radio-TV Station Guide, *3rd Edition (RSG-3), by Vane A. Jones.*

Alabama

Birmingham
- WCRT-FM 96.5
- WSFM 93.7

Dothan
- WOOF-FM 99.7

Huntsville
- WAHR 99.1
- WNDA 95.1

Mobile
- WLPR-FM 96.1

Montgomery
- WAJM 103.3
- WFMI-FM 98.9

Muscle Shoals
- WLAY-FM 105.5

Alaska

Anchorage
- KBYR-FM 102.1
- KNIK-FM 105.5

Arizona

Phoenix
- KMEO 96.9
- KNIX 102.5
- KOOL-FM 94.5
- KRFM 95.5

Sun City
- KTPM 106.3

Tucson
- KSOM 92.9

Arkansas

El Dorado
- KELD-FM 103.1
- KRIL 99.3

Fort Smith
- KMAG 99.1

Jonesboro
- KBTM-FM 101.9

Little Rock
- KARK-FM 103.7

California

Alameda
- KJAZ 92.7

Bakersfield
- KGEE-FM 101.5
- KIFM 96.5

Fresno
- KCIB 94.5
- KXQR 102.7

Garden Grove
- KGGK 94.3

Lodi
- KCVR-FM 97.7

Long Beach
- KNOB 97.9

Los Angeles
- KCBH 98.7
- KFAC-FM 92.3
- KFMU 97.1
- KFOX-FM 100.3
- KPOL-FM 93.9
- KRHM 102.7

Los Banos
- KARL-FM 95.9

Monterey
- KHFR 96.9

Riverside
- KDUO 97.5

Sacramento
- KFBK-FM 92.5
- KHIQ 105.1
- KSFM 96.9

San Diego
- KBBW 102.9
- KFMX 96.5
- KGB-FM 101.5
- KLRO 94.9
- KPRI 106.5

San Fernando
- KVFM 94.3

San Francisco
- KBRG 105.3
- KFOG-FM 104.5
- KMPX 106.9
- KPEN 101.3
- KSFR 94.9

San Jose
- KEEN-FM 100.3
- KSJO-FM 92.3

San Luis Obispo
- KSBT-FM 93.3

Santa Barbara
- KGUD-FM 99.9
- KMUZ 103.3

Santa Maria
- KXFM 99.1

Stockton
- KUOP 91.3

Turlock
- KHOM 93.1

Ventura
- KUDU-FM 95.1

Visalia
- KONG-FM 92.9

Walnut Creek
- KDFM 92.1

Woodland
- KATT 102.5

Colorado

Colorado Springs
- KLST 94.3

Denver
- KFML-FM 98.5
- KLIR-FM 100.3
- KTGM 105.1

Manitou Springs
- KCMS-FM 102.7

Connecticut

Brookfield
- WGHF 95.1

Hartford
- WTIC-FM 96.5

Meriden
- WBMI 95.7

New Haven
- WNHC-FM 99.1

Delaware

Wilmington
- WDEL-FM 93.7
- WJBR 99.5

District of Columbia

Washington
- WASH 97.1
- WGMS-FM 103.5
- WMAL-FM 107.3

Florida

Belle Glade
- WSWN-FM 93.5

Bradenton
- WBRD-FM 103.3

Clearwater
- WTAN-FM 95.7

Cocoa
- WEZY-FM 99.3

Cocoa Beach
- WRKT-FM 104.1
- WXBR 101.1

Coral Gables
- WVCG-FM 105.1

Ft. Lauderdale
- WFLM 105.9
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The 970 is effective because it's *accurate* and *complete*. Using the famous B&K signal injection technique, this all-in-one instrument provides the required dc power, lets you test power and signal transistors in and out of circuit; generates RF and audio signals, and includes a rugged, accurate VOM. Four functions in one compact package—with solid state reliability, B&K professional quality.

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BUILT-IN POWER SUPPLY

Auto Radios—High current, low-ripple, for transistor, hybrid, and vibrator types.

Transistor Portables—1½ to 12 volts for battery substitution—plus separately variable voltage tap for bias.

QUICK AND ACCURATE TESTING OF POWER AND SIGNAL TRANSISTORS

In-Circuit—stage by stage DC signal injection and sensitive metering of power supply current.

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RF Generators—provide broadcast and IF frequencies for both AM and FM bands.

Audio Generator—for AM or FM modulation of the RF signals, and for trouble-shooting audio circuits.

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Gainesville
WRUF-FM 103.7
Jacksonville
WIVY-FM 102.9
WJAX-FM 95.1
WKTZ-FM 96.1
WQIK-FM 99.1
Marianna
WTOT-FM 100.9
Miami
WIOD-FM 97.3
WWPB 101.5
Miami Beach
WAEZ 94.9
Milton
WXBM-FM 102.3
Orlando
WHOO-FM 96.5
Palm Beach
WWOS 97.9
Panama City
WMAI-FM 107.9
Pensacola
WPEX-FM 94.1
St. Petersburg
WTCX 99.5
Sarasota
WYAK 102.5
Stuart
WMCF 92.7
Tallahassee
WBGM 98.9
WFSU-FM 91.5
Tampa
WFLA-FM 93.3
West Palm Beach
WPBF 107.9
Winter Haven
WINT-FM 97.5

Georgia

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WGPC-FM 104.5
Americus
WDEC-FM 94.3
Athens
WGAU-FM 95.5
Atlanta
WKLS 96.1
WLTA-FM 99.7
WSB-FM 98.5
Carrollton
WLBB-FM 92.1
Columbus
WRBL-FM 102.9
Gainesville
WDUN-FM 106.7
La Grange
WLAG-FM 104.1
Moultrie
WMTM-FM 93.9
Rome
WROM-FM 97.7
Savannah
WTOC-FM 94.1

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Honolulu
KAIM-FM 95.5
KPOI-FM 97.5

Illinois

Bloomington
WJBC-FM 101.5
Chicago
WEFM 99.5
WFMT 98.7
WKFM 103.5
WLS-FM 94.7
WMAQ-FM 101.1
WNUS-FM 107.5
WXRT 93.1
Crete
WTAS 102.3
Decatur
WSOY-FM 102.9
Elmwood Park
WXFM 105.9
Joliet
WJOL-FM 96.7
Loves Park
WLUV-FM 96.7
Mattoon
WLBH-FM 96.9
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WGEM-FM 105.1
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Springfield
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WIKY-FM 104.1
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WSMJ 99.5
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WWHC 104.9
Indianapolis
WFMS 95.5
WIFE-FM 107.9
Kendallville
WAWK-FM 93.3
Lafayette
WASK-FM 105.3
Peru
WARU-FM 98.3
Plainfield
WJMK 98.3
Richmond
WKBV-FM 101.3
South Bend
WNDU-FM 92.9
Terre Haute
WVTS 100.7
Vincennes
WAOV-FM 96.7

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WOI-FM 90.1
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De Ridder
KDLA-FM 101.7
Hammond
WGTI 107.1
Monroe
KMLB-FM 104.1
New Orleans
WDSU-FM 93.3
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KBCL-FM 96.5

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WFST-FM 97.7
Poland Spring
WMTW-FM 94.9

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WHAG-FM 96.7
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WAQE-FM 101.9

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WBCN 104.1
WHDH-FM 94.5
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WLYN-FM 101.7
North Adams
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Waltham
WCRB-FM 102.5
Worcester
WSRS 96.1

Michigan

Ann Arbor
WOIA-FM 102.9
Bay City
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WNEM-FM 102.5
Detroit
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WDTM 106.7
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WAYL 93.7
WPBC-FM 101.3
St. Louis Park
KRSI-FM 104.1

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WSWG 99.1
Gulfport
WROA-FM 107.1
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WFOR-FM 103.7
Jackson
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KORK-FM 97.1
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Atlantic City
WFPG-FM 96.9

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82 Channel TV lead-in

for the strongest, cleanest picture signal and best color... ever!

- Provides 82 channel color reception
- Less installation time and cost
- Eliminates transmission line pick-up of noise and ghost signals
- No expensive matching transformers required
- Can be installed anywhere

Unshielded twin-lead
Severe picture disturbance due to ignition noise.

Coaxial Cable
Ignition noise minimized—but not eliminated.

* Shielded Permohm
Eliminates automobile ignition noise.

New 8290 Shielded Permohm TV Lead-in combines the strong signal strength of twin-lead with the clean signal protection of shielded cable. Because it is a balanced line for 300 Ohm TV antennas and receivers, *costly matching transformers and connectors are eliminated.*

8290 is specifically designed for superior color reception on all 82 channels. The twin-lead is encapsulated in low-loss cellular polyethylene insulation, Beldfoil** shielded against all outside disturbances, and protected with a weatherproof jacket. A drain wire is provided for grounding the shield. The need for stand-offs, twisting or routing of lead-in is eliminated. 8290 can be taped directly to a mast or tower, routed through metal pipe, buried underground, or even installed in rain filled gutters to reduce installation time and cost.

Ask your distributor about 8290 Shielded Permohm TV Lead-in cable, today! Or, write P. O. Box 5070-A for complete information.

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8-9-5

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WRLB 107.1
Paterson
WPAT-FM 93.1
Princeton
WPRB 103.3
Trenton
WBUD-FM 101.5

New Mexico

Albuquerque
KHFM 96.3
Los Alamos
KRSN-FM 98.5
Roswell
KBIM-FM 94.9
University Park
KRWG 91.7

New York

Babylon
WGSM-FM 94.3
Binghamton
WNBF-FM 98.1
Buffalo
WADV 106.5
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Garden City
WLIR 92.7
Jamestown
WKSN-FM 101.7
Lake Success
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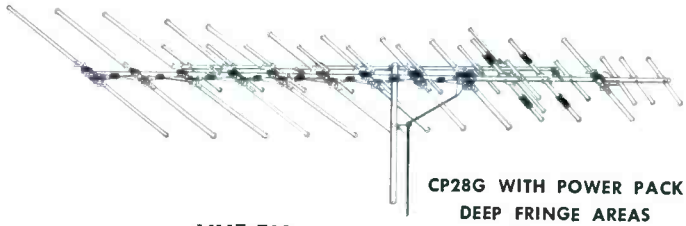

VHF-FM

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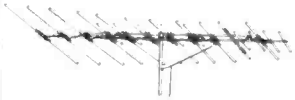

CP23G WITH POWER PACK
FRINGE AREAS
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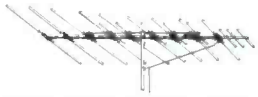
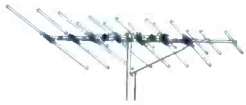


CP19G WITH POWER PACK
NEAR FRINGE-FRINGE
LIST $35.05



CP15G WITH POWER PACK
SUBURBAN-NEAR FRINGE
LIST $26.10

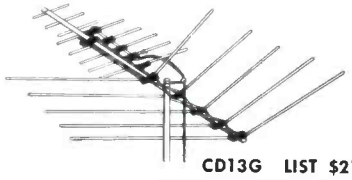
CP11G
SUBURBAN
LIST $20.19

CP7G
CITY AREAS
LIST $13.02

COLORDYNE

COMBINATION UHF-VHF-FM

An antenna for all channels 2 through 83. Simplicity of design permits high gain reception at low cost.



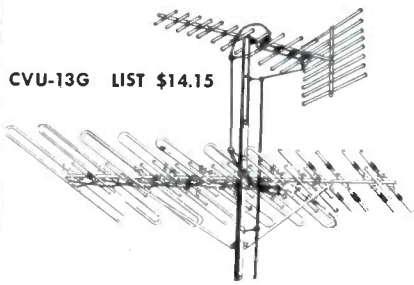
CD13G LIST $21.92
SUBURBAN-NEAR FRINGE

SUBURBAN—CITY
CD11G LIST $17.70

All models include Free Band Splitter

COLORVISTA UHF

Converts any existing VHF antenna to 82 channel reception with a single lead. Receives UHF in one direction and VHF in another with no rotor or coupler necessary.



CVU-13G LIST $14.15

Colorphase Combination

ALL-BAND UHF-VHF-FM
WITH PIGGY BACK POWER PACK

One antenna to cover all channels 2 through 83 with single down lead for all areas including FRINGE AREA.

FRINGE
CPC27G WITH POWER PACK LIST $40.75

SUBURBAN
NEAR FRINGE
CPC24G WITH POWER PACK LIST $35.41

CITY AREAS
CPC12G LIST $17.42

All models include Free Band Splitter

KAY-TOWNES AFFILIATED ONLY WITH FINE PERFORMANCE QUALITY ENDORSED by SATISFIED USERS ANTENNA SYSTEMS

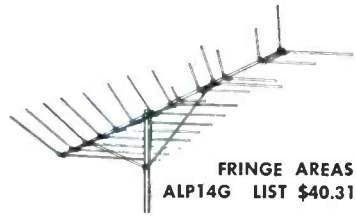
GENUINE
GOLD ANODIZED

Not a Spray to Wash Away!

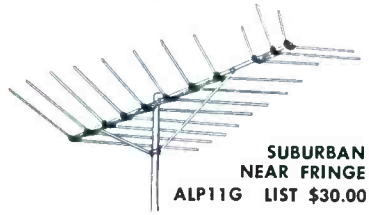
ALP MODELS

VHF-FM

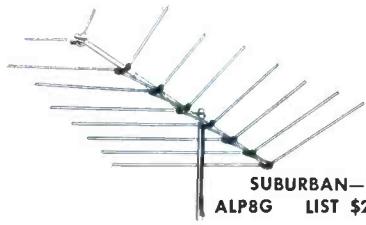
All channels 2 through 13. Simple swept-element permits low cost with high gain and excellent color as well as black and white and FM Stereo.



FRINGE AREAS
ALP14G LIST $40.31



SUBURBAN
NEAR FRINGE
ALP11G LIST $30.00



SUBURBAN—CITY
ALP8G LIST $20.85

SEE US AT THE SAN FRANCISCO SHOW — BOOTH 2606

SALES TERRITORIES OPEN IN SOME AREAS

QUALITY • PERFORMANCE • ECONOMY

KAY-TOWNES antenna company

HEADQUARTERS OFFICE AND PLANT — 1511 DEAN AVE., ROME, GA. 30162

Circle 21 on literature card

FREE!

Product Seal Awarded by Popular Science Product of the Month Readers Services Division

$9.95

HIGHWAY EMERGENCY KIT

with the

AEROVOX AK600H CAPACITOR KIT

Highway Emergency Kit contains:

- Tire Inflator
- Two-way flashlight
- Nite Glo S.O.S. Flag
- First Aid Kit
- Fire Extinguisher
- Magnetic Police-type red flasher

AK600H Capacitor Kit contains:

5—DBE 6D1	*1—AFH 2-57
5—DBE 6D5	1—PR 1-075
5—DBE 6S1	*1—PRS 1360
5—DBE 6S5	*1—PRS 1470
5—DBE 6P1	*1—PRS 1735
1—AFH 1-22-05	*1—PRS 1750
1—AFH 1-24	*1—PRS 1780
1—AFH 1-24-75	1—PRS 2200
1—AFH 1-25-65	1—PRS 2240
*1—AFH 1-37-25	*Color Certified

It's the biggest deal in town, and it's as legitimate as the United States Mint!

Your Authorized Aerovox Distributor will present you with an Electro-Lite Highway Emergency Kit FREE OF CHARGE with the purchase of the AK600H Capacitor kit.

Now get this!

...The capacitors alone list for more than forty dollars.

...The Highway Emergency Kit is a national best seller at $9.95.

YOU GET *BOTH* FOR ONLY $22.95...Save over twenty-seven dollars on a single purchase!

Look at the capacitors listed and you will see that there are no "dogs." You get 25 bypass tubulars, 8 tubular electrolytics, and 6 twist-prong electrolytics...including 7 red-hot color certified units!

Don't delay. Your distributor has these kits in stock *right now!* Get one for your truck, one for your car...and if your wife drives her own, one for her too. This is an item she'll really appreciate.

Order *now* while supply lasts.

AEROVOX® **AEROVOX CORPORATION**
DISTRIBUTOR DIVISION NEW BEDFORD, MASS.

Technical Leadership — Manufacturing Excellence

Circle 22 on literature card

Portsmouth
WPAY-FM 104.1
Springfield
WBLY-FM 102.9
Toledo
WCWA-FM 104.7
Urbana
WCOM-FM 101.7
Youngstown
WBBW-FM 93.3

Oklahoma

Lawton
KLAW 101.5
Midwest City
KTEA-FM 92.5
Oklahoma City
KFNB 101.9
Stillwater
KOSU-FM 91.7
Tulsa
KOCW 97.5
KRAV 96.5

Oregon

Eugene
KFMY 97.9
KWFS-FM 96.1
Portland
KPFM 97.1
KXL-FM 95.5

Pennsylvania

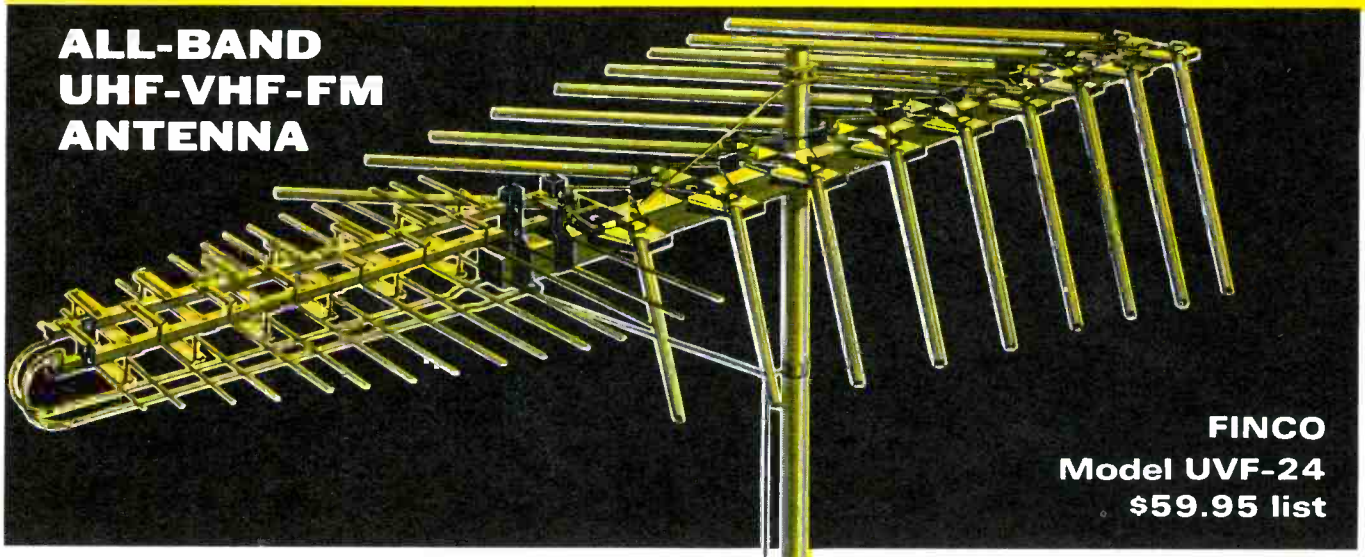
Allentown
WFMZ 100.7
Altoona
WFBG-FM 98.1
Boyertown
WBYO-FM 107.5
Braddock
WLOA-FM 96.9
Chambersburg
WCHA-FM 95.1
Hanover
WYCR 98.5
Harrisburg
WTPA-FM 104.1
Johnstown
WJAC-FM 95.5
Oil City
WDJR 98.5
Philadelphia
WDVR 101.1
WFIL-FM 102.1
WFLN-FM 95.7
WHAT-FM 96.5
WIFI 92.5
WIP-FM 93.3
WQAL 106.1
Pittsburgh
WKJF 93.7
Red Lion
WGCB-FM 96.1
Scranton
WWDL-FM 104.9
Tyrone
WGMR-FM 101.1
Warren
WRRN 92.3
Wilkes-Barre
WYZZ 92.9

Puerto Rico

Aguadilla
WABA-FM 100.3
Rio Piedras

FINCO COLOR-VE-LOG ANTENNAS FOR UHF, VHF, FM RECEPTION

ALL-BAND UHF-VHF-FM ANTENNA

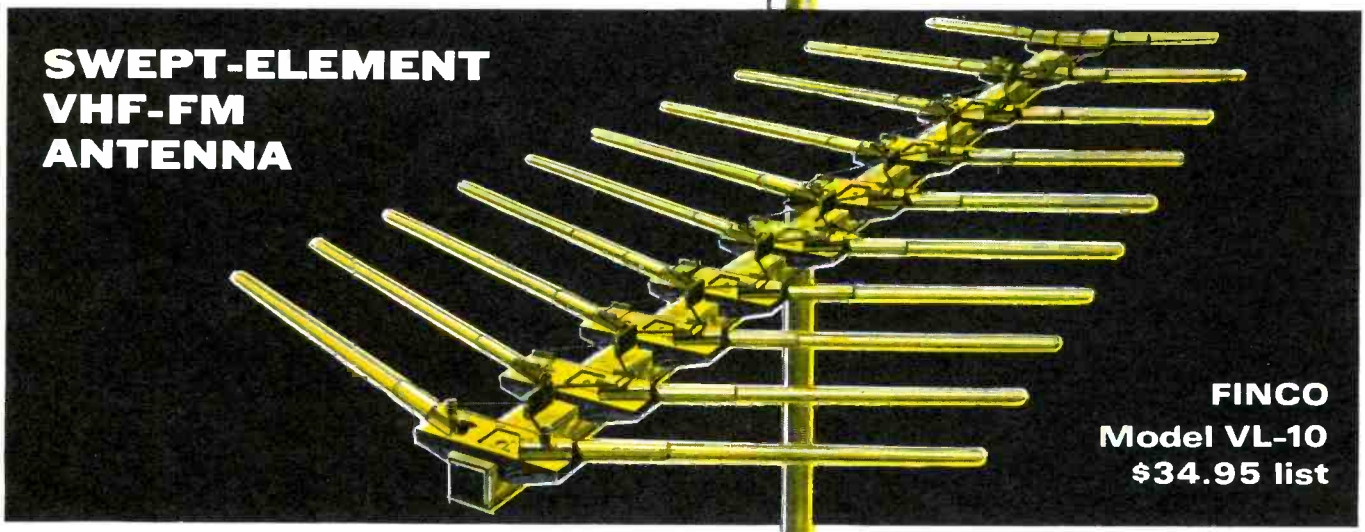


FINCO Model UVF-24 $59.95 list

The one antenna that does the work of 3! Gives startlingly clear black and white pictures and beautiful color on **both** UHF and VHF television channels — plus the finest in stereophonic and monophonic sound reproduction.

FINCO Model UVF-18—$42.50 list
FINCO Model UVF-16—$30.50 list
FINCO Model UVF-10—$18.50 list

SWEPT-ELEMENT VHF-FM ANTENNA



FINCO Model VL-10 $34.95 list

FINCO's Color-Ve-Log challenges all competition! Its swept-element design assures the finest in brilliant color and sharply defined black and white television reception — as well as superb FM monaural and stereo quality.

FINCO Model VL-18—$54.50 list
FINCO Model VL-15—$46.95 list
FINCO Model VL-7—$23.95 list
FINCO Model VL-5—$16.95 list

Featuring FINCO's exclusive Gold Corodizing

FINCO COLOR-VE-LOG

Prices and specifications subject to change without notice

THE FINNEY COMPANY • 34 W. Interstate Street • Bedford, Ohio

Write for beautiful color brochures Number 20-322, and 20-307, Dept. 310

Circle 23 on literature card

Look what's happened to the RCA WR-51A FM Stereo Signal Simulator

...it got to be the WR-52A...

NEW, REDESIGNED AND IMPROVED

Last year we decided to make a few improvements in our WR-51A Stereo FM Signal Simulator... for two years **THE** established test instrument for multiplex stereo servicing. We intended to call it the WR-51B.

But one thing led to another and we made **so many extensive** improvements that we virtually had a new instrument on our hands. You're looking at it: the NEW RCA WR-52A STEREO FM SIGNAL SIMULATOR.

We've added an RF Deviation Meter to measure the modulation level of both stereo and monaural FM signals. The meter is also used to accurately establish the level of the 19 Kc subcarrier.

We've included provisions for modulating left or right stereo signals with an external monaural source.

We've added a switch to disable the 19 Kc oscillator to provide a low-distortion monaural FM output.

We've added a new frequency (72 Kc)... required, along with the 67 Kc frequency, for trap alignment in some sets.

These features, together with numerous internal circuit design changes have resulted in a vastly improved, almost completely new instrument. And, the RCA WR-52A includes all those features that made its predecessor such a valuable servicing tool.

- COMPOSITE STEREO OUTPUT—for direct connection to multiplex circuit
  - Choice of left stereo and right stereo signals
- RF OUTPUT—for connection to receiver antenna terminals
  - 100 Mc carrier, tuneable
  - Choice of FM signals—left stereo, right stereo, monaural FM, internal test and 60 cycle FM sweep
  - FM stereo deviation adjustable from 0-100%
  - 100 Mc sweep signal adjustable from 0 to more than 750 Kc at a 60 cps rate
  - RF output attenuator
- CRYSTAL-CONTROLLED 19 Kc SUBCARRIER (±.01%)
- SINE WAVE FREQUENCIES
  - Three low-distortion frequencies—400 cps, 1 Kc, 5 Kc
  - Two crystal-controlled frequencies—19 and 38 Kc
  - Additional frequencies—67 and 72 Kc for trap alignment
- READILY PORTABLE—weighs only 12¾ pounds, measures 13½" by 10" by 8"
- COMPLETE WITH WIRED-IN CONNECTING CABLES

We also raised the price... just 50 cents. The WR-52A is now $250.00.* Ask to see it at your Authorized RCA Test Equipment Distributor.

*Optional distributor resale price, subject to change without notice. May be slightly higher in Hawaii and the West.

RCA ELECTRONIC COMPONENTS & DEVICES, HARRISON, N.J.

The Most Trusted Name in Electronics

WFID	95.7

Rhode Island

Providence	
WBRU	95.5
WCRQ	101.5

South Carolina

Beaufort	
WBEU-FM	98.7
Greenville	
WMUU-FM	94.5
North Charleston	
WKTM	102.5
Spartanburg	
WSPA-FM	98.9

South Dakota

Sioux Falls	
KELO-FM	92.5

Tennessee

Chattanooga	
WDOD-FM	96.5
Kingsport	
WKPT-FM	98.5
McKenzie	
WKTA	106.9
Morristown	
WMTN-FM	95.9
Nashville	
WLAC-FM	105.9
WNFO-FM	103.3
WSIX-FM	97.9
Sevierville	
WSEV-FM	102.1
Tullahoma	
WJIG-FM	93.3

Texas

Abilene	
KWKC-FM	105.1
Amarillo	
KVII-FM	94.1
Austin	
KTBC-FM	93.7
Beaumont	
KHGM	95.1
Clear Lake City	
KMSC	102.1
Dallas	
KIXL-FM	104.5
KVIL-FM	103.7
WRR-FM	101.1
El Paso	
KTSM-FM	99.9
Fort Worth	
KCUL-FM	93.9
WBAP-FM	96.3
Gainesville	
KGAF-FM	94.5
Houston	
KBNO	93.7
KFMK	97.9
KLEF	94.5
KODA-FM	99.1
KRBE	104.1
KXYZ-FM	96.5
Lubbock	
KBFM	96.3
Port Arthur	
KFMP	93.3
San Angelo	
KWLW	93.9
San Antonio	
KEEZ	97.3

KITY 92.9
Sinton
KTOD-FM 101.3
Wichita Falls
KNTO 95.1

Utah

Ogden
KBOC 101.9
Salt Lake City
KSL-FM 100.3
KSOP-FM 104.3

Virginia

Harrisonburg
WSVA-FM 100.7
Martinsville
WMVA-FM 96.3
Norfolk
WTAR-FM 95.7
WYFI-FM 99.7
Richmond
WFMV 103.7
Roanoke
WSLS-FM 99.1

Washington

Aberdeen
KDUX-FM 104.7
Seattle
KBBX 98.9
KETO-FM 101.5
KISW 99.9
KIXI-FM 95.7
KLSN 96.5
KZAM 92.5
Tacoma
KLAY-FM 106.1

West Virginia

Bluefield
WHIS-FM 104.5
Charleston
WKNA 98.5
WVAF 99.9
Martinsburg
WEPM-FM 97.5

Wisconsin

Delafield
WHAD 90.7
Eau Claire
WIAL 94.1
Green Bay
WBAY-FM 101.1
Kenosha
WAXO 96.9
WLIP-FM 95.1
Madison
WHA-FM 88.7
WISM-FM 98.1
WMFM 104.1
WRVB-FM 102.5
Milwaukee
WFMR 96.5
WMKE 102.1
WTMJ-FM 94.5
Tomah
WTMB-FM 98.9
Wausau
WSAU-FM 95.5
West Bend
WBKV-FM 92.5

Wyoming

Cheyenne
KVWO-FM 106.3

Canada

Alberta

Calgary
CHFM-FM 95.9
Edmonton
CFRN-FM 100.3
Red Deer
CKRD-FM 98.9

British Columbia

Kamloops
CFFM-FM 98.3
Penticton
CKOK-FM 97.1
Vancouver
CHQM-FM 103.5
CKLG-FM 99.3
Victoria
CFMS-FM 98.5

Manitoba

Winnipeg
CBW-FM 98.3
CJOB-FM 97.5
CKY-FM 92.1

New Brunswick

St. John
CFBC-FM 98.9

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CHML-FM 95.3
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CFPL-FM 95.9
Ottawa
CFMO-FM 93.9
Sault Ste. Marie
CJIC-FM 100.5
CKCY-FM 104.3
Toronto
CHFI-FM 98.1
CHUM-FM 104.5
CJRT-FM 91.1
CKFM-FM 99.9
Windsor
CKLW-FM 93.9

Quebec

Montreal
CFCF-FM 92.5
CJFM-FM 95.9
CJMS-FM 94.3
CKGM-FM 97.7
Quebec
CHRC-FM 98.1
Rimouski
CJBR-FM 101.5
Sherbrooke
CHLT-FM 102.7
Verdun
CKVL-FM 96.9

Saskatchewan

Saskatoon
CFMC-FM 103.9

NOW! ADD TO OR COMPLETE YOUR PHOTOFACT® LIBRARY AT PRESENT LOW PRICES!

UNTIL JULY 1, 1966—
SAVE $123.75
on your purchase of a 225-Set PHOTOFACT LIBRARY
ORDER NOW!

Until July 1, 1966, you can buy a PHOTOFACT LIBRARY (minimum of 60 Sets) at the present low Easy-Buy contract price of $1.95 per Set—you save 55¢ per Set—
you save over $120.00 on a 225-Set Library purchase!

(After July 1, 1966, PHOTOFACT prices go up: Single Sets 1 through 200 go to $3.00 each; Single Sets 201 through current issues go to $2.50 each)

ACT NOW! THERE'S NEVER BEEN A DEAL LIKE THIS:

NO INTEREST, NO CARRYING CHARGE
LIBRARY EASY-BUY PLAN

- Yes—no interest—no carrying charge—no other deal like it!
- Only $10 down—30 months to pay while the Library earns for you!
- Prepaid transportation to your shop.
- Add-on privilege of a year's advance subscription to current PHOTOFACT Sets on same contract.

4 WAYS TO SELECT YOUR LIBRARY

1. Complete your present PHOTOFACT Library.
2. Order a "Starter" Library of 225 Sets. (Sets 451-675—coverage from 1959 to 1964—only $14.29 per month).
3. Order by brand name and year—see the handy selection chart at your Sams distributor.
4. Order a *complete* PHOTOFACT Library.

FREE
the famous 14-volume
NEW STANDARD ENCYCLOPEDIA!

RETAIL VALUE
$149.50

FREE with the purchase of a PHOTOFACT LIBRARY consisting of 225 or more Sets . . . an invaluable TREASURY OF KNOWLEDGE for your family—a complete, authoritative, indispensable reference library for your home!

ACT NOW!
Offer ends June 30, 1966

SAVE OVER $120.00! Order your Photofact Library today!

Use the handy order form on opposite page—bring it to your Sams Distributor or mail to Howard W. Sams & Co., Inc.

PLEASE CUT ALONG DOTTED LINE

SAVE NOW-ORDER YOUR PHOTOFACT® EASY-BUY LIBRARY!

ENTER YOUR ORDER BELOW—OFFER ENDS JUNE 30, 1966

I understand I may select and order a library of PHOTOFACT Sets (minimum 60 Sets) and receive bonuses as explained below. I also understand there will be no interest or carrying charges added to this contract and that all merchandise on the order will be shipped transportation charges PREPAID from Indianapolis, Indiana (Within continental limits of U.S.A.).

CHECK PHOTOFACT SETS TO BE ORDERED ON THIS PLAN

1966 MONTH OF PUBLICATION

1	31	61	91	121	151	181	211	241	271	301	331	361	391	421	451	481	511	541	571	601	631	661	691	721	751	781	811
2	32	62	92	122	152	182	212	242	272	302	332	362	392	422	452	482	512	542	572	602	632	662	692	722	752	782	812 May
3	33	63	93	123	153	183	213	243	273	303	333	363	393	423	453	483	513	543	573	603	633	663	693	723	753	783	813 May
4	34	64	94	124	154	184	214	244	274	304	334	364	394	424	454	484	514	544	574	604	634	664	694	724	754	784	814 May
5	35	65	95	125	155	185	215	245	275	305	335	365	395	425	455	485	515	545	575	605	635	665	695	725	755	785	815 May
6	36	66	96	126	156	186	216	246	276	306	336	366	396	426	456	486	516	546	576	606	636	666	696	726	756	786	816 May
7	37	67	97	127	157	187	217	247	277	307	337	367	397	427	457	487	517	547	577	607	637	667	697	727	757	787	817 June
8	38	68	98	128	158	188	218	248	278	308	338	368	398	428	458	488	518	548	578	608	638	668	698	728	758	788	818 June
9	39	69	99	129	159	189	219	249	279	309	339	369	399	429	459	489	519	549	579	609	639	669	699	729	759	789	819 June
10	40	70	100	130	160	190	220	250	280	310	340	370	400	430	460	490	520	550	580	610	640	670	700	730	760	790	820 June
11	41	71	101	131	161	191	221	251	281	311	341	371	401	431	461	491	521	551	581	611	641	671	701	731	761	791	821 June
12	42	72	102	132	162	192	222	252	282	312	342	372	402	432	462	492	522	552	582	612	642	672	702	732	762	792	822
13	43	73	103	133	163	193	223	253	283	313	343	373	403	433	463	493	523	553	583	613	643	673	703	733	763	793	823
14	44	74	104	134	164	194	224	254	284	314	344	374	404	434	464	494	524	554	584	614	644	674	704	734	764	794	824
15	45	75	105	135	165	195	225	255	285	315	345	375	405	435	465	495	525	555	585	615	645	675	705	735	765	795	825
16	46	76	106	136	166	196	226	256	286	316	346	376	406	436	466	496	526	556	586	616	646	676	706	736	766	796	826
17	47	77	107	137	167	197	227	257	287	317	347	377	407	437	467	497	527	557	587	617	647	677	707	737	767	797	827
18	48	78	108	138	168	198	228	258	288	318	348	378	408	438	468	498	528	558	588	618	648	678	708	738	768	798	828
19	49	79	109	139	169	199	229	259	289	319	349	379	409	439	469	499	529	559	589	619	649	679	709	739	769	799	829
20	50	80	110	140	170	200	230	260	290	320	350	380	410	440	470	500	530	560	590	620	650	680	710	740	770	800	830
21	51	81	111	141	171	201	231	261	291	321	351	381	411	441	471	501	531	561	591	621	651	681	711	741	771	801	831
22	52	82	112	142	172	202	232	262	292	322	352	382	412	442	472	502	532	562	592	622	652	682	712	742	772	802	832
23	53	83	113	143	173	203	233	263	293	323	353	383	413	443	473	503	533	563	593	623	653	683	713	743	773	803	833
24	54	84	114	144	174	204	234	264	294	324	354	384	414	444	474	504	534	564	594	624	654	684	714	744	774	804	834
25	55	85	115	145	175	205	235	265	295	325	355	385	415	445	475	505	535	565	595	625	655	685	715	745	775	805	835
26	56	80	116	146	176	206	236	266	296	326	356	386	416	446	476	506	536	566	596	626	656	686	716	746	776	806	836
27	57	87	117	147	177	207	237	267	297	327	357	387	417	447	477	507	537	567	597	627	657	687	717	747	777	807	837
28	58	88	118	148	178	208	238	268	298	328	358	388	418	448	478	508	538	568	598	628	658	688	718	748	778	808	838
29	59	89	119	149	179	209	239	269	299	329	359	389	419	449	479	509	539	569	599	629	659	689	719	749	779	809	839
30	60	90	120	150	180	210	240	270	300	330	360	390	420	450	480	510	540	570	600	630	660	690	720	750	780	810	840

Total Number of PHOTOFACT Sets_____@ $1.95 each (minimum order 60 Sets) Until July 1, 1966 $_____

PHOTOFACT BONUSES (SELECT ONE CATEGORY) ALTERNATE BONUS FOR PURCHASE OF LESS THAN 225 SETS

- ☐ 14 Volume Set New Standard Encyclopedia FREE ____ (one allowed with purchase of 225 sets)
- ☐ Deluxe Four-Drawer Cabinets to be shipped FREE ____ (one allowed with purchase of 200 sets)
- ☐ Single Drawer Cabinets to be shipped FREE ____ (one allowed with each purchase of 60 sets)
- ☐ Regular 4-Drawer Cabinets to be shipped FREE ____ (one allowed with purchase of 180 sets)

- ☐ Special 4-drawer Cabinet with extension drawer @ $55.00 EACH_____ . . . . . $_____
- ☐ Regular 4-drawer Cabinet @ $38.95 each_____ . . . . . $_____
- ☐ Number of single drawer file cabinets @ $9.95 each_____ . . . . . $_____
- ☐ Bases for single drawer file cabinets @ $2.50 each_____ . . . . . $_____

TOTAL COST SAMS BOOKS OR SPECIALIZED VOLUMES ADDED TO YOUR PHOTOFACT LIBRARY ORDER . $_____

Cat. No.	Price	Cat. No.	Price	Cat. No.	Price
_____	$_____	_____	$_____	_____	$_____
_____	$_____	_____	$_____	_____	$_____
_____	$_____	_____	$_____	_____	$_____

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Keyed AGC

(Continued from page 22)

In earlier keyed AGC systems using a pentode, the screen voltage is usually higher than normal for the particular tube employed. In many models the high screen voltage is obtained from boost. Knowledge of this produced a quick analysis in one intermittent condition. Vertical deflection would shrink slowly while picture contrast increased rapidly to overloaded or blanked-out conditions. A look at the circuit revealed one component common to both vertical and AGC circuits; the resistor feeding voltage to the screen of the AGC tube also fed B+ to the plate of the vertical oscillator from the boost source. A visual examination of this resistor, a two-watt composition unit, showed it to be badly overheated; it was replaced with a five-watt wirewound unit and normal operation was restored.

The circuit in Fig. 10 also had an odd, but in this case, strictly AGC trouble. The set was dead and something was smoking—the 'something' was found to be R71, which was overheating due to a cathode-to-filament short in the AGC tube. Replacing the tube eliminated the overheating, but did not restore the picture as expected. Instead it produced an overloaded blanked-out condition resulting from no AGC. Using a VTVM, the AGC tube was found to have approximately normal voltage on the cathode, while the screen was only about twenty volts higher. Since the voltage difference between screen and cathode, in this set, is determined by the voltage drop across R71, it was checked and found to be about one-fourth its normal resistance. Replacing it restored normal operation. One observation is worth noting: the screen voltage of a 'BU8, 'HS8, and other related types is normally only about eighty volts with respect to the cathode, compared to the much higher values in pentode types used for AGC stages. In this case, the use of an override bias to check AGC would have been absolutely useless, inasmuch as the voltage checks would still be necessary and might not have been as conclusive.

The keying pulse applied to the plate of the keyed AGC tube will also produce AGC trouble. A unique trouble of this sort was found in one set. The AGC pot could be used as a contrast control on some stations but on other stations the picture would be either overloaded or blanked-out. In this set, the keying pulse was taken from the horizontal oscillator circuit and was quite different from the usual keying pulse. See Fig. 11. This keying pulse had an amplitude of only thirty volts as against the normal 120-150 volts. Shunting the pulse-coupling capacitor provided normal

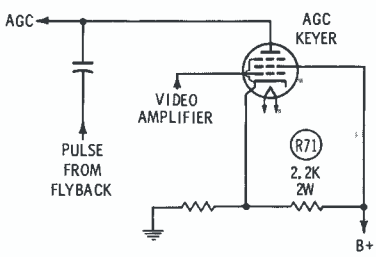

Fig. 10. Source of screen voltage.

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amplitude. After the old unit was removed it was found to be cracked, a condition not noticeable while it was in the set.

Troubleshooting

Applying an override bias on the IF AGC line is a very common approach to AGC trouble. If its use clears up an overloaded condition, it shows that the AGC circuit is not developing the proper control voltage; however, the picture condition or a VTVM connected to the IF AGC line will tell you the same thing. If override bias restores a normal picture from the dead, blanked-out condition of Fig. 7A or the washed out condition of Fig. 7B, it indicates that the AGC is supplying excessive control voltage. Again either the picture or a VTVM will give the same information. Even after employing override bias to restore the picture, it is still necessary to use the VTVM, and invariably it will reveal voltage discrepancies in the circuit.

AGC troubles discussed in this article have been presented in the order of their possible occurrence, and the troubleshooting techniques that were applied to those cases are recommended in a similar order. For example, in the cases first discussed concerning open peaking coils that produce dead blanked-out rasters from excessive AGC (which a VTVM reading verifies), the initial step is to check the voltage drop across the load resistor of the tube that controls the AGC tube. While it was noted that open peaking coils in video amplifiers cause excessive conduction of a keyed AGC tube and excessive AGC, open cathode resistors or open screen circuits can also produce excessive AGC. In troubleshooting keyed AGC, first check voltages on the stage that controls the AGC tube.

Directly tied in with the voltage drop across the controlling tube's load resistor is the voltage difference between the control grid and cathode of the AGC tube. It is virtually impossible to know exactly what this voltage difference should be, but in normally operating receivers it will be found that it will range between 15 and 30 volts with strong signals. With no signal being received, the voltage difference will range above thirty. Because this voltage difference controls conduction of the AGC tube, some technicians have wondered how the AGC tube can be conducting at all with the heavy bias provided when strong signals are being received. A triple-exposure photo taken from a DC scope (Fig. 12) shows that VTVM readings do not tell the entire story when measuring this control-grid-to-cathode voltage difference. The lower line on Fig. 12 was exposed with the scope probe grounded; it

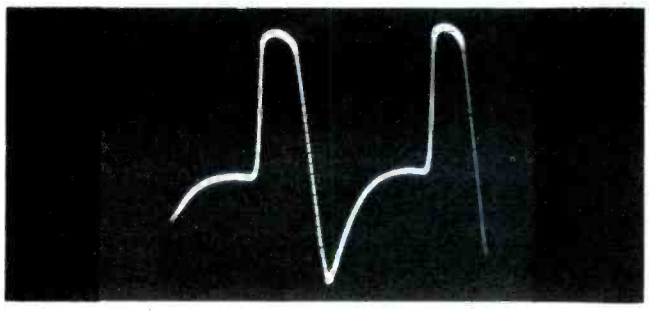

Fig. 11. Unusual keying pulse.

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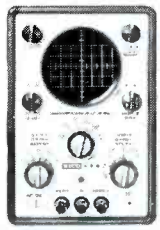

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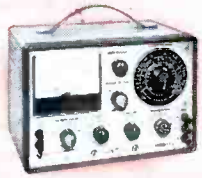

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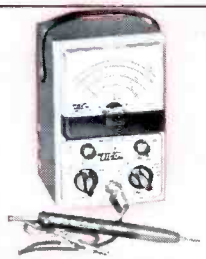

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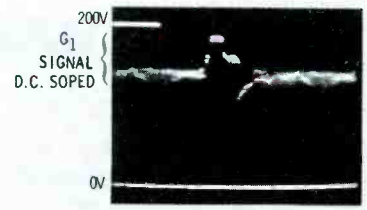

Fig. 12. DC levels at AGC grid.

represents zero volts, and the beam was positioned at the bottom of the screen. Next the scope probe was applied to the cathode of the AGC tube. It represents 200 volts, the same value as measured by a VTVM, and its trace line was shortened for the purpose of identification. The third exposure is the signal at the grid of the AGC tube. Note that its sync tip is very close to the 200 volt level. This third exposure shows that DC levels of the signal vary from a little less than two hundred volts to about 100 volts. A VTVM reading at the grid gave about 160 volts. Thus the bias as indicated by VTVM readings is far greater than the actual bias of the tube.

After it has been established that normal bias is present on the keyed AGC tube, the voltage should be measured between screen grid and cathode. For 'BU8 type tubes, the voltage is always between 65 and 90 volts; for other type pentodes the limits are considerably greater—in some designs as low as 150 volts, in others as much as 300 volts. The tighter limits in the 'BU8 types make this phase of testing a little easier, but the additional grid used for noise cancelling in these tubes is also capable of producing AGC trouble. Any effect of this noise-cancelling grid can be eliminated entirely by shorting it to the cathode.

If all these tests fail to reveal the cause of the AGC trouble, the keying pulse to the plate should be examined. The easiest and only sure way to check the pulse is with a scope. The amplitude ranges from as low as 250 volts to more than 600 volts in some models.

Conclusion

A thorough understanding of keyed AGC theory —knowing how the negative voltage is developed from a positive pulse, knowing how the magnitude of the voltage is controlled, and full awareness of the part played by the controlling stage—is the most important factor in solving AGC problems. Without a thorough understanding the keyed AGC theory, the measurements or values indicated by test equipment have little meaning.

While there are 'quickie' checks that can in some instances help in troubleshooting keyed AGC, pinpointing the defect in most cases requires extensive, closely examined voltage measurements. It is somewhat ironic that as helpful as a scope can be for troubleshooting less complex circuits, it has definite limitations for troubleshooting this complex circuit. Your knowledge and your VTVM are your best tools in handling these circuits. ▲

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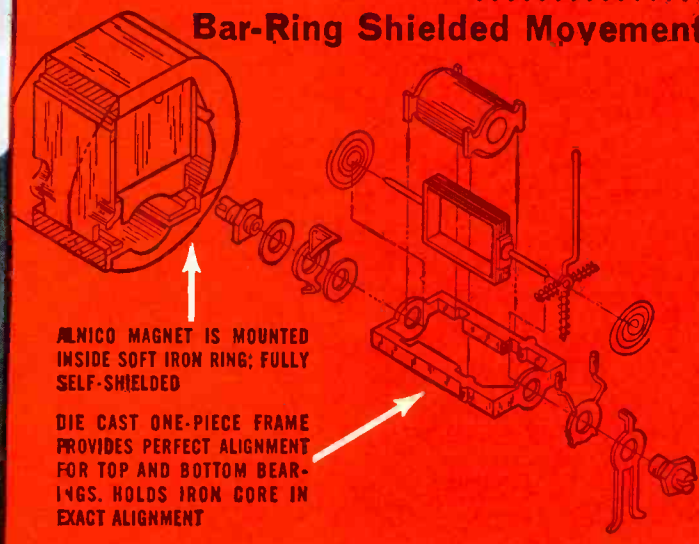

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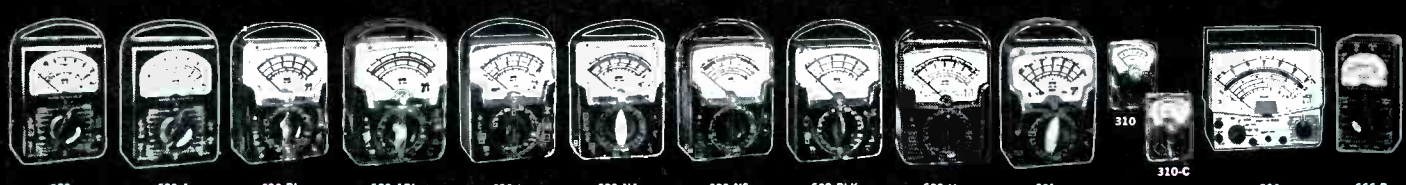

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Chasing Stereo

(Continued from page 33)

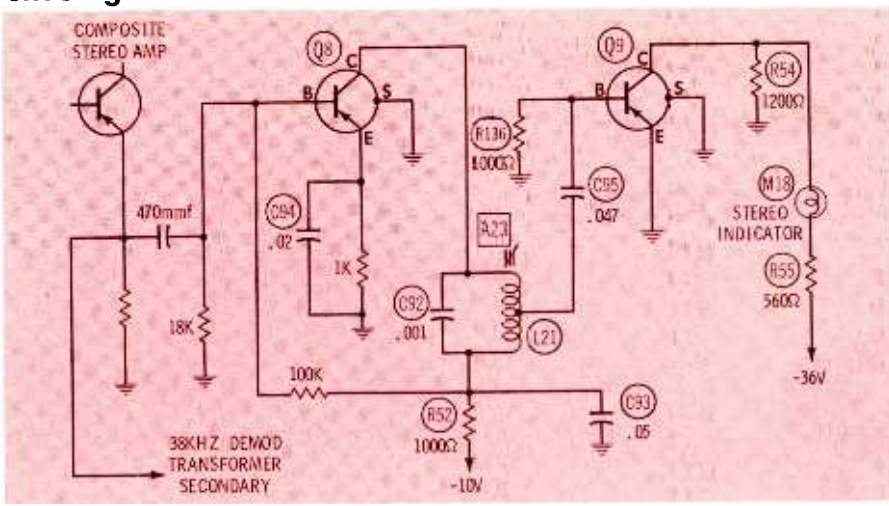

Fig. 5. Schematic Claritone TC-4 chassis.

open diode X28 would also prevent stereo separation.

A leaky or shorted capacitor C95 would reduce the sensitivity of the meter. In fact, if C95 shorts, the meter will not register at all unless the threshold control is turned fully clockwise and the received signal is strong. Capacitor C95 can be checked by measuring the negative voltage at the base of Q14 under a no-signal condition. The DC voltage at the base of Q14 should not change when R4 is rotated; if it does, C95 should be changed. The stereo-threshold setting will affect meter sensitivity.

Fig. 5 is another example of a separate stereo-indicating circuit. Two transistors are used to operate the stereo-on indicator. The signal coupled to the base of Q8 is the composite stereo signal and is developed on the emitter of the stereo-amplifier stage. The same signal is also coupled to the center tapped secondary of the 38kHz demodulation transformer. Q8 has a 19kHz tunable tank in the collector circuit. Adjustment of this tank (A23) will affect the sensitivity of the stereo-on indicator.

The 19kHz signal coupled to the base of Q9 provides forward biasing. The resultant collector/emitter current illuminates stereo indicator M18.

The arrangement of the collector circuit of Q9 makes voltage checking for open components very effective. An open R55 or lamp would result in zero collector voltage. Should R54 open, the collector voltage will increase above normal. This would make the indicator excessively bright with a faint glow possible in monaural operation.

If capacitor C95 is leaky, a negative voltage would be placed on the base of Q9. The negative base would keep this stage forward biased and the lamp would indicate stereo-on at all times. When the receiver is tuned to a monaural station, the base of Q9 should read zero.

A base/emitter short in Q9 would prevent the stereo-on indicator from working. The base/emitter junction can be checked with an ohmmeter, just as a diode is checked. However, when checking by reversing the ohmmeter leads, remember that the highest reading will be the 1000 ohms of R136.

The components in the first amplifier can affect the sensitivity of the stereo-on indicator. A normal reading of —8.8 volts on the collector would indicate that R52 and tank coil L21 are not open. It would also indicate that decoupling capacitor C93 was not shorted. The emitter/-base junction of Q8 should read .2 volts with forward bias. It would be best to check this voltage by placing the voltmeter leads directly from emitter to base. (This is good procedure for checking emitter/base bias anytime the emitter is not grounded.)

The frequency determining components of L21 and C92 will affect the indicator operation. If the voltages on Q8 are normal you may check the tank-circuit components as follows: Insert a 19kHz signal on the collector of Q8. Reduce the amplitude of the generator so that the

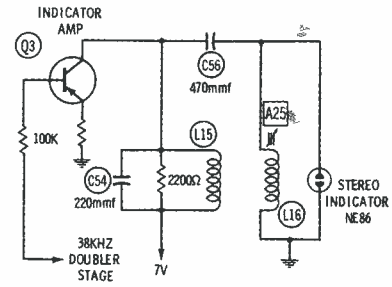

Fig. 6 Schematic Motorola HS 1128.

indicator just turns off. Move the generator lead to the base of the transistor. Assuming the transistor is okay, the indicator should show stereo-on if the tank circuit components are of proper value. If the indicator does come on, adjustment of A23 should control sensitivity. You may have to reduce the generator signal when checking the adjustment of A23. You can also observe C94, the emitter bypass capacitor: If the emitter voltage is normal, the capacitor is not shorted. However, an open C94 would cause degeneration and reduce the sensitivity of the stereo-on indicator.

A solid-state circuit using an NE-86 neon bulb is shown in Fig. 6. Transistor Q3 is the indicator amplifier and is forward biased by a positive voltage developed across a 100K resistor connected to the primary of the 38kHz transformer. The collector load, a parallel tank, develops an AC voltage when 19kHz is present in the received signal. The AC is also placed across a series-resonant circuit consisting of C56 and L16.

While the total AC across the series circuit may be small (considering the voltage across C56 is out of phase with that across L16), the voltage across the inductor is large and approaches 100 volts p-p. This voltage ignites the neon indicator.

Anything affecting the series-resonant circuit would reduce the ignition voltage developed across coil L16. The adjustment of A25 will change both the available ignition voltage and the sensitivity of the stereo-on indicator.

Troubleshooting of this circuit when the indicator fails to light should start with a check of the bulb, then the voltages at the emitter,

base, and collector of Q1. If the collector is low, check C56 for leakage and L15 for an open. If the collector voltage is high, a check of the transistor is called for. The emitter base junction should be tested by placing a voltmeter between the emitter and base.

When voltages on the transistor are normal, but the indicator does not show stereo-on, the component values in the two tank circuits may be at fault. Try this procedure for checking tank circuits: Insert a 19 kHz signal from the generator onto the collector of the transistor. If the bulb ignites, lower the amplitude of the generator as low as possible, keeping the bulb ignited. Check the adjustment of A25. If the adjustment affects bulb sensitivity, the circuit comprised of L16 and C56 is okay. Next, reduce the generator output to the point where the bulb goes out, and connect the generator signal to the base of Q3. The bulb should ignite if the tank-circuit components are of proper value. Remember that this check assumes the transistor is good.

Conclusion

It has been the purpose of this article not only to acquaint the servicemen with the various types of separate stereo-on indicator circuits, but to offer an effective system of troubleshooting such circuits. A good understanding of the normal operation of the circuit under test and an application of the troubleshooting techniques discussed should provide a speedy solution to most stereo-on indicator problems. ▲

Leave Those Parts

(Continued from page 36)

tivity of this test may make it worthwhile to go to the extra trouble in critical circuits.

If you've figured out why the test is so sensitive, you'll also see how you can sometimes check coupling capacitors for leakage without unsoldering them at all. Just pull the following tube, and if the grid resistor is high enough in value, it stimulates the high input impedance of a VTVM and a positive voltage develops across it in proportion to leakage in the capacitor. If the resistor is below 500,000 ohms in value, it takes considerable leakage to build a measurable voltage; therefore, this version of the test may not be sensitive enough for critical circuits. If not, revert to the open-end test.

Shorted Capacitors

Shorted capacitors often leave a trail of burned resistors behind, making the short easier to track down: find which resistors are burned, trace from B+ through the last burned one, and the capacator connected there is probably your culprit. However, that isn't always the case.

Suppose you found the trail of burned resistors shown in Fig. 2. Quick reasoning tells you C3 is the shorted one. If R1 and or R2 happens to be of a value or a wattage rating that won't easily develop an overdose of heat, the culprit could just as easily be C2 or even C1.

A trip down the line with your ohmmeter would tell quickly which is at fault. In an actual case that happened in Jim's shop, we found these measurements between ground and the junctions: R-C1, 1000 ohms; R1-R2, 10 ohms; R2-R3, 5000 ohms; R3-R4, infinity; R4-R5, 50 K; R5-C5, 60K. Analyzing: C2 is shorted. The R1-C1 reading is the value of R1 (the other end is grounded through C2). Similar situation for R2-R3. R3-R4, infinity because R3 and R4 are burned open. At R4-R5, 50K is the reading of leakage across the B+ glter, and 60K at R5-C5 has the 10K resistance added. As a result of our quick run down the string B+ filter, and 60K at R5-C5 has the 10K resistance and a single capacitor.

Shorted coupling capacitors such as C1 in Fig. 1 will ordinarily put a positive voltage on the grid of the following tube, no matter what the value of the grid resistor. It is even possible that the grid resistor and plate resistor will be damaged. In any case, a check with your VTVM will definitely pinpoint a shorted coupling capacitor.

Shorted bypass or decoupling capacitors on B+ lines (both the capacitors in Fig. 2 and C2 in Fig 1)

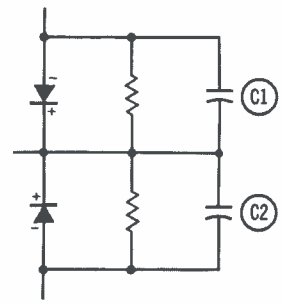

Fig. 3. Balanced diode circuit offers unusual problems.

are usually easy to find by this ohmmeter method, or they can be traced with a voltmeter—simply track down the overload by following the succeeding lower voltages until you reach the point on the B+ line where the voltage is virtually at ground potential.

Direct shorts in capacitors that aren't connected to B+ or other easily measured DC voltages are tough to spot. An ohmmeter is usually the best means; simply check across them with the ohmmeter leads. If they have unusual shunt paths, you may have to unsolder one end. In a circuit like Fig. 3, C1 (or C2) could be checked for a short by clipping the leads across the capacitor, then reversing them. In one direction, the diode will show a low resistance. In the other, the resistance should be that of the resistor. If the resistance is low in both directions, either the capacitor or the diode is shorted (usually the diode, so unsolder it first). You can use this type of reasoning to check small capacitors for shorts in other unusual and low-voltage circuits.

These and similar techniques can be used to test other types of capacitors as well as other components. I've started with small capacitors to introduce you to the techniques and the reasoning involved.

In the next installment, we'll apply these methods to electrolytic capacitors in both tube and transistor equipment and to coils and transformers. Be sure to save this issue so you can refer back to the methods and techniques introduced in this part. ▲

Look for the JUNE issue

- **The Transistor Amplifier**
- **Transistorized Automatic Tuning Auto Radios**
  Servicing those automatic tuners.
- **Transducer Circuits in Industry**
  Sensing devices and their uses.
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- *. . . and many more features.*

PFR Puzzler

VACUUM-TUBES

The puzzle below contains 25 words relating to vacuum-tube terminology. Some of these words are the actual names of tube types; others are related to tube construction. These words are scattered throughout the puzzle, some interlocking with another word. They may be discovered by reading left-to-right, right-to-left, up, down, or diagonally.

See how many of these vacuum-tube terms you can discover. The answers and a score sheet will appear in the June PF REPORTER.

Q X E M R S T A C K Y B E L U Z T N K I C K E P D H O M T V P
D B K H L N A U S P R A O E J Z C H A S I S L O V Y E J B C A
J F S P O N N E T V A T Z L S R T R A E J I E X Z B K M Q T C
S T P L A T E C C A H M N K T V O B K J R E C W C H D O Q S P
N O R M E N Z V O Y T S K B P T K U S C E D T I J E Y M T N O
S I M D N U G M R V Q P A E C N O M B F D C R O S E B A T F T
L O O T P L Z A X X T U V E M N O R P A E F O G N Q G H J I P
M S O C K E T B E O L Y T F M E P S A R F L D U G W M T Z L Y
G R T L O R X T B E H E M R S C J K V O R T E M P P Q X X B D
J U N E O P B Q S X D E L L I F S A G V W A T T A R G E T P Z
R P M N A C F Q Z Y L T A V M T C R U Z K J I U M R T S E O L
D D M O R E P X D A V Q T X R U A B F H H J T N A X Z B A L M
C A B F R I N G I I P S U T U C J K N Q Z V O I L T A C O K T
M N X R N N A L R B E S W M I N G K C B V M B N T R P C M K A
I Z T O W F B E G S Y F E C C N E O F F N A F G S O T H X V B
T X R S X B I P X T R J L D X P R U I H H L G E E O S J A E B
Z B Q T A F L R F F U Q C I V Z Q L J A A K T Y D P A I S N E
Q F P P I B O Z H L X O P R M A O B V T E Z L E X X L B Q S P
A T L T P T T B A M B E E Q E I V Z Q T K V L P H B P R M G B
X O C E Q H R S C R E E N Z A L T Q T E Z E Z P F N Y G F J H
B E P N N G E P D O L C V V T T A E R R M S X A L Q K Q I I J
R N H Z V I Z H W O C O N V E R T E R E S T Q R R A P T A X L
F V J N B L Y M N F A P A H O U H N N M Q E S F B M A P J W M
T E X Q H M R O B I T M X J R N M T A P Y J M J I E X A R Z T
M L T R T M E B E N H B P I T Q W A B B F I L A M E N T E R R
U O B I J E M F J G O A F L B H A X N O H B P I F L V R A D W
H P E A L C T J I D D R J Q I J F Y K Y J A A S Z E A E B E A
Y E M B Q A W R P D E M R A N F G P K N I T T K R C M N V H V
J A Q H P E N T O D E T O Z D L I R X G N S H E A T E R W Y Y
I T L X T P Z A L D O N H M E V R E U T O K V T E R S A X Q X
O F V L S I N B T M E A Y N R E A Z R O T U A Q B O P V T S A
L U Y T R J C E V Z B A L L A T R Z A N B T T A M N U L O V S

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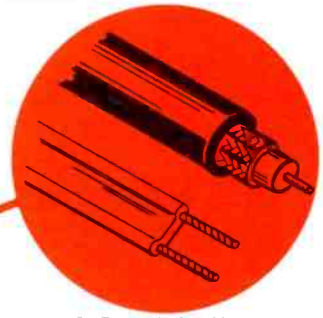
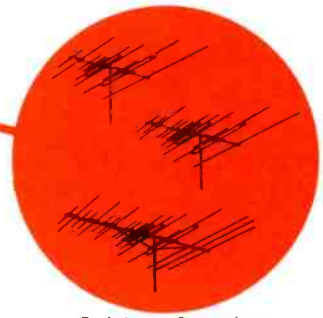


D. Transmission Lines

B. Antenna Installations



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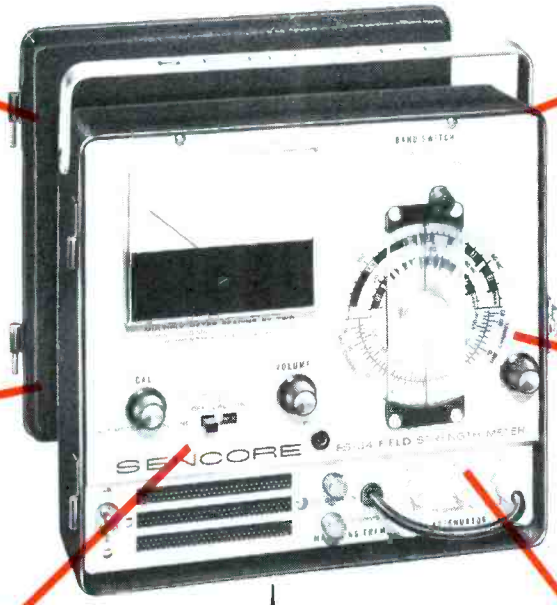

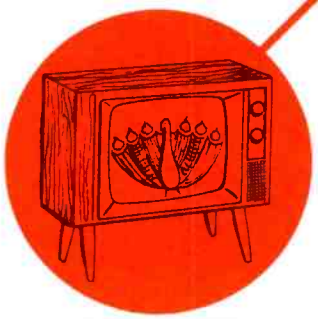

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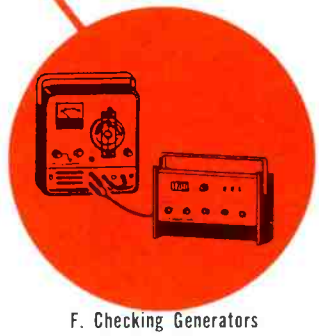

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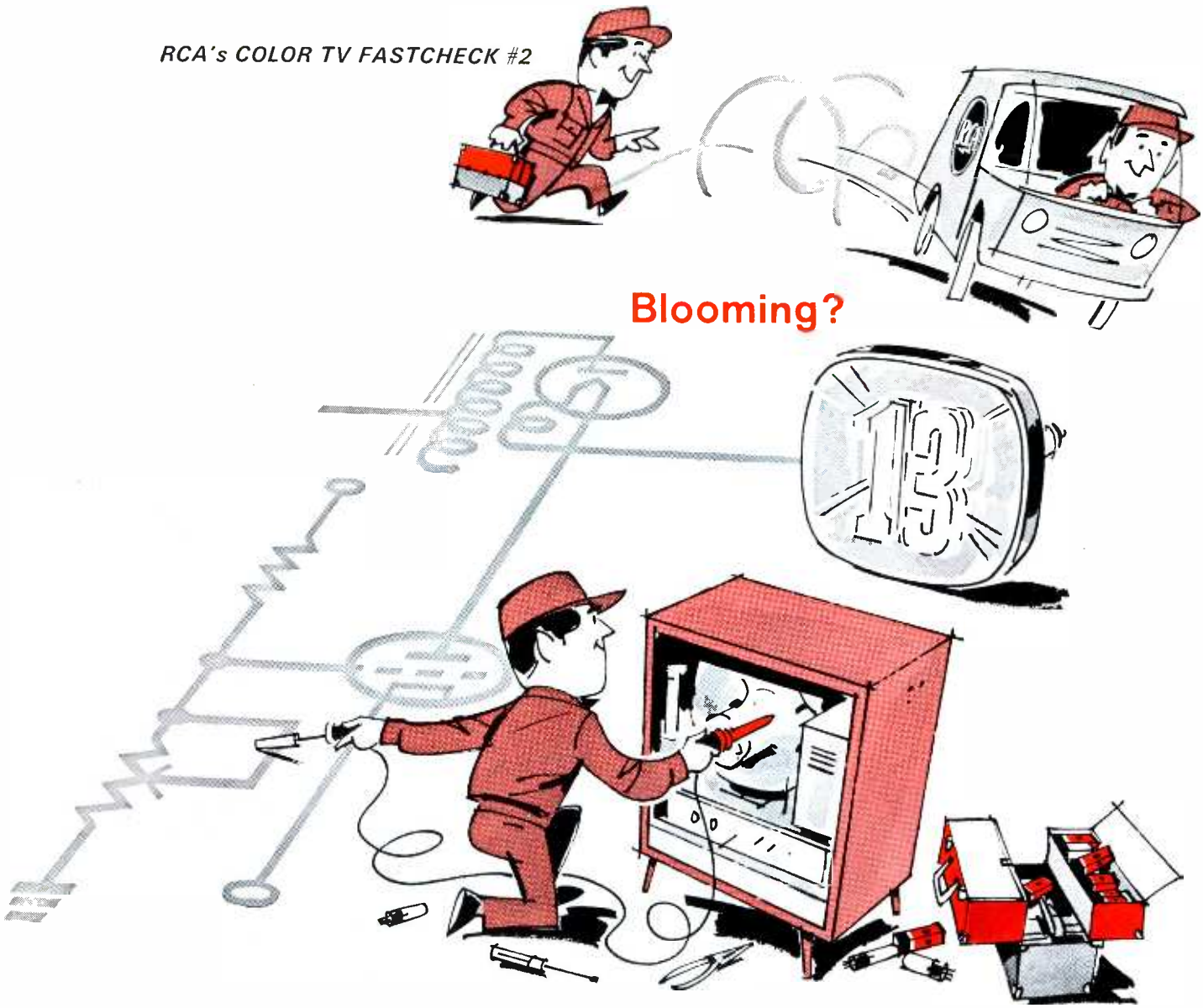
Circle 43 on literature card

RCA's COLOR TV FASTCHECK #2



...Varying picture size? Misconvergence?

Check the high voltage regulator section

Poor high-voltage regulation in color sets can be the cause of many needless call-backs, and in some cases, the outright loss of a valued customer. Merely replacing tubes in the horizontal and high voltage sections could result in a premature tube failure brought about by improper high voltage regulator action. Follow these simple FAST-CHECKS and make your color set servicing life a little easier.

1. Determine the proper value for the high voltage by checking the service notes of the receiver. Measure the high voltage at the picture tube anode connection and adjust the high voltage control for the specified value.
2. Turn the brightness control back and forth. If during this adjustment you get blooming, varying picture size and misconvergence, measure the cathode current of the high voltage regulator tube with the brightness turned down. If the regulator tube cathode current is below the specified minimum when the correct high-voltage is attained, the high-voltage input to the regulator system is probably low.
3. To correct small errors in the high-voltage input to the regulator tube, measure cathode current in the horizontal deflection output tube and adjust the horizontal efficiency coil for the specified current.
4. If this adjustment does not increase the regulator tube cathode current to the specified value, check the horizontal output tube, the damper tube and the drive to the horizontal output tube.
5. After making any adjustments or changes required in step 4, rotate the brightness control. If the shunt regulator tube is in good operating condition and you have made the proper adjustments, the blooming, varying picture size, and misconvergence will disappear.

Before replacing a shunt regulator tube, always follow the procedure above. You'll save time and money and have a satisfied customer.

This color TV service hint is another in a series of service hints from RCA. When you order receiving tubes, always specify "RCA". You'll find your customers better satisfied and you'll have fewer callbacks.

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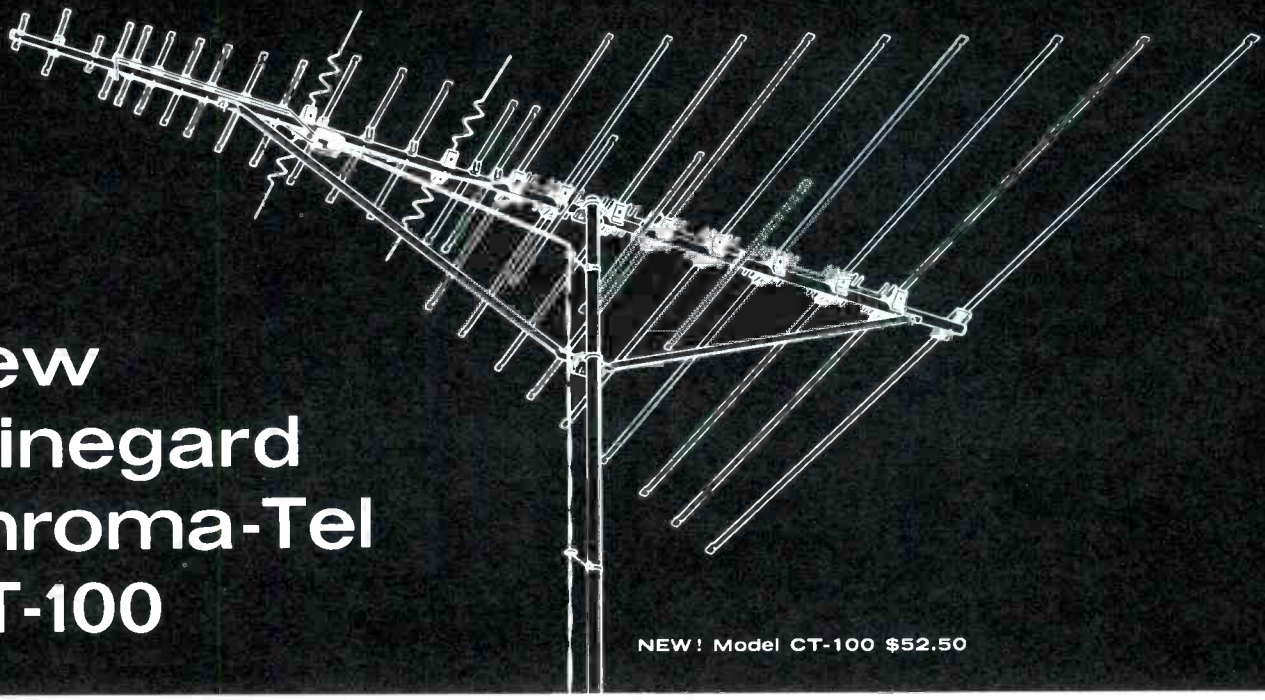

New Winegard Chroma-Tel CT-100

NEW! Model CT-100 $52.50

Wingard's sensational new CT-100 Chroma-Tel has 29 elements in all. And they're all working to provide the finest all-band reception (UHF-VHF-FM) even in difficult fringe areas.

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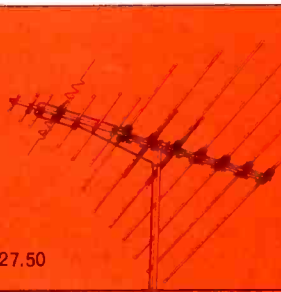
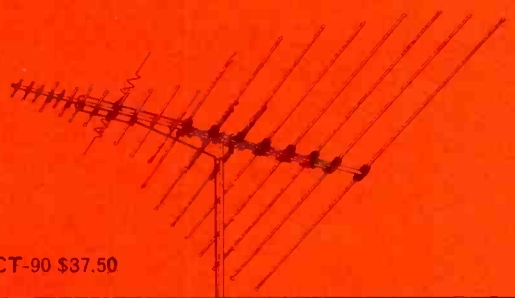
That's Winegard's new CT-100 Chroma-Tel. Bigger and better. But not too big. The full-line of Winegard Chroma-Tels still offers half the bulk; half the wind loading; half the truck space; and half the weight of all other all-band antennas—and at much lower prices. No wonder Winegard Chroma-Tels (now 4 models) are the hottest performing, hottest selling all-band antennas on the market! Better call your Winegard distributor or write for Chroma-Tel Fact Finder 242.

Model CT-40 $17.50



Model CT-80 $27.50



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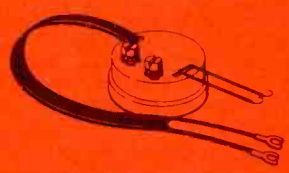

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Every Winegard Chroma-Tel, including the new CT-100, comes complete with free CS-283 UHF-VHF Signal Splitter. Hangs behind set and separates UHF and VHF signals coming from antenna to the two pairs of set terminals.

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Circle 43 on literature card

XYZ Color

(Continued from page 26)

raster from black and white to a blue or red tint. The new Admiral color receivers use a variable resistor in the CRT grid circuit to change the tint of the screen from blue through gray to sepia. This control also will vary the color picture when a color broadcast is on.

One example of the color-fidelity circuit is shown in Fig. 3. In this version, R2 controls the bias on the blue and green guns of the CRT. Advancing this control produces a higher positive voltage on the blue and green grids. Since R201 is smaller than R196, the blue grid voltage will be raised proportionally higher than the green. The result is a greenish blue tint on the raster. Reversing the action lowers the voltage on those grids, and since the red grid remains at a constant potential, the raster will take on a reddish tint. The fidelity control should be centered during initial gray-scale tracking adjustments.

There are advantages for this color-fidelity control for both the customer and for the serviceman. After the color receiver has been in use several months, the tubes and components in the XYZ circuits will age and change the picture tint. The color-fidelity control can be adjusted to compensate for this condition. Also, when we look at the color picture we do not all see alike, so the viewer can adjust the shade or tint to his own vision.

The tint should be set to the customer's preference. He may want a little more red or blue put into the picture. With the color-fidelity control he can adjust the picture to suit himself. ▲

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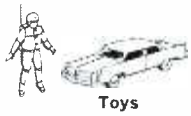
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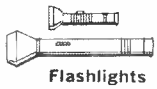
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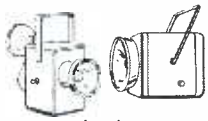
Lanterns


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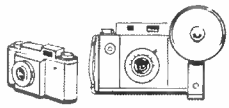
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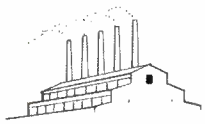
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The base section can also be used as a showcase for transistor radios and other battery-operated devices.

Now display *and sell* up to 40 different battery types for radios, toys, flashlights, hearing aids, cameras and industrial and commercial applications. Batteries can be grouped by application for faster service, easier inventory control. RCA's Lazy Susan Full Line Battery Center (1P1214) is a clear extruded vinyl plastic showcase with revolving shelves of high impact styrene. Solid brass trim adds strength to the unit. It's attractive, durable and convenient. Latched half doors in the rear allow easy access to battery stock. Don't let those potential sales walk by...contact your RCA Battery Distributor...and start making your battery business that much better.

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The Troubleshooter

answers your servicing problems

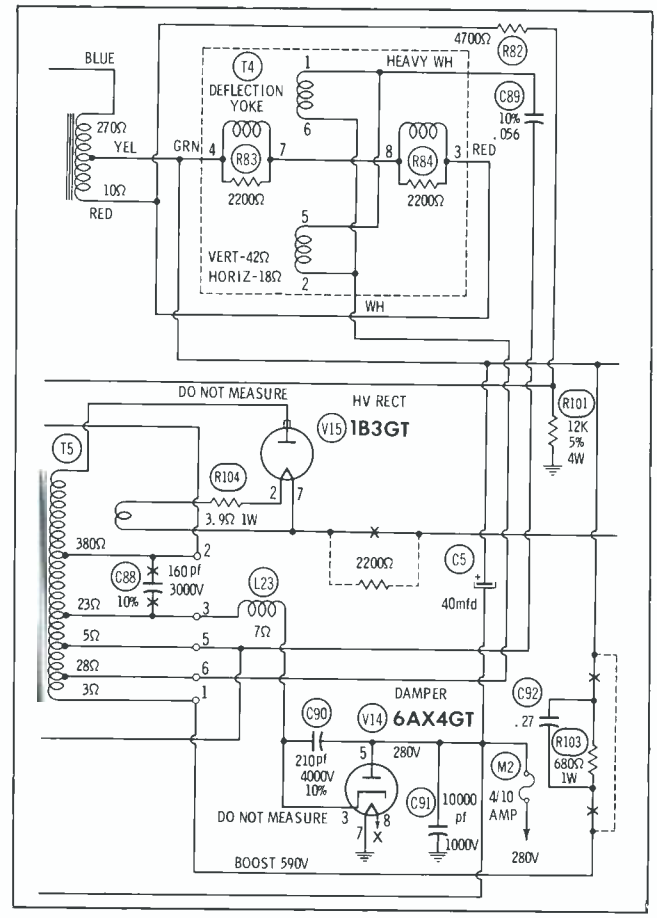
Spurious Signal

I have recently run across a symptom in a General Electric TV model 21C1562 (PHOTOFACT Folder 391-1) which I have never seen in five years of servicing. After the set has played for about 40 minutes, a white streak appears on the right side of the screen. It moves up and down the right side of the screen, but does not pull in the picture or raster. The length of the white line varies from 2″ to 4″ and extends from the right side toward the center about 3″. The streak is present even when the set is receiving no signal. The picture has a slight vertical jitter.

I have substituted all tubes but it has not helped. When I shunt C5 with another 40 mfd capacitor the streak disappears; however, after removing the original C5 and replacing it, the streak is still present.

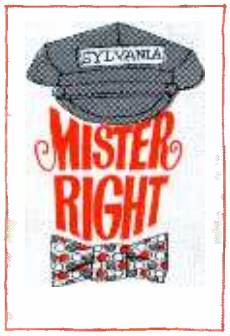
RONALD STROUP

Deer Creek, Okla.



Join our profit-sharing plan for color TV repair.

Here's how the plan works. First, Sylvania advertises you in TV Guide as the right TV serviceman for color repair—Mister Right. We make you a big name in a booming business.



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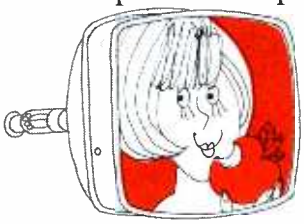

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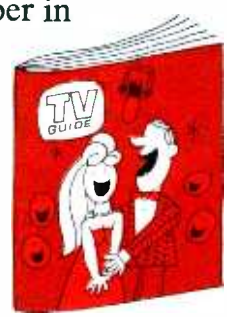

He also gives you up to nine Mister Right display pieces. Free banners, displays to spark up your windows, decals and cards. And, an illuminated Color TV Service sign for a slight charge.

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Sylvania Electronic Tube Division, Electronic Components Group, Seneca Falls, New York 13148.

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Circle 51 on literature card

What you have described appears to be a picture curl, although a picture curl normally runs the entire length of the raster. However, it is possible that only a portion of the curl is being displayed in this case.

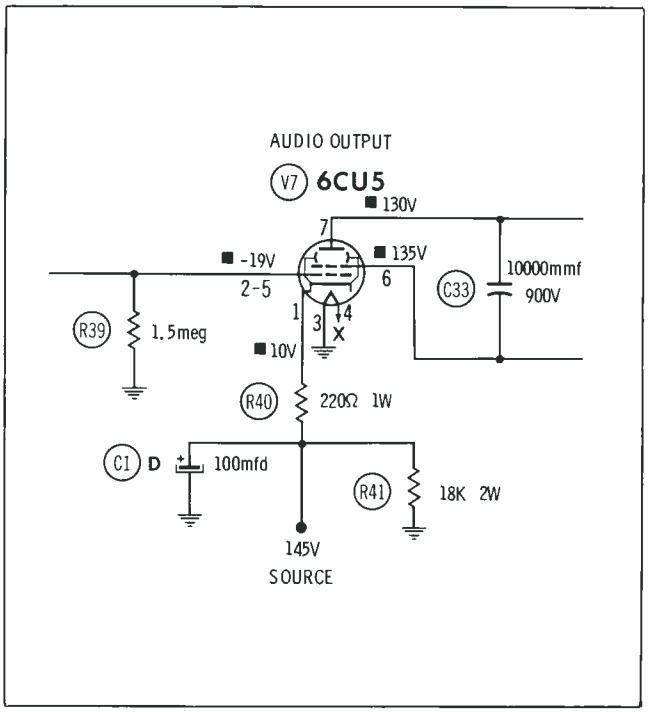
General Electric Product Service Bulletin No. 8T (Oct '57) lists a production change to eliminate picture curl on the right side of the raster. It consists of a parallel combination of a 680 ohm, 1 watt resistor and a .25 mfd capacitor in series with terminal No. 1 of the horizontal output transformer (590 volt boost voltage). The chassis location of both components is shown in the "chassis top view" of PHOTOFACT.

Low Voltage Too Low

I have substituted every component in the audio-output stage of a Philco Chassis 8L41 (PHOTOFACT Folder 399-2), but have been unable to determine the reason for a 35 volt reading at the 145 volt source. The plate and screen voltages are normal and I have resoldered all connections to eliminate the possibility of a high-resistance connection. I have also substituted the 6CU5 several times, and have tried lowering the resistance of the plate circuit by placing a 150 ohm resistor across the primary of T5. What have I overlooked?

J. H. BARNETT

Freeport, Texas



It should be remembered that a voltage source can be affected by the circuits to which it provides voltage. In this example, the 145 volt source provides plate and screen voltages to the 1st, 2nd and third video IFs, the sound IF and limiter, and to the remote control chassis (if the set you are servicing is so equipped). Suggest you check capacitors C10, C13, C16 and C27 in these circuits for a shorted condition. (Larry Allen's article "Leave Those parts In the Circuit!" in this issue provides some good tips on checking such components.) ▲

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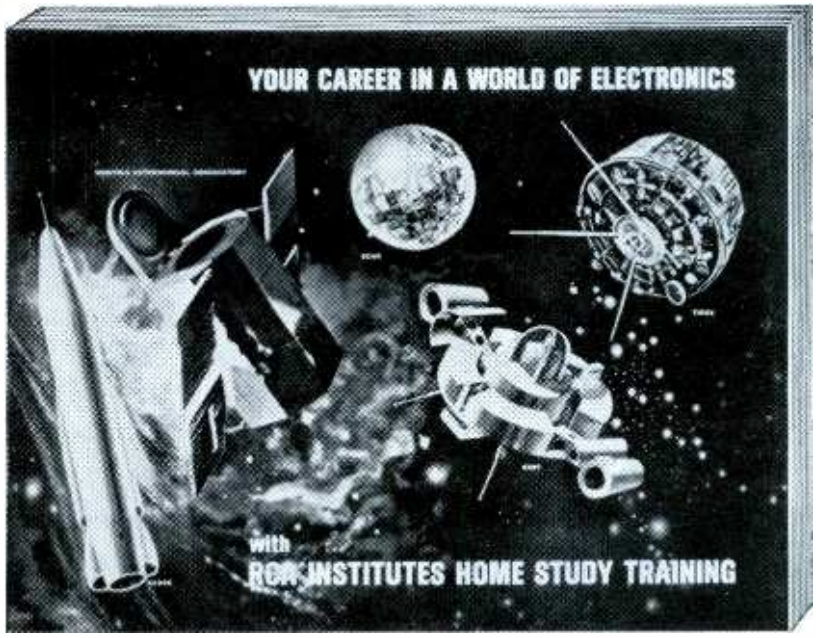

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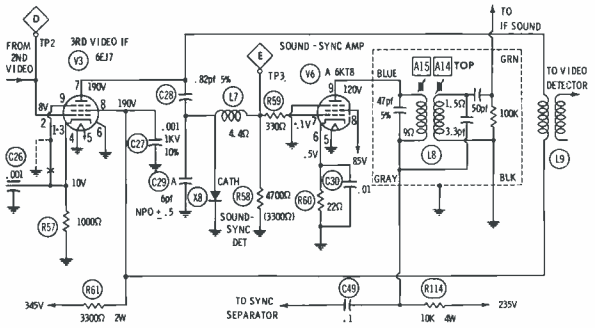
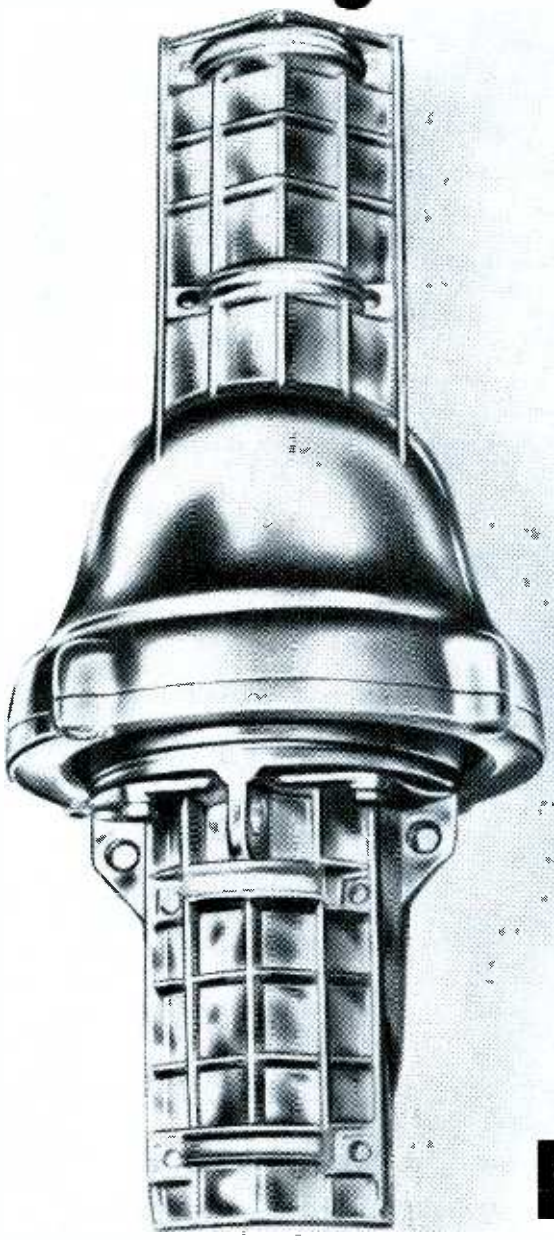
Color Countermeasures

Symtoms & Tips From Actual Shop Experience

Chassis: Zenith (All Chassis)
Symptoms: No separation between sound and picture during fine tuning with continuous buzz in sound. AGC control smears picture.
Tips: Replace X8 Crystal Diode used as sound and sync detector.



Never ask a lightweight rotor to do a heavyweight's job.



Selling your customer a lightweight rotor when he has a large antenna array just doesn't make sense. Especially since you can offer him an alternative: the heavy-duty "Bell Series" rotor, from CDE.

Available in both automatic and manual forms, this rotor is designed specifically for large, heavy antenna arrays... designed specifically for unmatched fringe-area reception... designed to give your customers the finest color TV reception possible. In fact, this is the *only* heavy-duty rotor available.

We call it the Bell Series because of its completely weatherproof, die-cast aluminum housing. You'll call it rugged because it has 4 to 5 times the stalling and braking torque of any other rotor! This means *any* antenna will turn, even under the most adverse weather conditions... and that your customers will get terrific color or black and white reception despite high winds or heavy icing. Great FM reception too!

The Bell Series rotor: one-of-a-kind built for one-of-a-kind performance!

CDE CORNELL-DUBILIER

Circle 57 on literature card

Product Report

For further information on any of the following items, circle the associated number on the Catalog & Literature Card.

Paging and Talkback Speakers

A screwdriver is the only tool required to mount, connect and adjust the volume on the AP-30T (70 volt) and AP-30T-25 (25 volt) Professional Series, 30 watt, omnipurpose public-address speakers now available from **Atlas Sound.**

AP-30T and AP-30T-25 specifications: Power, continuous up to 30 watts; equalized to frequencies above horn cutoff, 40 watts. Frequency response 225 - 14,000 Hz. Sound level, 125 db measured 4' on axis at 30 watts input. Dispersion, 100°.

Time and cost saving features for installing and wiring both types of speaker include: built-in 70 volt or 25 volt line transformer; watts/impedance selector switch; screw terminals; and omnidirectional, three way adjustable mounting bracket.

The speakers are constructed of metal, using die castings and aluminum parts. Special corrosion proofing and enamel weather protection are also used.

The dimensions of both speaker models are 10" wide, 9½" high and 10½" deep. Price is $48.50.

Semiconductor Tester
(76)

A new in- or out-of-circuit semiconductor tester has been announced by **American Electronic Laboratories, Inc.** The Model 259 In-Circuit Semiconductor Tester provides a rapid and safe means of testing semiconductors. It measures both transistors and diodes, in-circuit, for reverse leakage down to 500 ohms of shunt loading. The Model 259 also measures field effect transistors for leakage and transconductance, and both low and high power transistors for 1000 cycle beta. Other measurements include the resistance across the emitter-to-base, collector - to - base, and collector - to - emitter electrodes.

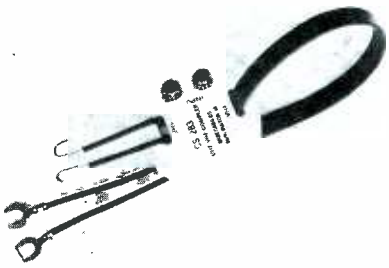
The Model 259 is housed in a drip-proof, high-impact plastic case, with cover.

Scrulox Screwdriver
(77)

Because of increasing industry use of square recessed screws in the production of appliances and electronic instruments, **Upson** has added Scrulox drivers to their regular line. The 4" blades are aluminum with genuine Scrulox inserts to insure long life. Other features include shock-proof, breakproof handle construction which prevents blade drive through or

twisting. Handles are UL approved.

The new Scrulox screwdrivers are color coded and are available in No. 0, 1, 2, and 3 tip sizes.



Signal Splitter
(78)

A printed circuit UHF-VHF back-of-set signal splitter, Model CS-283 has been introduced by the **Winegard Company.** Use of a printed circuit provides low loss and high efficiency and eliminates capacitance between coils.

The CS-283, described as a "pigtail" splitter, is designed to separate UHF and VHF signals coming from a combination UHF-VHF antenna or antenna coupler. The pre-attached 300-ohm lead-in connects to the UHF and VHF antenna terminals on the set or UHF converter.

VHF bandpass is 0-235 mc. UHF bandpass is 400-1000 mc. UHF and VHF circuitry has 15 db minimum isolation to prevent interaction. The unit is completely assembled and lists at $3.00.

Solid-State Regulated Power Supply
(79)

A solid-state power supply designed to supply fully regulated DC voltages for transistorized equipment, is announced by **Pace Communications Corp.**

The unit delivers from zero to 15 volts DC at up to 2.5 amperes—useful for servicing Citizens-band transceivers, auto radios, transistor radios, industrial-laboratory instruments, and production-line equipment.

Designated Model 5803, the power supply provides regulation better than 1% (line and load) at 13V, 1A continuous rating; ripple less than 1 millivolt, continuous. All silicon semiconductor construction assures good reliability and heat resistance.

The metered output may also be used to charge storage or Nicad batteries, as a source for low-power metal plating, or to power variable-speed DC motors.

The price is $59.95.

Stereo Headphones

(80)

Stanford-MB headphones are the latest quality electronic products from West Germany, imported and distributed nationally by **Stanford International.**

Model MB-K64S stereo headphones feature exceptionally clean design and light weight (5 ozs.) to eliminate listener fatigue.

The single headband is made of plastic covered unbreakable steel. Air-cushioned oval earpads of foam rubber fit snugly and shut out ambient noise. The 17-ohm standard stereo model has an 8-foot cable with bright metal telephone plug, and has a frequency range of 20-17,000 cps. Retail price is $17.95.

Transmatch

(81)

A compact, portable, "laboratory" that indicates the status of the vital RF characteristics of equipment to help maintain optimum operation, the Model 715 Transmatch is manufactured by **EICO** Electronic Instrument Co., Inc. It is designed for both the professional and hobbyist in ham & CB work.

At the flip of a switch, the 715 gives you fast, accurate readings of: standing wave ratio, true RF power, modulation percentage, modulation distortion, and relative field strength. Rugged, all solid-state, self-powered, and sensitive (with 100-ua meter), the 715 complements the EICO line of ham and CB transceivers. Kit is $34.95, wired is $44.95.

Letters

(Continued from page 16)

of the first man and have a limited knowledge. The solution is to get more training, facts, and experience.

This probably answers your question "why then don't these same intelligent technicians use such logic in their everday work?

It is evident to me that you already knew the answer because of the quality, content, and accuracy of your publication. I shall continue to study your magazine—I say study on purpose—it is that type as well as being entertaining. I am also starting a review of mathematics!

I could not hope for a magazine to be more timely, more helpful with less chaff than yours. In a crew of 16 men with whom I work, none but myself believes in a trade magazine subscription out of their own pocket (strange?) yet, two besides me do subscribe to PF REPORTER because of my enthusiasm.

Sincerely,
WILL MORGAN

Citrus Heights, Calif.

Mr. Morgan's letter needs no answer from us. The answering should be done by all service technicians—to themselves. —Ed.

INDEX TO ADVERTISERS

MAY, 1966

FREE Catalog and Literature Service

Check "Index to Advertisers" for further information from these companies.

Please allow 60 to 90 days for delivery.

ANTENNAS & ACCESSORIES

90. *ALLIANCE* — Colorful 4-page brochure describing in detail all the features of Tenna-Rotors.
91. *AMPHENOL CORPORATION* — New 28-page catalog aids selection of RF connectors and coaxial cable. Specifications are detailed for nearly 1400 items.*
92. *ANTENNACRAFT* — Four-color catalog sheet about the new *"Big-Shot-8"* VHF-UHF-FM antenna designed for city and suburban use.*
93. *BLONDER-TONGUE* — New products catalog, featuring all channel UHF-VHF-FM amplifiers, couplers, converters, etc.
94. *FINNEY* — Form 20-349 describes the new Finco-axial color matching transformer kit.*
95. *GC ELECTRONICS* — Catalog FR-3-CM is a 12-page catalog describing color-magic antennas, other antennas and accessories.
96. *JFD* — New 1966 dealer catalog covering complete line of log-periodic outdoor antennas, indoor antennas, rotators, converters, amplifiers, masting, splitter-couplers/combiners, matching transformers, lightning arrestors, antenna mounts, and hardware.*
97. *PARKER METAL GOODS CO.* — Catalog sheet illustrating rachet type chimney mount.
98. *WINEGARD* — 12-page brochure "Color Spectacular" featuring antenna products designed for color TV use.*
99. *ZENITH* — Information bulletin on antennas, rotors, batteries, tubes, power converters, record changers, picture tubes, wire, and cable.*

AUDIO & HI-FI

100. *ADMIRAL* — Folders describing line of equipment; includes black-and-white TV, color TV, radio, and stereo hi-fi.
101. *BENJAMIN* — Product literature on *Miracord* 40A, 40H and 50H automanual turntables and associated accessories. Product literature on stereo 200 and stereo 200/FM compact systems.
102. *CLEVELAND ELECTRONICS INC.* — 3 multi-color flyer sheets describing *Babe* reverberation kit, *Cathedral-Sonic* self-contained reverberation kit, and *Cletron* TV camera components.
103. *JENSEN* — Multicolored 24-page catalog No. 165-L featuring speakers and headphones. Also, 22-page catalog No. 6801 supplying phono-cartridge list and cross-reference.
104. *NUTONE* — 16-page full-color booklet illustrating built-in stereo music system and intercom radio systems. Includes specifications, installing ideas and prices.
105. *OAKTRON* — "The Blueprint to Better Sound," an 8-page catalog of loudspeakers and baffles giving detailed specifications and list prices.*
106. *OXFORD TRANSDUCER* — 4-page catalog describing three lines of automobile rear-seat speaker kits.
107. *PHONOLA* — Full-color 18½" x 12" brochure depicting full line of phonographs, tape recorders, and consoles.
108. *SWITCHCRAFT* — Bulletin 159 about two new high-powered miniature pre-amps.

COMMUNICATIONS

109. *ACTION! COMMUNICATIONS SYSTEMS* — Form 715 depicts the new Touch/Dial multi-station communications system.
110. *COMCO* — Complete communications systems brochures available on request.
111. *MOSLEY ELECTRONICS* — Catalog covering complete 1966 line of Citizens-band equipment.
112. *PEARCE-SIMPSON* — Specification brochure on 1BC 301 business-band two-way radio, *Companion II, Director, Escort II, Guardian 23,* and *Sentry* Citizens-band transceivers. "The Modern Approach to Business Communications" concerning land mobile radio service for businessman.

COMPONENTS

113. *BUSSMAN* — New 1966, 16-page car and truck fuse list. Shows proper fuse to use and where it is located. Covers foreign as well as domestic cars and trucks. Buss form AWC.*
114. *CORNELL-DUBILIER* — 96-page reference catalog about Twist-prong Electrolytic capacitors.*
115. *OAK* — Catalog and supplement describes Oak line of rotary and lever switches.*
116. *SONOTONE* — Spec sheet on 19T and 1ST stereo and mono cartridges.
117. *SPRAGUE* — Catalog K-508 is a large 64-page replacement manual cross-referencing electrolytic capacitors from manufacturers part number to Sprague number. Covers TV, tape recorders, radios, etc. Includes list prices.*
118. *TRIAD* — 12-page replacement guide on transformers. Manufacturer's number to Triad number.
119. *WORKMAN* — Form X-47 describes noninductive ceramic resistors used in color TV sets.*

SERVICE AIDS

120. *CASTLE* — How to get fast overhaul service on all makes and models of television tuners is described in leaflet. Shipping instructions, labels, and tags are also included.*
121. *CLEVELAND INSTITUTE OF ELECTRONICS* — New pocket-sized, plastic "Electronics Data Guide" of formulas and tables, including frequency and wavelength, db formulas and table, antenna lengths, and color code.*
122. *ELECTRONIC CHEMICAL* — Brochure of aerosol chemicals for controls, tuners, and tape heads.*
123. *G.C.* — New 300-page catalog FR 67 covers *GC, Walsco, Audiotex, Telco,* and *Electrocraft* brands of service aids and components.
124. *PRECISION TUNER* — Literature supplying information on complete low-cost repair and alignment service for any TV tuner.
125. *RAWN* — Instruction bulletin on how to make knobs in minutes with *Plas-T-Pair.**
126. *WALDOM NYLON AND BUTYRATE HARDWARE* — 4-page brochure about Nylon and Butyrate hardware.
127. *YEATS* — The new "back-saving" appliance dolly Model 7 is featured in a four-page booklet describing featherweight aluminum construction.

SPECIAL EQUIPMENT

128. *AMPROBE INSTRUMENT* — Catalog sheet REC 1007 about the *Direct-O-Log* strip-chart recorder.
129. *PERMA-POWER* — New catalog LCG-680- describes *Electro-Lift* garage door opener.
130. *SAMPSON* — Flyer sheet about the new *Waltham* Micro-8 vest pocket size transistor radio.
131. *TERADO CORPORATION*—Flyer sheet describes Model 50-160 portable 115VAC supply.

TECHNICAL PUBLICATIONS

132. *CLEVELAND INSTITUTE OF ELECTRONICS* — Free illustrated brochure describing electronics slide rule and four-lesson instruction course and grading service.*
133. *HAYDEN* — New, 64-page catalog listing books published by the Hayden Book Company, Inc. and John F. Rider Publisher, Inc. for the electronics service technician, student, and hobbyist.
134. *HOWARD W. SAMS* — Literature describing popular and informative publications on radio and TV servicing, communications, audio, hi-fi, and industrial electronics, including special new 1966 catalog of technical books on every phase of electronics.*

TEST EQUIPMENT

135. *B & K* — New 1966 catalog featuring test equipment for color TV, auto radio, and transistor radio servicing, including tube testers designed for testing latest receiving tube types.*
136. *EICO* — 1966 short-form catalog is 48 pages long. Describes a complete line of test instruments, CB and ham equipment, hi-fi components, and miscellaneous electronic equipment.*
137. *HICKOK* — New flyer detailing selected items of service test equipment.
138. *JACKSON* — New catalog of "Service Engineered" test equipment.
139. *MERCURY* — All new test-equipment catalog featuring time saving "Service-Man" equipment.*
140. *SECO* — Catalog sheet No. 90065 describing Model 900 color-bar generator and Models 88, 98, and 107B tube testers.
141. *SENCORE* — Latest 4-color catalog plus other information on new developments in the *Econoline* series of test equipment.*
142. *SIMPSON* — Flyer giving specifications of Model 604 Multicorder for measuring and recording volts, amps, milliamps, and microamps.*
143. *TRIPLETT* — New test equipment catalog D-66-1 with full line of panel and portable instruments and accessories.*

TOOLS

144. *ARROW* — Fly sheet illustrating three staple guns and showing uses.*
145. *ENTERPRISE DEVELOPMENT*—Time-saving techniques in brochure from Endeco demonstrate improved desoldering and resoldering techniques for speeding and simplifying operations on PC boards.
146. *VACO* — New 4-page catalog on Vaco's line of Professional Pliers and wrenches.*

TUBES & TRANSISTORS

147. *GE* — New 18-page "Semiconductor Almanac" for use in servicing radio, TV, and audio sets.
148. *RCA* — 6-page brochure illustrating the full line of dealer aids and promotional material about replacement color picture tubes.*

RCA's REPLACEMENT COLOR PICTURE TUBE

POINT-OF-PURCHASE PROGRAM FOR '66

...will help you reap the profits from the long-awaited "color boom"

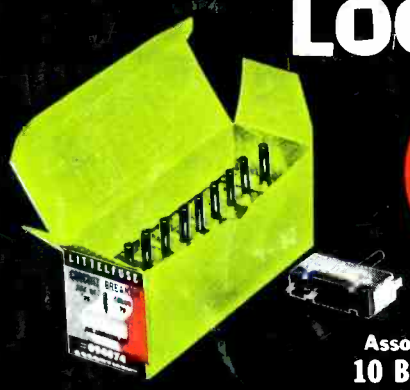
Identify with RCA... because RCA is identified with COLOR! Get ready... now! Color TV picture tube replacement sales are expected to increase sharply during '66. This Illuminated Window Display (ID 1227) is only one of the many attractive pieces available to help you get your share of this growing business. Others include counter cards, window decals and streamers, mailers, consumer folders, and promotional giveaways... all designed to help you advertise your color TV servicing capability.

Contact your RCA Color Picture Tube Distributor today!

RCA Electronic Components and Devices, Harrison, N. J.

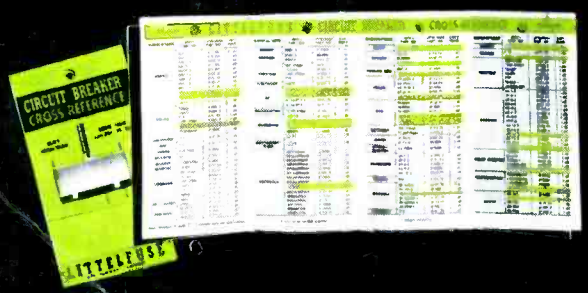
The Most Trusted Name in Electronics

LOOK WHAT'S HATCHING IN COLOR TV



Assortment #094074
10 BULK BREAKERS

Assortment #094073
10 CARDED BREAKERS



A COMPLETE ASSORTMENT OF CIRCUIT BREAKERS FOR COLOR TV APPLICATIONS

Ten breakers, seven ratings in one handy box for 100% replacement needs. Assortment available consisting of breakers on individual display cards or in bulk.

Included with each assortment: Pocket size cross-reference on color and black/white TV circuit breaker applications. Form No. CBCRP865H.

LITTELFUSE

DES PLAINES, ILLINOIS

Circle 71 on literature card