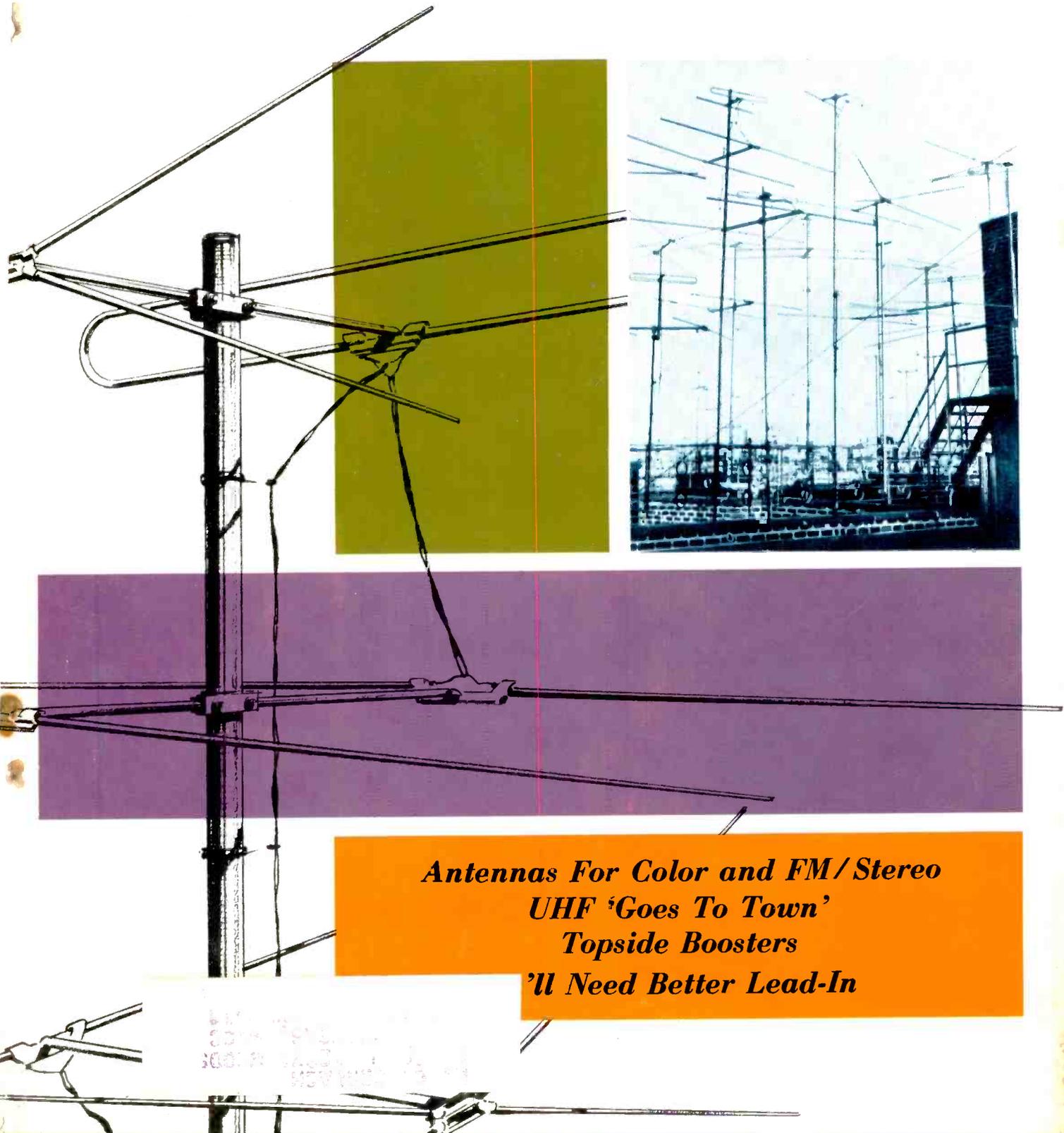


ELECTRONIC TECHNICIAN

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION



FEBRUARY 1965



*Antennas For Color and FM/Stereo
UHF 'Goes To Town'
Topside Boosters
'll Need Better Lead-In*

INTRODUCING **Jerrold COLORAXIAL™ Program** **COAX IS A MUST FOR COLOR TV**



← **THIS**
NOT
THIS →



Commercial installations have proved that coaxial download is *essential* for predictable, consistently good color TV pictures. Coax loss doesn't increase in wet weather, while twinlead loss goes up as much as six times. Coaxial cable can be run anyplace, even next to metal, without mismatch. Coax doesn't deteriorate with age. It won't pick up ignition noises or other interferences. In a word, for satisfactory color reception, even in "ideal" reception areas, your customers need coax.

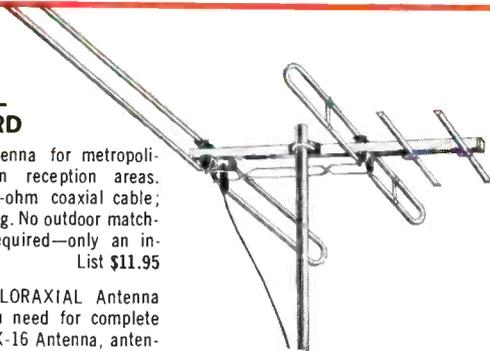
And now, new Jerrold COLORAXIAL antennas

and kits give you a perfect home-installation package for every color-reception need. With COLORAXIAL, you can offer the whole system, from coaxial antenna to indoor matching transformer, or adapt an existing 300-ohm antenna for coax operation. Listed below are all the COLORAXIAL components packaged individually and in kits, for easy, low-cost conversion. Ask your Jerrold distributor for COLORAXIAL brochure, or write *Jerrold Electronics, Distributor Sales Division, Philadelphia, Pa. 19132.*

CAX-16 • COLORAXIAL COLORGUARD

COLORAXIAL Antenna for metropolitan and suburban reception areas. Prematched to 75-ohm coaxial cable; complete with fitting. No outdoor matching transformer required—only an indoor Model T378. List \$11.95

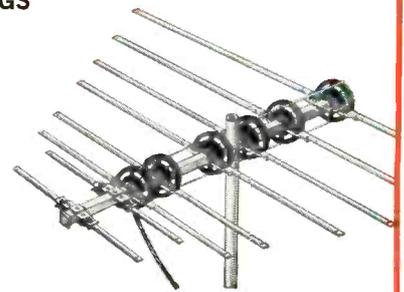
K-CAX-16 • COLORAXIAL Antenna Kit. Everything you need for complete installation—a CAX-16 Antenna, antenna tri-mount with 5-ft mast, 50 feet of coax cable with fittings, and T378 indoor matching transformer. List \$29.95



COLORAXIAL PARALOGS

PAX-40 • COLORAXIAL Antenna for difficult suburban areas. Prematched to 75-ohm coaxial cable; complete with fitting. No outdoor matching transformer required—only an indoor Model T378 needed. List \$22.95

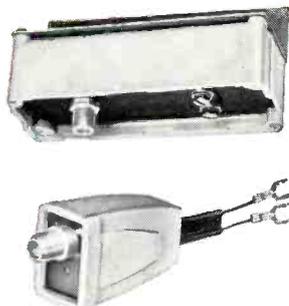
PAX-60 • COLORAXIAL Antenna for suburban to semi-fringe areas. Prematched to 75-ohm coaxial cable; complete with fitting. No outdoor matching transformer required—only an indoor Model T378 needed. List \$32.95



CAT-2 • COLORAXIAL MATCHING TRANSFORMER KIT

One TO-374A mast-mounting matching transformer for any 300-ohm antenna, and one T378 set-mounting matching transformer, complete with bracket and mounting strap. List \$8.20

COLORAXIAL matching transformers are also available individually: TO-374A, list \$4.95; T378, list \$3.25



COLORAXIAL CABLE

CAB-50 • 50 feet of sweep-tested RG-59/U 75-ohm coaxial cable complete with F-59A fittings attached, plus weatherboot. List \$9.50

CAB-75 • 75 feet of sweep-tested RG-59/U 75-ohm coaxial cable complete with F-59A fittings attached, plus weatherboot. List \$11.50



**JERROLD
 ELECTRONICS**

A subsidiary of The Jerrold Corporation

904

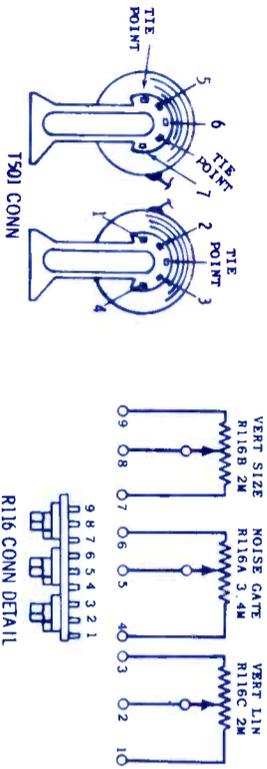
MOTOROLA
TV Chassis TS-586

February 1965

ELECTRONIC TECHNICIAN

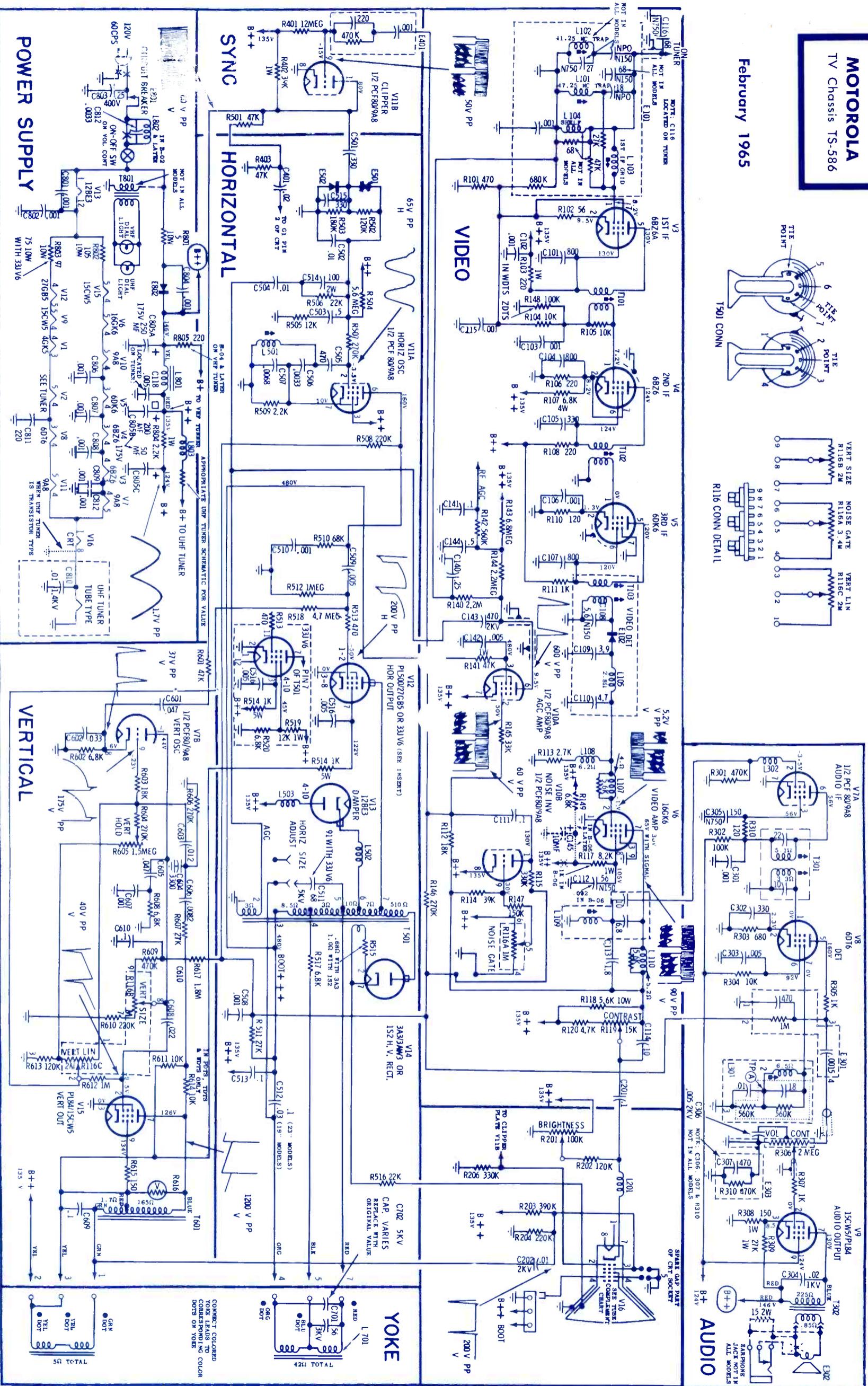
TEKTRAX

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR EIGHT NEW SETS

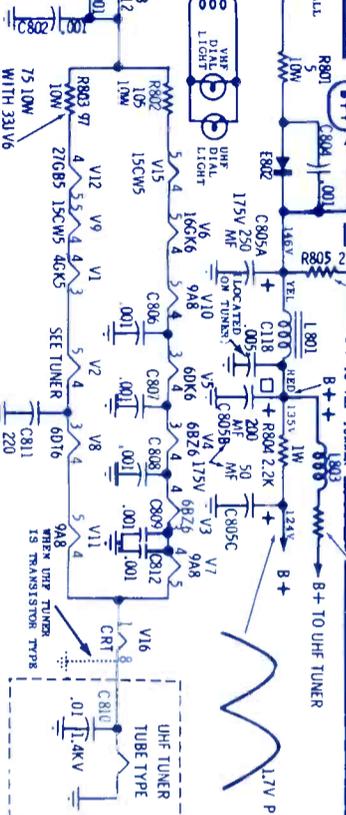


- NOTES:
- VOLTAGE MEASUREMENTS**
1. TAKEN FROM POINT INDICATED TO CHASSIS WITH A VTVM, $\pm 20\%$
 2. LINE VOLTAGE MAINTAINED AT 120V AC.
 3. VOLTAGES INDICATED BY AN ASTERISK WILL VARY WITH ASSOCIATED CONTROL SETTINGS.
 4. TAKEN WITH CONTRAST CONTROL AT MINIMUM AND ALL OTHER CONTROLS IN NORMAL OPERATING POSITION WITH NO SIGNAL INPUT.
 5. TUNER ON CHANNEL 13 OR CHANNEL OF LEAST NOISE WITH ANTENNA TERMINALS SHORTED.

- WAVEFORM MEASUREMENTS**
1. TAKEN FROM POINT INDICATED TO CHASSIS WITH A WIDE-BAND OSCILLOSCOPE.
 2. OSCILLOSCOPE SYNCED NEAR SWEEP RATE INDICATED.
 3. TAKEN WITH STRONG SIGNAL, CONTRAST CONTROL AT MAXIMUM; ALL OTHER CONTROLS IN NORMAL OPERATING POSITION. CAPACITORS UNLESS OTHERWISE SPECIFIED, VALUES LESS THAN ONE IN MF; ALL OTHERS IN MMF.
- * INDICATES SPECIAL COMPONENTS, SEE REPLACEMENT PARTS LIST FOR PROPER REPLACEMENT PART NUMBER.



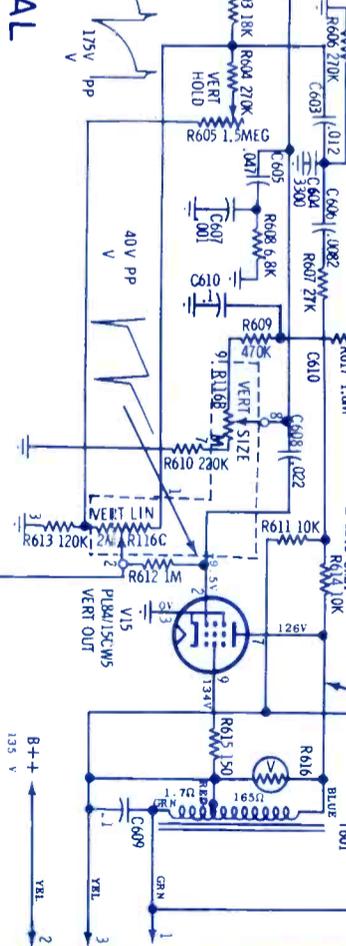
POWER SUPPLY



SYNC



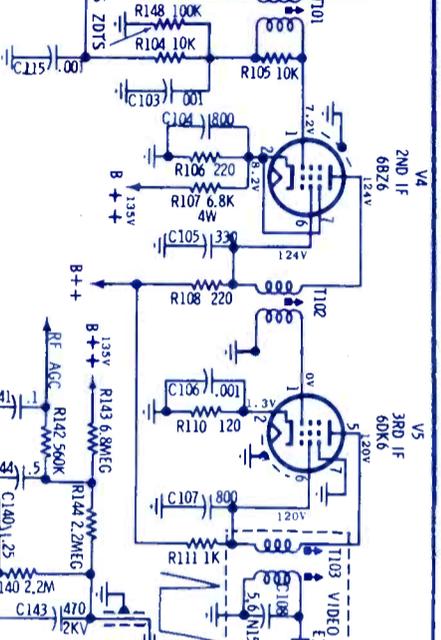
HORIZONTAL



VERTICAL



VIDEO



VIDEO AMP



VIDEO DET



VIDEO AMP



VIDEO AMP



VIDEO AMP



VIDEO AMP



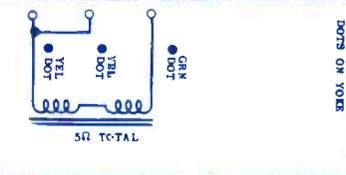
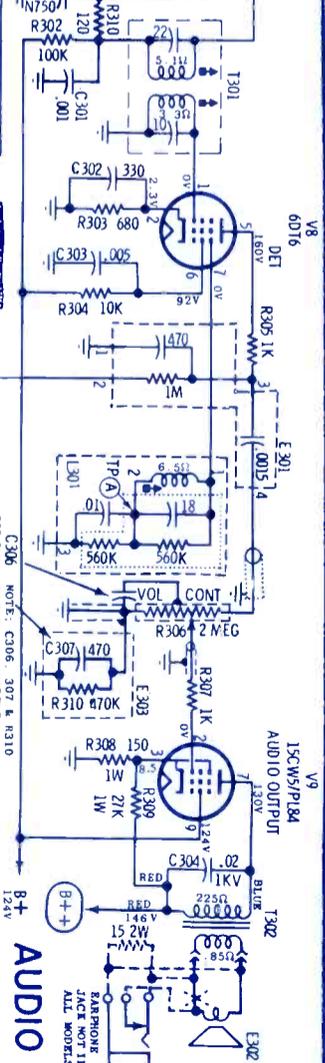
VIDEO AMP



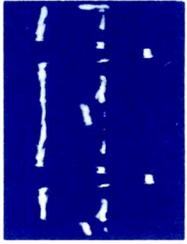
VIDEO AMP



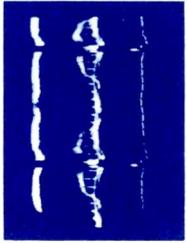
AUDIO



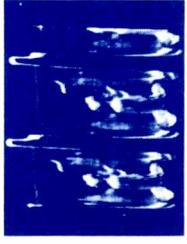
These waveforms were taken with the receiver adjusted for an approximate peak-to-peak output of 3.5 volts at the video detector. Voltage readings taken with the raster just filling screen and all controls set for normal picture viewing, except photos one and two where contrast control was set for maximum. The voltages given are approximate peak-to-peak values. The frequencies shown are those of the waveforms. . . . not the sweep rate of the oscilloscope. All readings were taken with a Model ES-550B Precision Oscilloscope.



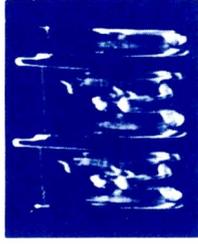
1 3.5 volts p/p, 15,750 cps (maximum contrast)



2 3.5 volts p/p, 60 cps (maximum contrast)



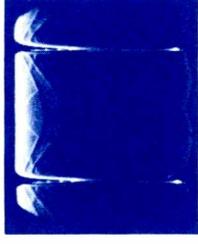
3 100 volts p/p, 15,750 cps



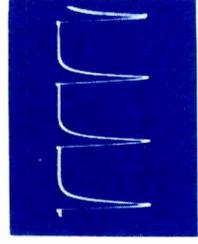
4 80 volts p/p, 15,750 cps



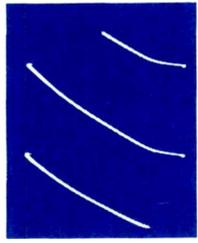
5 80 volts p/p, 60 cps



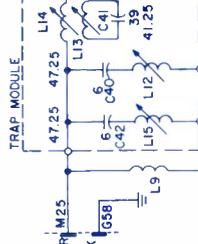
6 50 volts p/p, 60 cps



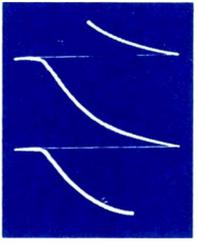
7 50 volts p/p, 15,750 cps



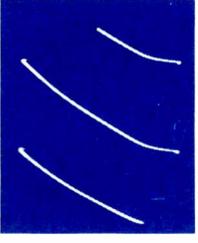
8 40 volts p/p, 60 cps



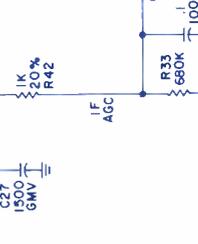
9 60 volts p/p, 60 cps



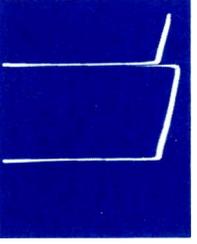
10 40 volts p/p, 60 cps



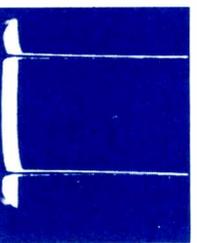
11 60 volts p/p, 60 cps



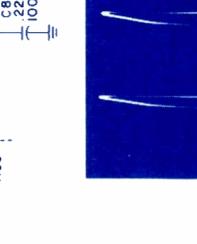
12 60 volts p/p, 60 cps



13 8 volts p/p, 15,750 cps



14 12 volts p/p, 15,750 cps



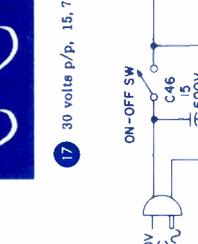
15 15 volts p/p, 15,750 cps



16 8 volts p/p, 15,750 cps



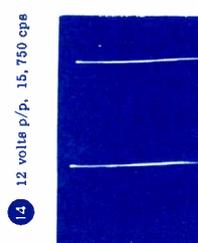
17 30 volts p/p, 15,750 cps



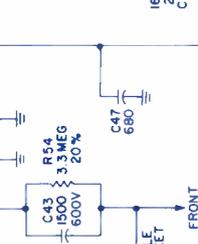
18 25 volts p/p, 15,750 cps



19 90 volts p/p, 15,750 cps



20 100 volts p/p, 15,750 cps



21 90 volts p/p, 15,750 cps

ELECTRONIC TECHNICIAN

TEKFAK

905

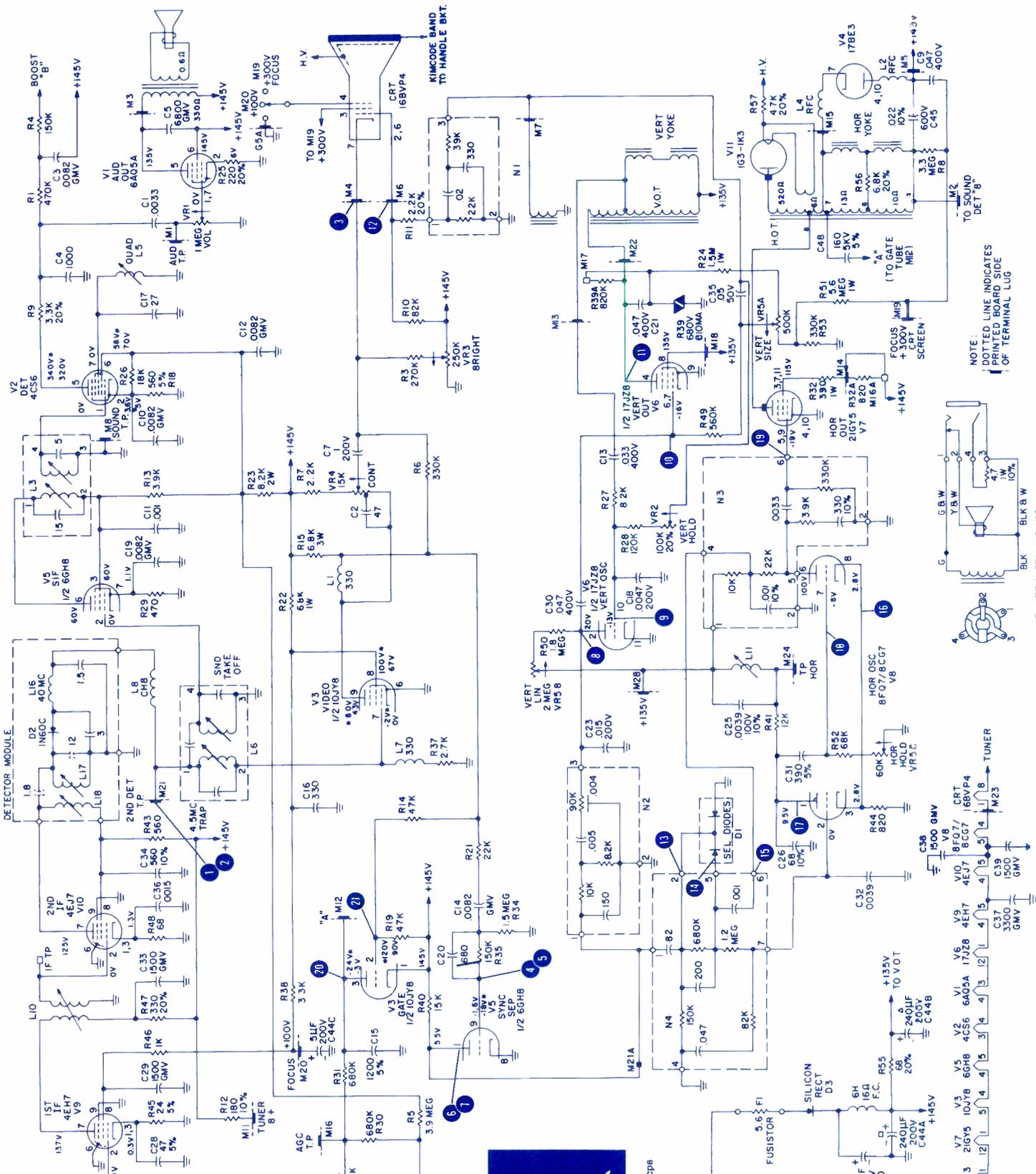
COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR EIGHT NEW SETS

PHILCO
TV Chassis 15G20

February 1965

- NOTES:
1. ALL VOLTAGES TAKEN UNDER NO SIGNAL CONDITIONS. ANTENNA REMOVED AND TUNER OFF CHANNEL.
 2. VOLTAGES MEASURED WITH A "PRECISION MODEL 88", V.T.V.M., FROM POINT INDICATED TO CHASSIS GROUND.
 3. VOLTAGES MARKED * WERE TAKEN UNDER AVERAGE SIGNAL CONDITIONS. ANTENNA CONNECTED, TUNER ON AN ACTIVE CHANNEL AND CONTROLS ADJUSTED FOR A NORMAL PICTURE.
 4. COIL RESISTANCES READ WITH COIL IN CIRCUIT EXCEPT FOR
- A.O.T. SEC. AND SPEAKER V.C.

5. BALLOONS 1, 2, . . . ETC. SHOWN ON SCHEMATIC. INDICATE WAVEFORM TEST POINTS.
6. CONTROL SETTINGS:
VOLUME - MINIMUM
CONTRAST - MID-RANGE
BRIGHTNESS - MID-RANGE
ALL OTHER CONTROLS SET FOR NORMAL OPERATION.



906

RCA VICTOR
TV Chassis KCS
143F

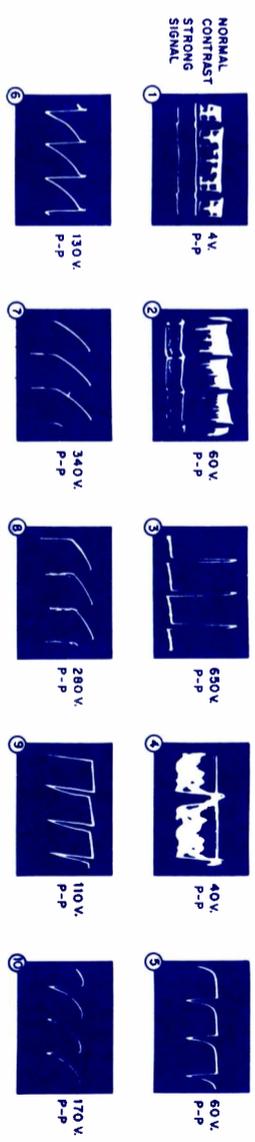
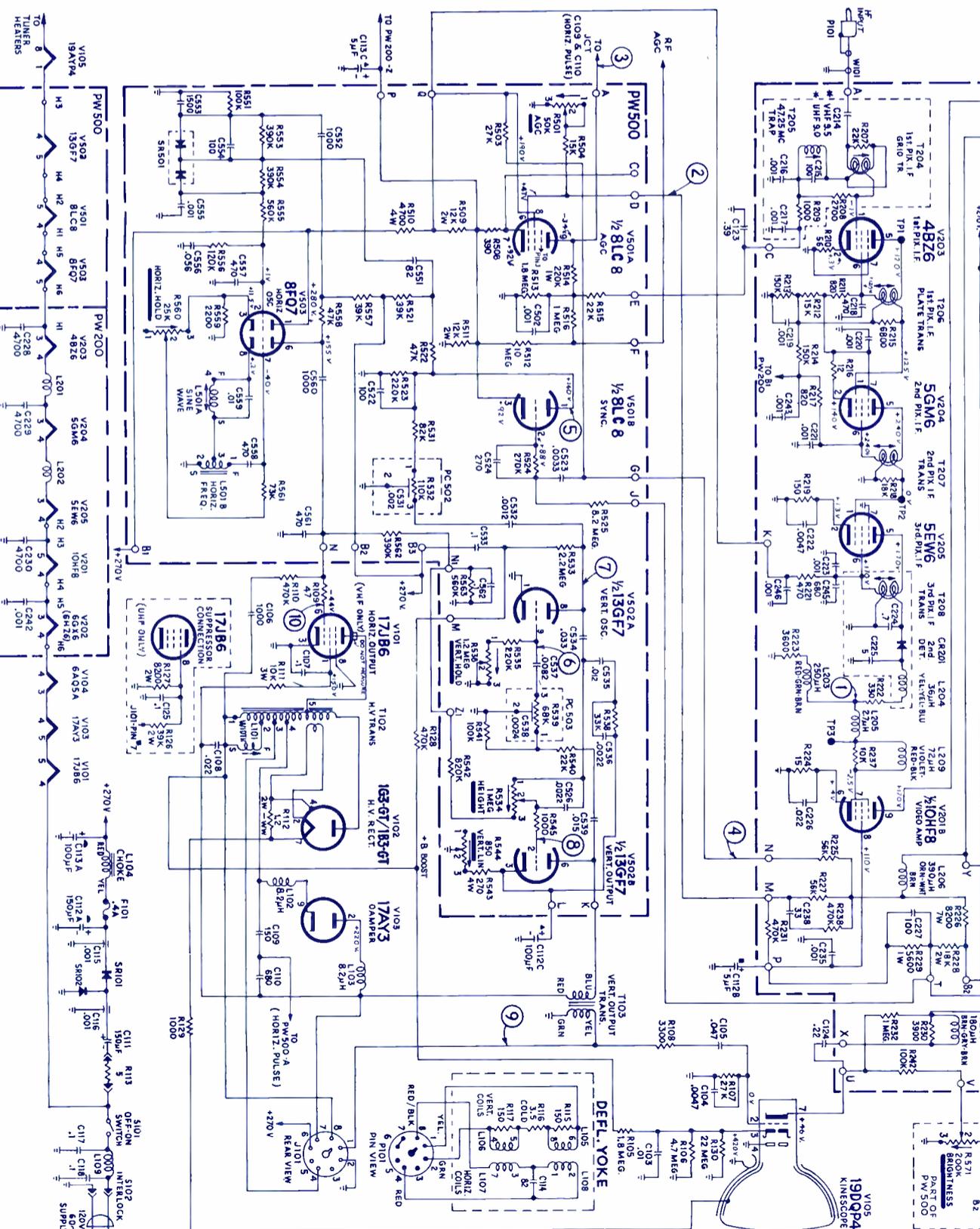
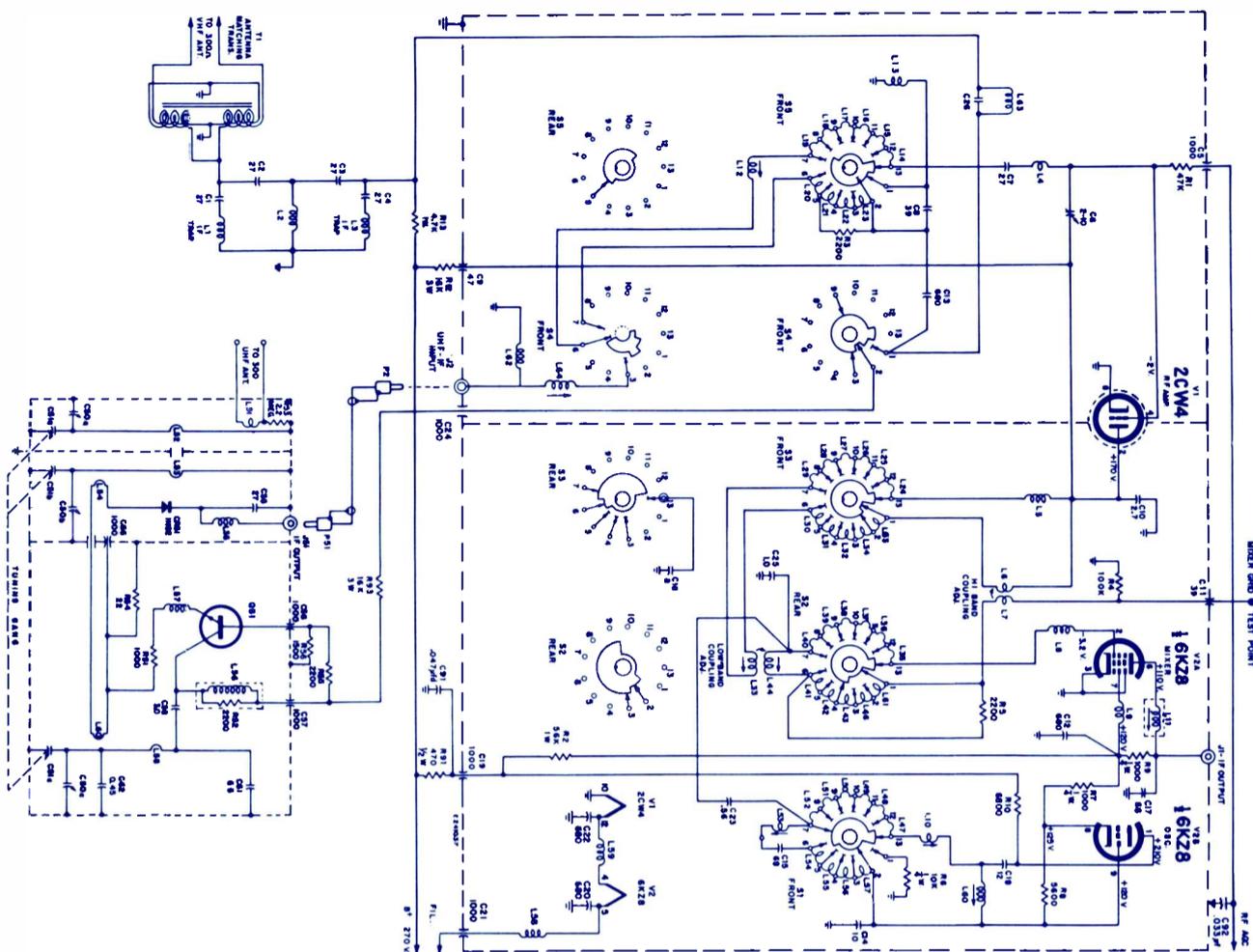
ELECTRONIC TECHNICIAN

TEKTRAX

COMPLETE MANUFACTURER'S CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR EIGHT NEW SETS

February 1965

NOTE:
K=1000
ALL RESISTANCE VALUES IN OHMS
ALL CAPACITANCE VALUES ARE IN P.F.(P) EXCEPT WHERE NOTED
SWITCHES SHOWN IN CHANNEL 13 POSITION
• DENOTES THROUGH CONNECTION OF ROTOR BLADE
○ DENOTES CONTACT CONNECTED TO CONTACT ON
OPPOSITE SIDE OF SWITCH
○ DENOTES CONTACT CONNECTED FROM CONTACT ON
OPPOSITE SIDE OF SWITCH



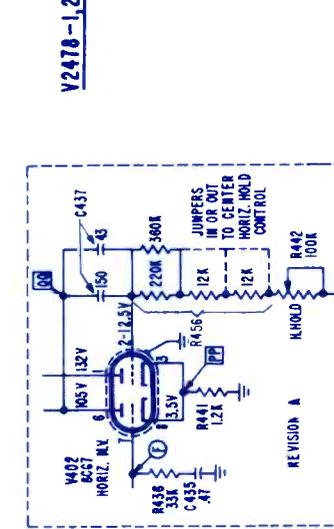
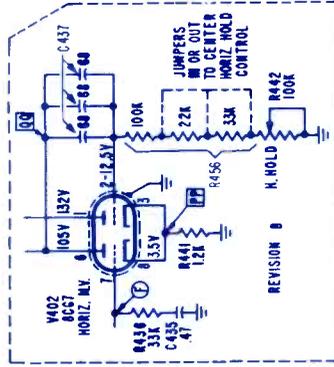
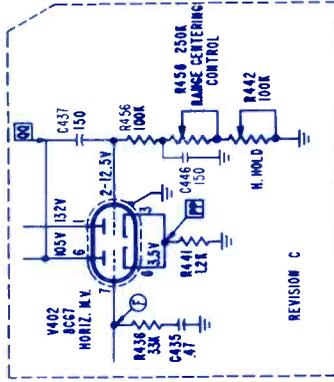
ELECTRONIC TECHNICIAN TEKIFAX

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR EIGHT NEW SETS

February 1965

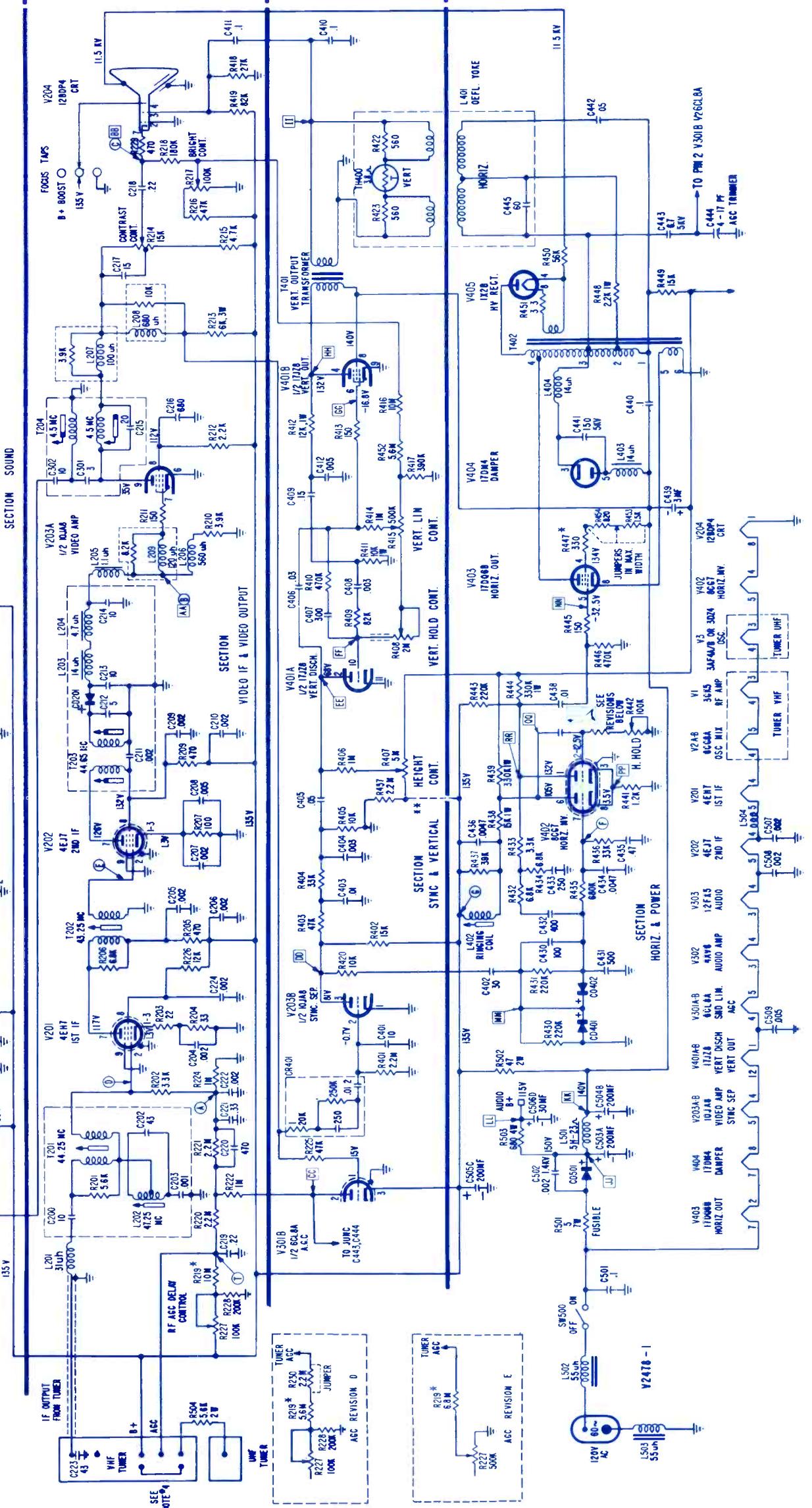
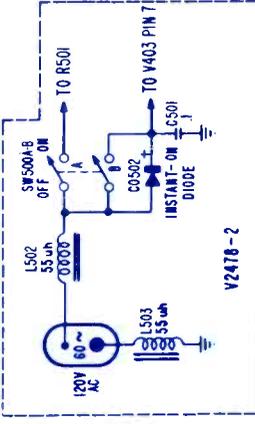
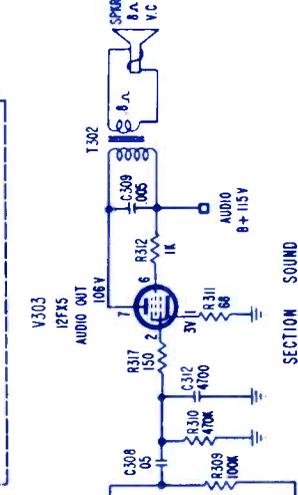
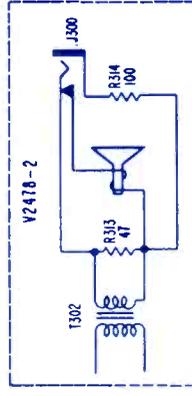
907

WESTINGHOUSE
TV Chassis V-2478-1,2

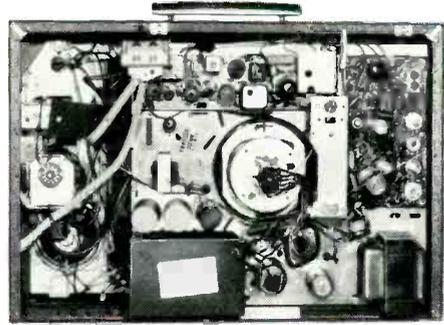
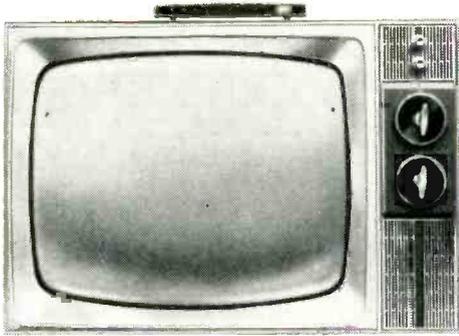


TOTAL R456 APPROX 160K
TOTAL C437 APPROX 200PF

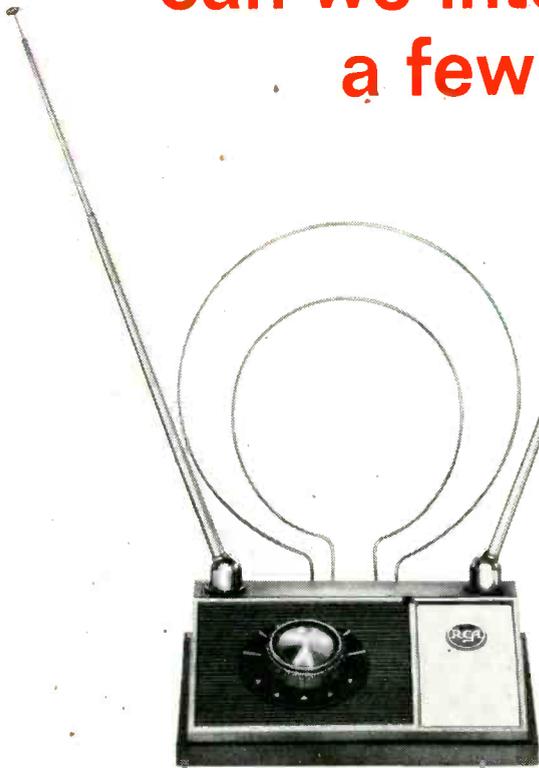
- NOTES:**
- ALL CAPACITOR VALUES LESS THAN 1.0 ARE IN MF. AND VALUES GREATER THAN 1.0 ARE IN PF. (PICOFARADS). ALL RESISTANCE VALUES ARE IN OHMS 1/2 WATT, UNLESS OTHERWISE INDICATED.
 - DC VOLTAGES ARE MEASURED FROM POINT INDICATED TO CIRCUIT GROUND WITH A VTVM. LINE VOLTAGE AT 120 VAC. NO SIGNAL APPLIED.
 - WAVEFORMS WERE TAKEN WITH CONTROLS SET FOR A NORMAL PICTURE.
 - SWITCH MAKES CONTACT ON UHF POSITION ONLY.
 - RELOCATED OFF THE P.C. BOARD.
 - ** JUMPER REMOVED IN LATE PRODUCTION



If you sell or service TV sets



can we interest you in making a few extra dollars?



New RCA Stratomaster—
for both VHF and UHF channels.



New RCA Stratoscope—
for VHF channels only.

If you're in the TV business, why not include these two natural profit makers in your line? These RCA indoor TV antennas are styled so smartly they virtually sell themselves. And they work so well they keep customers sold on you!

SMART STYLING. An instant selling point. The first indoor antennas you can recommend with pride as a decorative asset to any interior.

EXCELLENT PERFORMANCE. These RCA indoor antennas are designed by the same RCA engineers who develop antennas for satellites and space. They include (a) an automatic signal-phasing device to pull in the strongest, sharpest picture possible with an indoor antenna, (b) a channel selector switch to block out ghosts and interference, (c) super-fine tuning, (d) telescoping 45-inch arms turnable in any direction without moving the base.

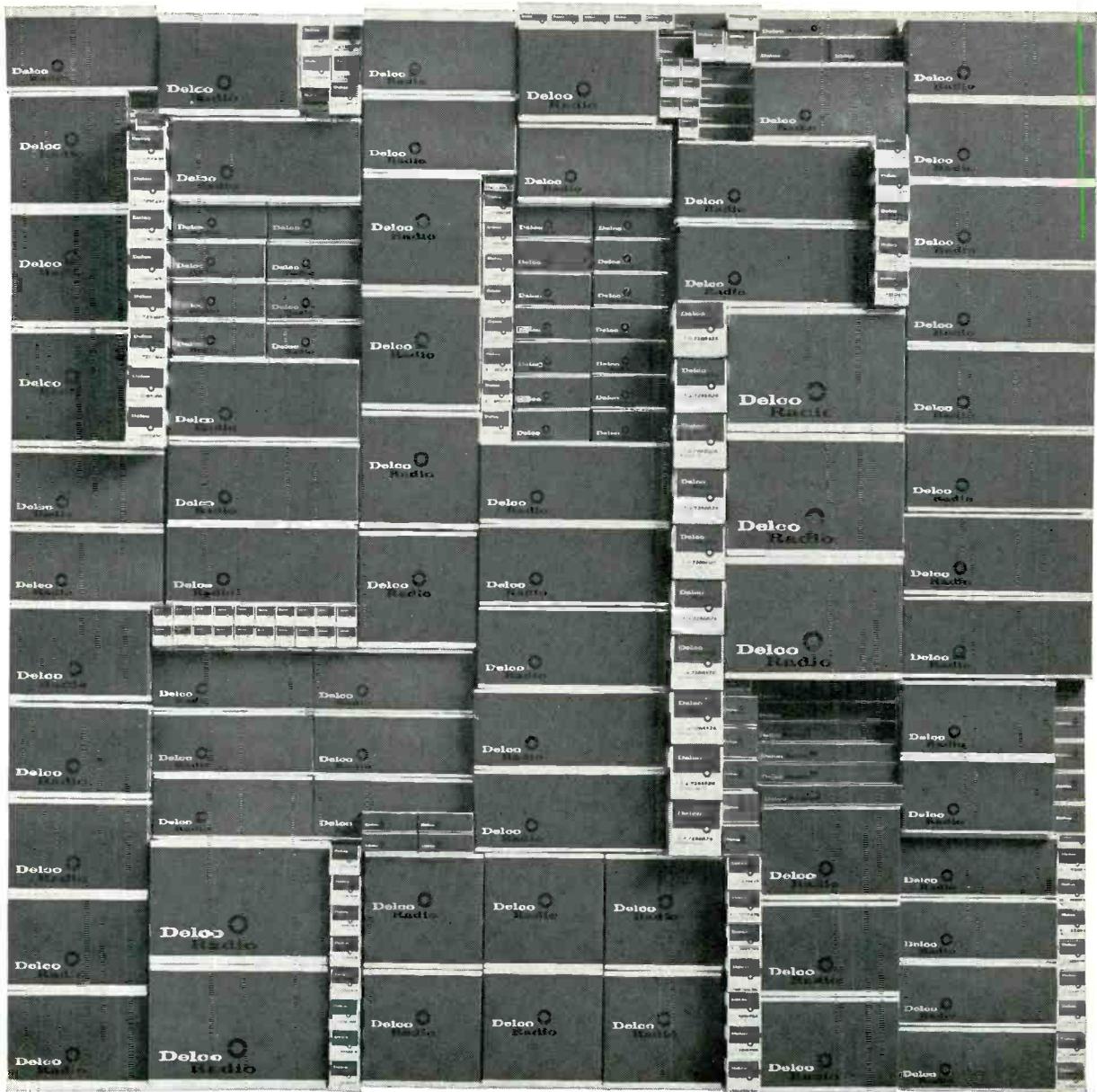
and they're advertised nationally in **POST** and **TV GUIDE**
for immediate customer recognition and acceptance.

ORDER FROM YOUR RCA DISTRIBUTOR. AND HURRY...SO YOU'LL HAVE THEM IN STOCK WHEN CUSTOMERS START ASKING FOR THEM.

RCA PARTS AND ACCESSORIES, DEPTFORD, N. J.



The Most Trusted Name in Electronics



If the part you need isn't here, we've probably got it on the next shelf.

How can we be so sure we've got the auto radio parts you need? There are two reasons. One, nearly *half* the cars on the road have Delco radios. And we make Delco radio parts. Two, you can service *most* other kinds of radios with Delco parts.

We think this makes things easier on you. Because you can get just about all your parts from one reliable source, your United Delco supplier.

And what you get are good parts. You don't have to say a prayer every time you use them. They're well-built, well-tested parts

that won't let you or your reputation down. Your United Delco supplier will gladly send you our big detailed catalog. (To find the supplier nearest you, phone your area number below and ask for the Zone Service Manager.)



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Charlotte.....Edison 4-8671	Indianapolis.....Melrose 6-4351	Philadelphia.....Garfield 3-8200
Chicago.....437-5300	Jacksonville.....Exbrook 8-5755	Pittsburgh.....Court 1-6551
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	Newark.....297-3300	

... for more details circle 24 on post card

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FEBRUARY 1965
VOL. 81 NO. 2

ELECTRONIC TECHNICIAN

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION

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Cover

Across the roof-tops of every large city the 'antenna forest' stretches as far as the eye can see. Our artist had little difficulty adapting the scene to symbolize this month's main editorial content.

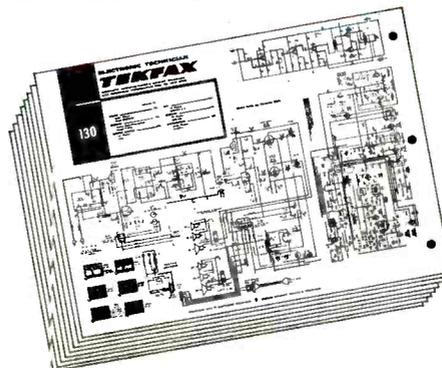
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TEKFAX 16 PAGES OF THE LATEST SCHEMATICS



ADMIRAL: TV Chassis 1D611-1, 2, 3, 4;
1D610-1, 2; 1D61-1 and 4D6

AIRLINE: TV Model GEN-2485A

MAGNAVOX: TV Chassis 49 Series

MOTOROLA: TV Chassis TS-586

PHILCO: TV Chassis 15G20

RCA VICTOR: TV Chassis KCS 143F

WESTINGHOUSE: TV Chassis V-2478-1, 2

ZENITH: TV Chassis 15M22

FREE from RCA!



WIN ONE OF BRAND-NEW 1965

Plus over 100 additional prizes awarded in

EACH GRAND PRIZE CHEVY-VAN LOADED WITH THESE RCA PRODUCTS



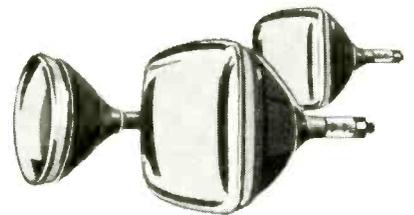
A.

A pair of new RCA Mark-Nine CB radio units for fastest shop-to-truck communication in your neighborhood.



B.

An RCA Treasure Chest Tube Caddy fully loaded with the fastest selling RCA replacement receiving tube types.



C.

One RCA Colorama picture tube and two popular RCA Silverama black-and-white replacement picture tubes.



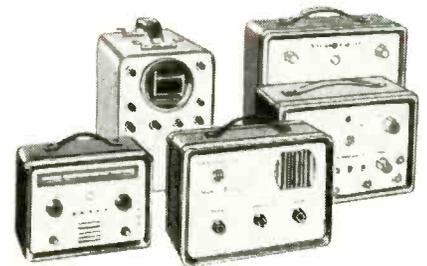
D.

A colorful, attractive counter merchandiser fully stocked with RCA transistor radio batteries.



E.

Two complete kits of RCA's "Top-of-the-Line" replacement transistors for entertainment-type equipment.



F.

Five RCA popular and versatile test instruments:
RCA WR-64A Color Bar/Dot/Crosshatch Generator
RCA WO-33A Super-Portable 3" Oscilloscope
RCA WR-69A Television/FM Sweep Generator
RCA WR-99A Crystal-Calibrated Marker Generator
RCA WR-70A RF/IF/VF Marker Adder



THESE NINE CHEVY-VANS !!!

nine separate regions of the United States!

ADDITIONAL PRIZES INCLUDE:



18

SECOND PRIZES:
RCA Victor Color TV Sets



27

THIRD PRIZES:
RCA Victor Black-and-White Portable TV Sets



72

FOURTH PRIZES:
RCA Victor Portable Transistor Radios

RCA's 1965 Regional Sweepstakes is for Radio/TV/Hi-Fi Service Dealers and Technicians **EXCLUSIVELY!**

NO JINGLES TO WRITE—NOTHING TO GUESS—NOTHING TO BUY! Simply pick up and fill out an entry blank and official rules at your RCA Distributor.

Enter as often as you like. Each entry must be submitted and mailed separately. See your Participating RCA Distributor right away.

This offer not made in states and localities where restricted or prohibited, such as Wisconsin and Florida.

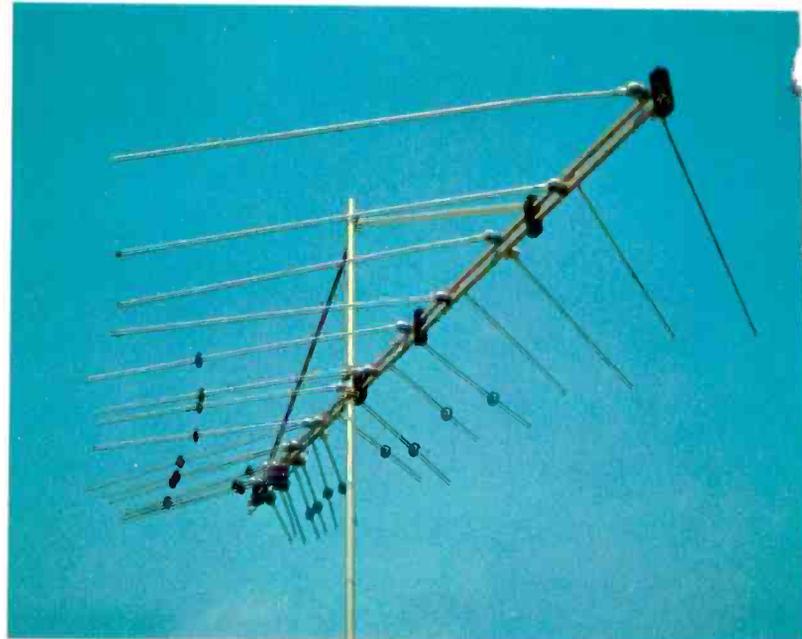
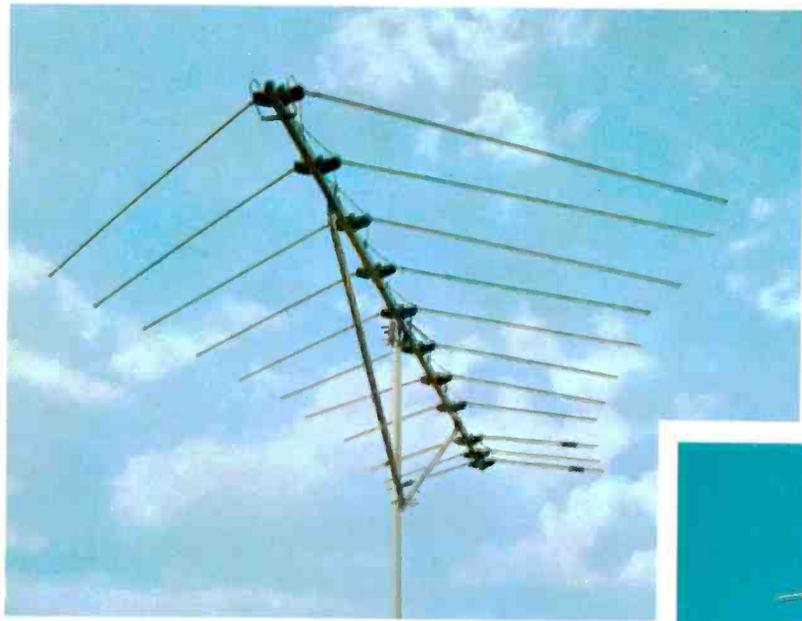
RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N.J.



The Most Trusted Name In Electronics

LICENSED UNDER ONE OR MORE OF U.S. PATENTS 2,958,081; 2,955,879; 3,011,184; 3,108,280; 3,120,376 AND ADDITIONAL PATENTS PENDING IN U.S.A. AND CANADA. PRODUCED BY JFD ELECTRONICS CORPORATION UNDER EXCLUSIVE LICENSE FROM THE UNIVERSITY OF ILLINOIS FOUNDATION.

ADVERTISED IN
LOOK / *Sunset*



Model LPV-11

Model LPV-VU15

Copyright JFD Electronics Corp. 1964

You Can Rely on JFD Log-Periodic* TV COLOR and

NEW—from the famous JFD R&D Laboratories in Champaign, Illinois — the authentic Log-Periodics with the engineering advances that outperform all others in **COLOR**, black and white—on VHF, UHF, VHF/UHF/FM!

WHY MORE JFD LPV LOG-PERIODICS ARE BEING INSTALLED THAN ANY OTHER VHF ANTENNA . . . The JFD Log-Periodic is a revolutionary new concept in antenna design. Its frequency-independent performance does not sacrifice gain, directivity, bandwidth or impedance match as other conventional antennas must on certain frequencies to achieve all-VHF-channel reception. Harmonically resonant V-elements operate on the patented Log-Periodic cellular formula $\frac{L(n+1)}{L_n} = \tau$ to provide the same superb performance on every VHF channel—color or black and white—plus FM/Stereo.

STOUTLY BUILT OF HEAVY WALL GOLD ALODIZED ALUMINUM . . . Inch for inch, ounce for ounce, JFD LPV Log-Periodics deliver more mechanical

strength in less mass. Gleaming gold alodizing (the same used by NASA and the military services) does not insulate vital contact points as does anodizing. Instead, electrically conductive gold alodizing improves signal continuity.

DEVELOPED FROM RESEARCH PERFORMED AT THE UNIVERSITY OF ILLINOIS ANTENNA RESEARCH LABORATORIES . . . The JFD Log-Periodic is the commercial end result of six years of electronic research. No other design has undergone such intensive research and development by leading antenna scientists.

INSTALLED BY MORE WORLD'S FAIR PAVILIONS THAN ANY OTHER BRAND . . . The New York World's Fair House of Good Taste, Formica House, New York City Pavilion, House of Japan, Eastman Kodak exhibit, Florida and Hawaii Pavilions installed JFD Log-Periodics to assure best possible performance of their color TV sets. Millions of Fair visitors will remember and ask for the JFD Log Periodic LPV, paving the way for more sales by you.



THE ONE AND ONLY ORIGINAL LPV LOG-PERIODIC FOR VHF CHANNELS 2 TO 13 & FM/STEREO

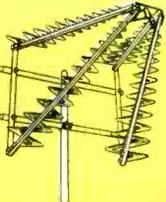
model	description	list
LPV17	18 Cells Directors	\$59.95
LPV14	15 Cells Directors	49.95
LPV11	11 Cells Directors	39.95
LPV8	8 Cells Directors	29.95
LPV6	6 Cells	21.95
LPV4	4 Cells	14.95

NEW! THE FIRST COMBINATION VHF/UHF/FM/STEREO —THE LOG PERIODIC "ALL-VU"—WITH SINGLE LEAD-IN

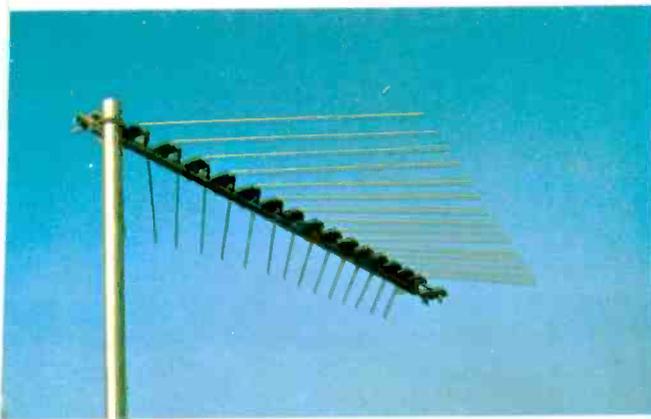


model	description	list
LPV-VU18	18 Cells	\$69.95
LPV-VU15	15 Cells	\$59.95
LPV-VU12	12 Cells	\$49.95
LPV-VU9	9 Cells	\$39.95
LPV-VU6	6 Cells	\$27.50

NEW! LOG PERIODIC ZIG-A-LOG FOR PROBLEM "UHF" AREAS



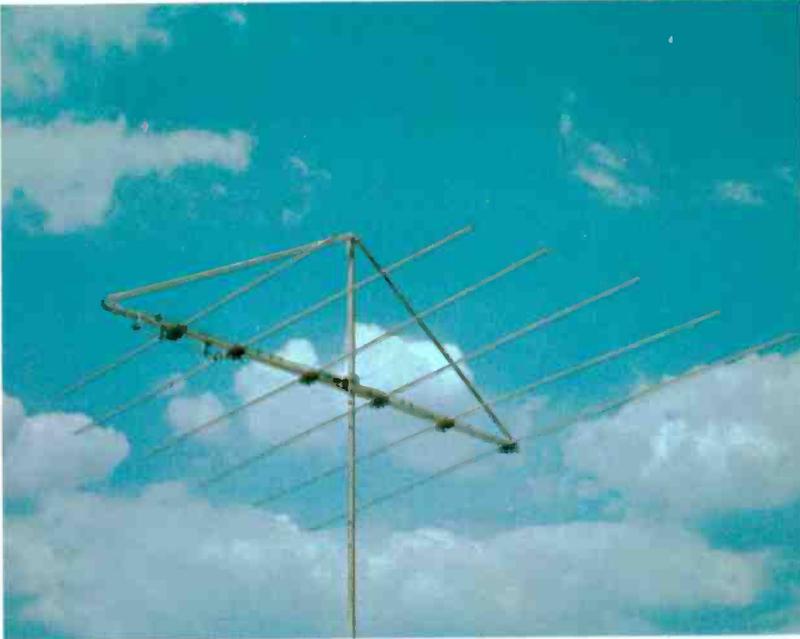
model	description	list
LPV-ZU20	E-Plane Stacked	\$37.50
LPV-ZU10	1-Bay	\$17.95



Model LPV-U15

Model LPV-ZU20 ZIG-A-LOG

Model LPL-FM6 FM/STEREO



antennas for the Finest Pictures In Sight-Black/White!

JFD FREQUENCY-INDEPENDENT LPV LOG-PERIODIC BREAKS THROUGH THE BANDWIDTH BARRIER FOR

GAIN: As high as 14 db (in model LPV17)—with extra gain on the high band where it is needed most.

BANDWIDTH: Frequency-independent log periodic design delivers broad band performance never before possible. Does not discriminate against any channel—or frequency.

RESPONSE: Consistently flat ($\pm 1/2$ db) across both low and high bands for the finest color reception.

DIRECTIVITY: No need to give up directivity to obtain bandwidth as other antennas do. Log-Periodic backfire horizontal radiation patterns, for example, are the narrowest of any all-channel antenna. Reject noise, ghosts, interference and other unwanted signals more effectively because: sharpness of beamwidth affects directivity more than any other factor.

VSWR: As low as 1.2 to 1 for maximum transfer of signal to line across the full bandwidth. Low VSWR's are typical of JFD LPV Log-Periodic antennas because of their constant 300 ohm impedance characteristic.

EVERY LPV YOU BUY EARNS YOU VALUABLE FAIR FESTIVAL POINTS . . . Each JFD Log-Periodic VHF, UHF, VHF/UHF/FM, or FM/STEREO you install includes Fair Festival certificates which you can trade in for FREE World's Fair tickets, trips or cash.

Whether it's VHF, UHF, VHF/UHF/FM, or FM/STEREO, JFD HAS THE LOG PERIODIC TO HELP YOU MAKE THE SALE OTHERS CAN'T!

SEE WHY AT THE MOMENT OF TRUTH, THE PICTURE IS THE PROOF—THE JFD LPV LOG-PERIODIC WORKS BEST!

"Don't gamble on Log-Periodic "look-alikes" and imitations! Insist on the genuine LPV by JFD—exclusive producers of the pace-setting Log-Periodic antenna developed from research performed by the Antenna Research Laboratories of the University of Illinois.



JFD ELECTRONICS CORPORATION
 15th Avenue at 62nd Street, Brooklyn, N. Y. 11219
 JFD Electronics-Southern Inc., Oxford, North Carolina
 JFD International, 64-14 Woodside Ave., Woodside 77, N. Y.
 JFD Canada, Ltd., 51 McCormack Street, Toronto, Ontario, Canada

NEW! LOG PERIODIC LPV FOR UHF CHANNELS 14 TO 83 & VHF 7 TO 13

model	description	list
LPV-U21	21 Cells	\$27.95
LPV-U15	15 Cells	\$18.95
LPV-U9	9 Cells	\$12.50
LPV-U5	5 Cells	\$ 6.95

NEW! LOG PERIODIC LPL-FM STEREO

model	description	list
LPL-FM10	10 Cells	\$49.95
LPL-FM8	8 Cells	\$39.95
LPL-FM6	6 Cells	\$29.95
LPL-FM4	4 Cells	\$19.95

NEW! TELE-AMP ANTENNA AMPLIFIERS FOR VHF, UHF & FM

model	description	list
VUT-3	3-Transistor VHF/UHF/FM Amplifier	\$49.95
VN-2	2-Nuvistor VHF Amplifier	\$39.95
VT-2	2-Transistor VHF Amplifier	\$39.95
VT-1	1-Transistor VHF/FM Amplifier	\$34.95
UHT-1	1-Transistor UHF Amplifier	\$39.95
FT-1	1-Transistor FM Amplifier	\$34.95

- - for more details circle 33 on post card

Announcing ... **'THE PRISM'** ... Brach's all new

COLOR

Indoor Antenna

THE FIRST AND ONLY RABBIT EAR DESIGNED FOR **COLOR** TELEVISION

- 300 Ohm Folded Dipole ■
- Perfect match and maximum transfer of signal ■
- Eliminates "color shift" and cancellation of "color burst" caused by standing waves on lead-in ■
- Smartly styled to fit any home decor. Available in chrome or simulated gold.



PATENT PROTECTED

Brach

MANUFACTURING CORP.
Division of General Bronze Corp.
200 CENTRAL AVENUE
NEWARK, NEW JERSEY 07103

... for more details circle 20 on post card

LETTERS TO THE EDITOR

TEKFAX Roundup

I wonder if reader J. T. White of Pensacola (September ET letters) ever received an offer of TEKFAX schematics Volumes 101, 102 and 103? I have 103 and 104 and would like someone to have them. I can also supply most of the old Circuit Digests (now TEKFAX) from Group Number 1 up to date. Would like for some of the newcomers to have this information — it has been very helpful to me in the past. I can also supply old issues of ELECTRONIC TECHNICIAN and even some RADIO & TV RETAILING copies (about 1945-56).

HORACE D. WESTBROOKS
Griffin, Georgia

... I have an extra 104 TEKFAX schematics Volume that I would like to trade for a 101 or 102. I have a complete schematics-book file otherwise.

D. R. GLADISH
Cape Girardeau, Mo.

... I have Circuit Digests (TEKFAX) Group Numbers 34 to 60 inclusive. I also have schematic Volumes No. 100, 104, and 105. I am primarily interested right now in getting TEKFAX Group Numbers 61 to 103 inclusive, but would like to complete my file from Number 1 through Number 33 also. Can anyone help me?

GUY F. WARREN
San Bernardino, Calif.

So Soon?

I am now 75 years old and — while I feel very sad about it — I have to call it quits. I have subscribed to this most helpful magazine for many years. There's no better in the business.

EDWARD UHLIG

Another Young'un Quits

I built my first 'one tuber' in September 1922. And this is a farewell hand-shake to a wonderful magazine for TV-radio, Hi Fi service technicians. It has been a

Have you tried new **QUIG**[®] connectors?

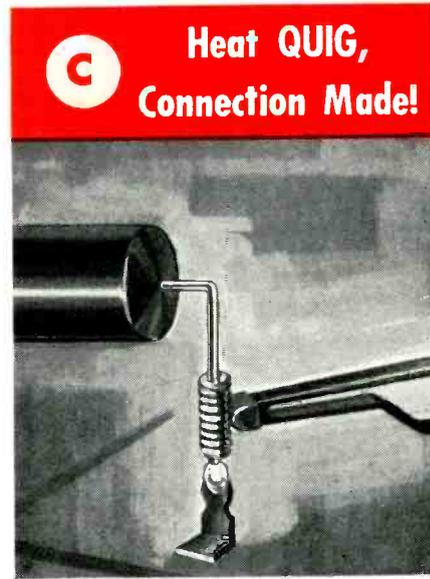
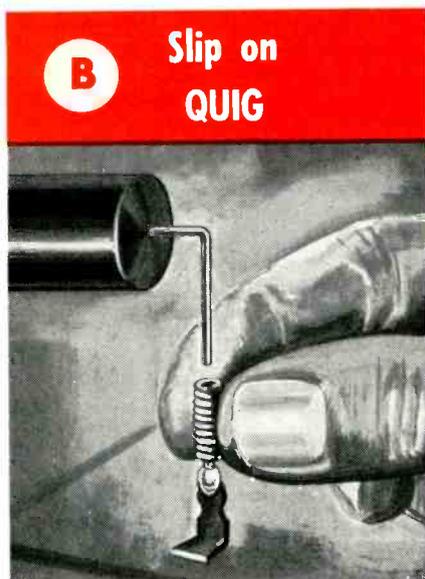
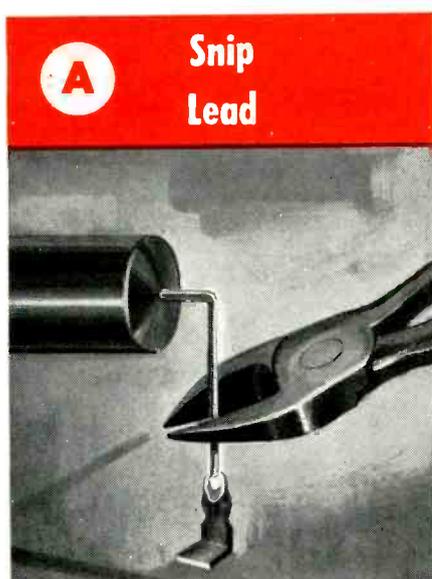
Not just another wire spring connector!
The 3-in-1 QUIG is brand new and different . . . Copperweld wire inner core, a layer of flux, and an outer jacket of solder . . . all you need is heat!
Makes one-handed soldering possible!

Once again, Sprague helps the TV-radio service industry by solving two increasingly serious problems . . . parts replacement in those "inaccessible" chassis nooks, such as crowded tube sockets, as well as soldering onto the delicate circuitry of printed wiring boards.

Mechanically sturdy and electrically reliable, the revolutionary QUIG provides fast, expertly-soldered connections as easy as A-B-C!



Ten times actual size



**NOBODY ELSE HAS QUIG CONNECTORS...
YOU GET 'EM ONLY FROM SPRAGUE PRODUCTS!**

QUIGS 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 QUIG component connectors . . . the biggest boon to the service technician since the soldering gun!



WORLD'S LARGEST MANUFACTURER OF CAPACITORS

65-4104

FEBRUARY 1965

--- for more details circle 49 on post card

27

only Weller® for all soldering

Dual Heat Soldering Guns

Weller dual heat soldering guns give time-saving instant heat. Two trigger positions let you switch to low heat, for soldering near heat-sensitive components, or high heat when needed. Spotlight illuminates work. Three models available.

100/140 watts—Model 8200—\$5.95 list
145/210 watts—Model D-440—\$9.95 list
240/325 watts—Model D-550—\$10.95 list



Soldering Gun Kits

"Expert" Kit (shown) includes 100/140 watt gun, 3 soldering tips, tip wrench, flux brush, soldering aid and solder in a plastic utility case. Model 8200PK—\$8.95 list.

Heavy-Duty Kit features 240/325 watt gun; soldering, cutting and smoothing tips; tip-changing wrench; solder; plastic utility case. Model D-550PK—\$12.95 list.



"Pencil" Soldering Iron

For miniature type soldering. A 25 watt, 115 volt soldering pencil that's small and lightweight. So efficient it does the work of irons that are much heavier and require much higher wattage. Rapid recovery. Cool handle. Complete with 1/8" screwdriver tip and cord set. Model WP—\$4.98 list.

Temperature-Controlled Low-Voltage Soldering Pencils



Temperature control of this new Weller soldering pencil is in the tip. Interchangeable tips give a choice of 500°F, 600°F, or 700°F controlled temperatures. Operates on 24 volts. Small, lightweight, highly efficient. Complete with 3/16" 700°F tip and 60 watt, 120 volt, 50/60 cycle power unit with stand for soldering pencil attached. Model W-TCP—\$26.00 list.

Also available: a soldering pencil controlled by thermistor and SCR (silicon controlled rectifier) circuit. It gives a choice of controlled temperatures between 200°F and 450°F. Highly efficient. Model W-TCP-2.

AT YOUR ELECTRONIC PARTS DISTRIBUTOR

WELLER ELECTRIC CORP., Easton, Pa.

WORLD LEADER IN SOLDERING TECHNOLOGY

In Canada: Weller Electric Corp., 121 Counter Street, Kingston, Ontario.

In Europe: Weller Elektro-Werkzeuge G.m.b.H., 7122 Besigheim Am Neckar (Postfach 140), West Germany.

... for more details circle 52 on post card

LETTERS TO THE EDITOR

tremendous help to me for many years. I am now sixty-seven years old and retiring. Time for younger men to keep pace with progress.

H. D. CHILDRESS

Haskell, Okla.

Needs Info on Museum Piece

I need a schematic for an At-water Kent radio, 6 tubes, 7 front controls, number on tag: 4700, number stamped on mtg board: 7846. Can anyone help me?

RUDOLF SCHLEGEL

Lake Villa, Ill.

Wants to Write

I am very interested in becoming a technical writer in my field of electronics. This has been on my mind for several years but I do not know how to begin. . .

ELIO J. CAVALET

Akron, Ohio

• *The best way to learn how to write is to start writing. Then, you study the basics of writing, and write some more. After a while you'll get the hang of it. Enclosed, copy of our Authors' Guide. — Ed.*

And Still They Come . . .

As a long time subscriber to ET, I am greatly interested in Engineer Certification. Thank you for an interesting magazine and please forward further information. . . .

ROBERT E. JONES

Garden City, Michigan

Need More Math

I want to compliment you on your good magazine. But check the December, 1964 issue, page 46, "Improving Color TV reception." The sound carrier for channel 2 is 59.75 Mc, correct you are, but the carrier is only 0.25 Mc from the top edge of the channel 2 band — instead of 1.25 Mc.

WAYNE RIENER

Lamar, Colo.

• *That's "overcycling" a bit, eh? — Ed.*

If this doesn't open your eyes to some awful truths in the electronics business, write us and we'll spell it out for you.

All electronic manufacturers *say* they love their dealers.

But do they? In embracing you, manufacturers often squeeze too hard. They squeeze you right out of the profit picture, in fact.

How?

By selling to national mail-order catalog houses, and their captive discount chain stores. To tube-checkers. And to other outlets that by-pass you, the dealers.

We won't spell out any names, mind you. But just pick up any of the leading mail order catalogues such as A - - - - d, L - - - - - e, O - - - - n, R - - - - o S - - - - k, etc. and look at the antennas or the rotators or the picture and receiving tubes or the boosters and other TV products.

You'll see that all these catalog houses sell the same products you sell — for approximately the same prices you *pay* for them.

You're entitled to an honest prof-

it, of course. But how can you compete when your own prices *must* seem excessive by contrast.

Poor you. Your business — not to mention your profits — is cut right out from under you.

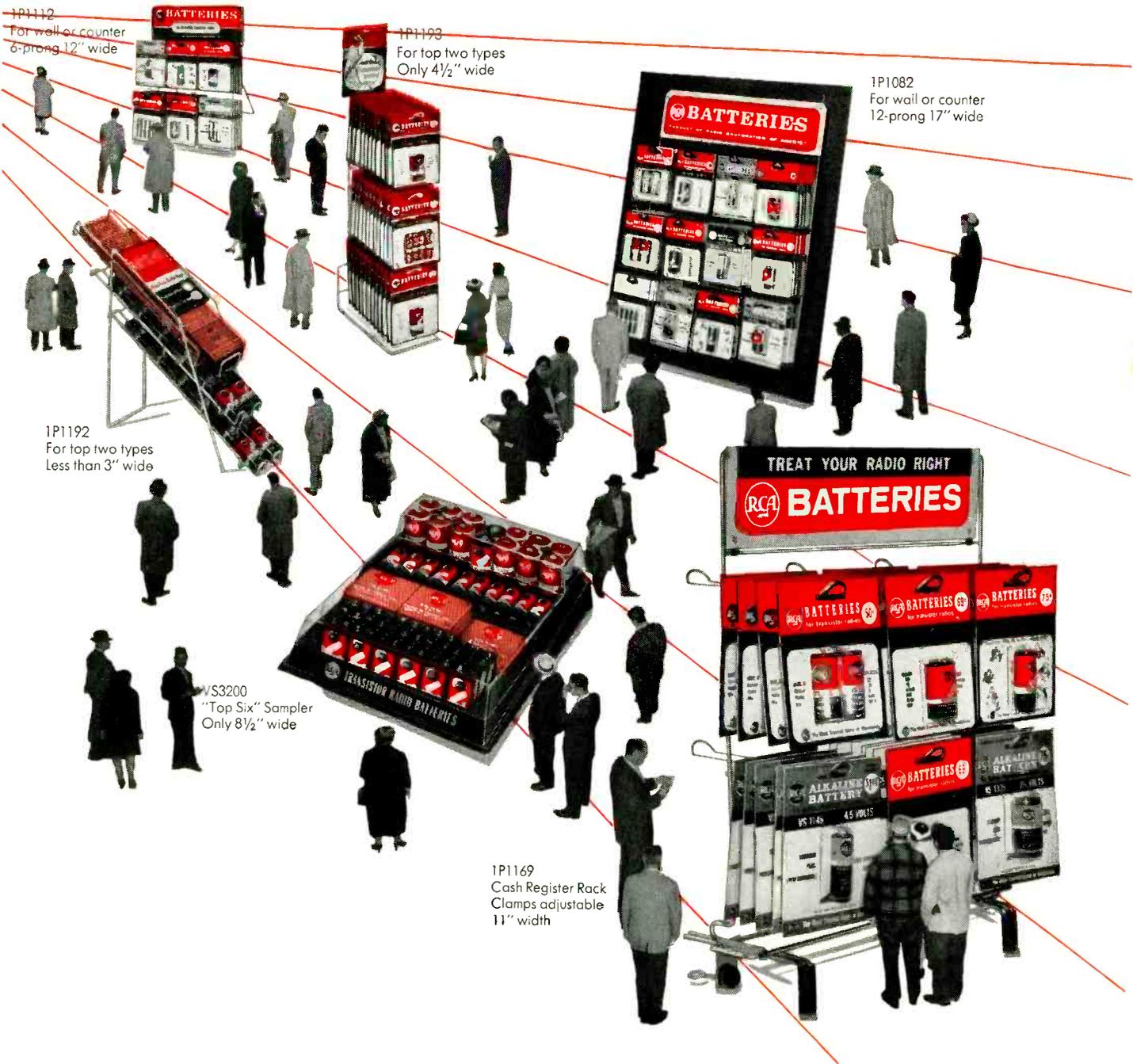
Many dealers are happy exceptions, of course. Dealers who handle Channel Master products, for example.

It's dead against Channel Master's policy to sell to any outlet that by-passes the dealer, or that sells to consumers at dealer prices. This way we protect your business and let you reap a full profit. The highest in the industry, by the way. We feel that the very least we owe the dealer who sells our products is a decent living.

We think it's just plain good business to support the firm that supports you. What do *you* think?

CHANNEL MASTER

Ellenville, N.Y.



Want your radio battery business to grow?

1. PICK THE BRAND NAME PEOPLE ASSOCIATE WITH RADIO-RCA.

With a small-ticket item such as batteries you want each sale to be final—sealed with customer satisfaction. That's the only way to keep the customer coming back. That's the only way to keep the profit in the till. To sell with confidence, rely on the name your customers have come to look to for quality and dependability—RCA.

With over 70 million transistor radios in use today and with other battery-operated devices sprouting in all directions, batteries can ease the squeeze on profits and more than rate the little space they require.

Advertised over Network TV on Walt Disney's "Wonderful World of Color"

RCA BATTERIES
FOR RADIOS • TOYS • PHOTOGRAPHIC DEVICES

1P1161
 Revolving Rack
 Only 11" wide



1P1183
 Deluxe Merchandiser
 25" wide



Radio Batteries
From RCA

1P1139 "Top Drawer"
 Full-Line Merchandiser
 Only 11" wide



RCA BATTERIES
FOR ALL LEADING TRANSISTOR RADIOS

1P1160 "Low-Boy"
 For transistor types
 Only 11" wide



Then take these two simple steps today.

2. PICK THE PACKAGE BEST SUITED TO YOUR NEEDS.

How do you want your batteries—blister-packed or regular? With RCA Batteries you have your choice. With attractive pricing either way. How much space can you afford to allocate to batteries? Is it 4 inches? Or 2 feet? You can surely meet your needs from this wide selection of attractive, practical RCA battery merchandisers.

And every battery...every merchandiser...proudly and clearly displays the RCA name, your assurance of satisfied customers. Get the most out of the booming battery business with the name people associate with radio: RCA. For details, contact your Authorized RCA Battery Distributor, or RCA Electronic Components and Devices, Harrison, N.J.



The Most Trusted Name in Electronics

a big improvement on an old favorite...

NEW WINEGARD BOOSTER COUPLER



Model BC-208

Runs 1 to 4 TV or FM sets
Replaces Model WBC4-X

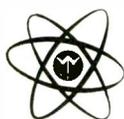
ONLY
\$29⁹⁵
LIST

Boosts Signal... Cuts snow... no picture smear... no interaction... 8 DB gain to each output.

Winegard engineers have taken advantage of the newest ampliframe shielded triode tubes to develop an improved booster-coupler. The new BC-208 uses *two* 6HA5 tubes

for higher gain and less noise. FM gets a boost, too, in this new circuit as it covers the entire FM band 88-108MC. It's a great new product from Winegard for better color, black & white or FM reception. Ask your distributor or write today for spec. sheets. Check the comparison chart against the old Winegard Booster Coupler.

	BC-208	WBC4-X
Number of tubes	2 6HA5	1 6DJ8
Gain to each isolated output	+8db	+5.8db
Gain across FM Band	+7db	+1.2db
Noise Figure, Low Band	3.7db	3.8db
Noise Figure, High Band	5db	5.2db
Isolation between outputs	18db	8db
Signal Input	20 to 350,000 microvolts	20 to 300,000 microvolts
Maximum Signal Output	1,800,000 microvolts	1,500,000 microvolts
ON-OFF Switch	Yes	Yes
Response	Flat $\pm \frac{1}{2}$ db per any 6mc channel	Flat $\pm \frac{1}{2}$ db per any 6mc channel
No-strip terminals	Yes	Yes
Removable mounting bracket	Yes	No
Module wiring	Yes	No
Number of isolated outputs	4	3



Winegard Co.
ANTENNA SYSTEMS

3019C KIRKWOOD, BURLINGTON, IOWA

... for more details, circle 54 on post card

EDITORS' MEMO

The 'Two-Ended' Rainbow

Everyone knows about the pot of gold at the "end" of every rainbow. But the multi-hued color TV rainbow, now emerging across the nation's skies, has a glittering pot of gold at both ends: *The sales end and the service end.*

A Chicago broadcast executive said recently that black and white TV will be "virtually a thing of the past" by 1972. Others feel that the number of color sets made will surpass the number of B/W sets made before 1970.

Approximately 1,300,000 color sets were delivered to homes in 1964. Conservative estimates indicate that 1965 will see more than 2,000,000 color sets delivered. What does this mean to service-dealers and technicians?

You do not need to stretch your imagination to understand that the future of this business will belong to those who successfully engage in color TV sales and service. If you are not now so engaged, or working hard to learn the business, you'd better start looking for a job in other fields.

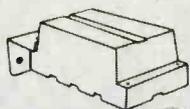
Not since the late '40s — when B/W TV began its phenomenal growth — have we been presented with a greater or more golden opportunity.

The profit margin on color sets is higher. Service charges run approximately 25 percent higher. Your investment in needed additional test equipment for servicing color TV is relatively small. And you can learn all about the sales and service ends by investing a few pennies and a few minutes of your time every day.

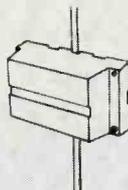
In the months and years immediately ahead, ELECTRONIC TECHNICIAN plans to bring you articles on every phase of color TV. Articles will cover sales and service; basic theory and practical applications; installation, troubleshooting and repair techniques; necessary antennas for top-quality reception; instruments for rapid alignment and repair.

In fewer words, we'll help you work both ends of the color TV rainbow.

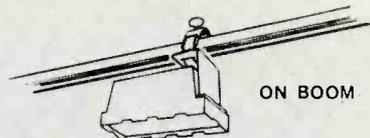
MOUNTS 5 WAYS



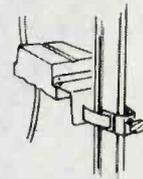
ON OUTSIDE OF HOUSE



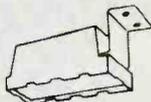
INSIDE OF HOUSE



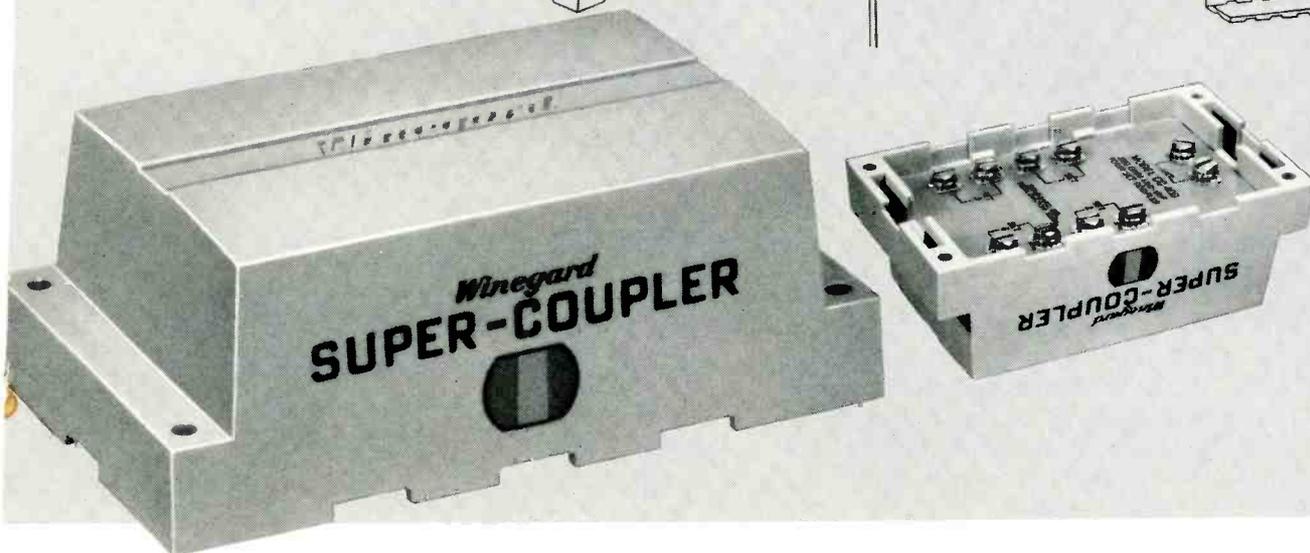
ON BOOM



ON MAST



UNDER EAVE



Never before couplers like these! New Winegard Super Color Couplers ...the 2 most efficient TV-FM 2 and 4 set Couplers ever built!

- Constant Isolation between sets . . . 22db minimum across all channels (2-13 and FM)
- Lowest Loss of Any Coupler . . . -3.2db maximum
- Best Impedance Match from Antenna to Coupler and Set to Coupler
- Allow Best Possible Reception on Color or Black & White Sets

There is a wide difference in the performance of TV-FM couplers. And now, with the new Winegard 2-set and 4-set Super Color Couplers, there is a greater difference than ever.

For example, no resistors are used for isolation of outputs. No resonant coils are used in the circuit. Instead, our research labs have developed an entirely *new coupler circuit* using three high frequency, ferrite core transformers in a unique "Balanced Bridge" circuit.

What does this do to performance? Well, for one thing, the 2-set Super Coupler provides an isolation figure of 22db minimum across *all* channels (2-13 and FM). Until now, the minimum isolation between sets with 2-set couplers was about 10db or 3 times, and was not constant on all channels. With the new Super Color Couplers, it's 12.8 times—*four times better* than the previous best. In fact, isolation is so good, you can put a dead short across one set of output terminals without affecting the set connected to the other output.

LOSS is another key factor in measuring the performance of a coupler. The lowest possible theoretical loss in a 2-set coupler is -3db but no coupler on the market had ever approached this ideal. Now, with Winegard's new 2-set Super Coupler (CC200), the **MAXIMUM** loss is -3.2, nearly perfect and by far the best on the market.

One more very important factor—**IMPEDANCE**. There are two impedance matches to consider . . . "Forward" from coupler to antenna, and "Backward" from set to coupler. A perfect coupler would have a VSWR of 1.1:1 on both matches. Some couplers have good match one way but, until now, no coupler ever had a good match both ways. Winegard Super Couplers have a near perfect VSWR of 1.2:1 both *forward and backward* . . . and on *all* channels. This far exceeds other couplers on the market.

What does all this mean to your customers? Most important, it means that the Super Coupler will not spoil picture resolution by adding smear or halos. *The Super Coupler is especially recommended for color installations* where preservation of picture quality is even more critical than on black & white.

What besides performance? Construction and price. The new Winegard Super Color Couplers have a unique 5-way mount, sleek new weather-proof coupler housing, pre-notched transmission line outlets, 1/4" slotted Hex terminal screws and no-strip terminal connections . . . the price is only \$4.50 for the CC200 which includes the special inside-outside mount.

Try the new Winegard Super Couplers now and *see* the difference. Ask your distributor for a 6 pack dispenser. Try them on your next six installations. If they aren't the finest you've ever used, take them back for a *full refund*.

CC200 — For VHF and FM Specifications as above.
List \$4.50 includes 5-way mounting bracket and strap.

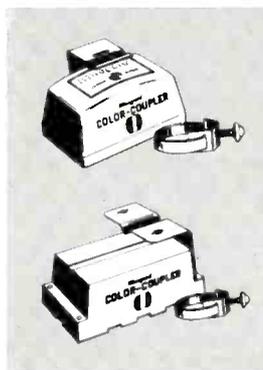
CC400 — For VHF, UHF and FM (replaces LT-43).

Max. loss -6.23DB
would be -6.0DB; Isolation 12DB min; Response $\pm 1/4$ DB per 6MC; VSWR: Input 1.15:1; Output 1.4:1 Max; Bandpass 20MC-1000MC; Impedance: Input 300ohm, Output 300ohm. List \$5.50 including 5-way mount and strap.

Winegard's Famous CC23 Color Coupler
Finest VHF/FM color coupler on the market next to our new Super Color Couplers. List Price \$3.95.

Winegard All New CVU-2 UHF-VHF Coupler Efficiently transfers UHF and VHF signals from antennas to sets. Serves as coupler or splitter for channels 2-83 (UHF-VHF). List \$3.95.

	UHF	VHF/FM
Splitter loss	3.5db	4.3db
Isolation	20 db	12 db
VSWR	1.4:1	2:1



NEW COUPLER
6 PACK DISPENSER

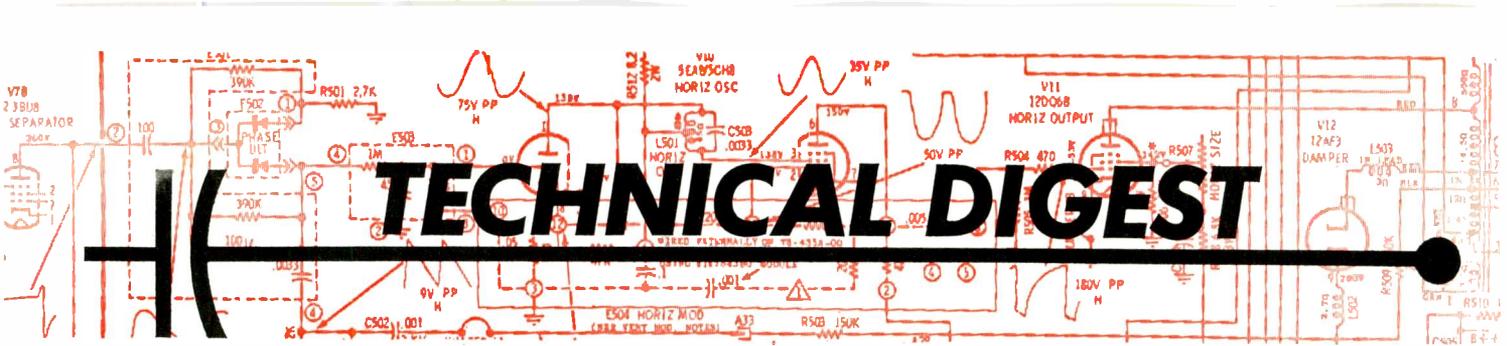


Winegard Co.

ANTENNA SYSTEMS

3019B Kirkwood, Burlington, Iowa

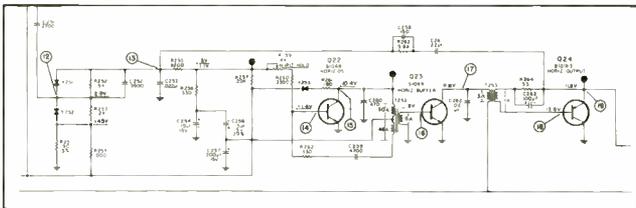
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GENERAL ELECTRIC

TV Chassis TA—Horizontal Phase Detector and Horizontal Circuit Operation

The negative sync pulse from the clipper, Q17, is applied through C251 to the common cathode connection of Y251 and Y252. The horizontal reference pulse is coupled from the collector circuit of Q24 to Y251, Y252 and integrated by R263 and C253 to shape the horizontal pulse into a sawtooth waveform. When either the sync pulse or the reference pulse is present, zero voltage will be developed from the phase detector. Also, no correction voltage is developed when the sync pulse and the reference pulse are both present and in phase. The only time any correction voltage is developed is when the sync pulse and the reference pulse are out of phase by some amount. The amplitude and polarity of the correction voltage are determined by the phase difference between the sync pulses and the reference pulses.

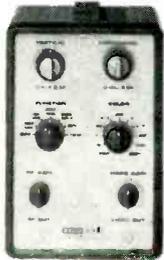


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NEW EASY-TO-BUILD EICO KITS / OVER 100 LABORATORY PRECISION KITS

COLOR TV LAB

THREE COMPACT, PORTABLE INSTRUMENTS FOR SHOP OR HOME COLOR TV SERVICING. ADD ONE MORE AND YOU'RE SET FOR FM-MPX STEREO.



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KIT ONLY \$129.95.
WIRED \$169.95.



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FOR EASIEST, FASTEST VISUAL ALIGNMENT OF COLOR OR B & W TV AND FM RF AND IF CIRCUITS. FIVE SWEEP RANGES FROM 3-220 MC/S. FOUR MARKER RANGES FROM 2-225 MC/S. CRYSTAL MARKER OSCILLATOR. POST INJECTION OF MARKERS.

KIT ONLY \$89.95.
WIRED \$139.95.



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ULTRA COMPACT! TAKE IT ALONG ON SERVICE CALLS. BRIGHT, **SHARP TRACE** ON FLAT-FACE 3-INCH CRT **EXPANDABLE** SEVERAL DIAMETERS. FLAT DC TO 4.5 MC/S. EDGE LIT CALIBRATION GRID. ZENER CALIBRATOR. **OUTPERFORMS 5-INCH SCOPES** THREE TIMES AS BIG AND TWICE AS HEAVY. TRUE LAB QUALITY.

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WIRED \$149.95.



EICO 342 FM-MPX SIGNAL GENERATOR

FOR PROFITABLE SERVICING IN THE FAST-GROWING FM STEREO MARKET. PROVIDES BOTH A COMPOSITE AUDIO SIGNAL FOR DIRECT INJECTION INTO MPX SECTION AND FM RF PLUS SYNC OUTPUT.

WIRED \$149.95.



THESE FAMOUS BEST SELLERS FROM EICO'S SELECTION OF 230 KITS AND WIRED UNITS.

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A MUST FOR COLOR OR B & W TV AND INDUSTRIAL USE. 7 NON-SKIP RANGES ON ALL 4 FUNCTIONS. WITH UNI-PROBE®.

KIT \$29.95.

WIRED \$49.95.

EICO 667 TESTER



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TESTS RECEIVING, SPECIAL PURPOSE, NUVISTOR AND COMPACTRON TUBES FOR **DYNAMIC CONDUCTANCE**. TWO-STEP TRANSISTOR TEST.

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150 KC/S TO 435 MC/S RANGE. FOR IF-RF ALIGNMENT AND SIGNAL TRACING OF TV, FM, AM, CB AND MOBILE. BUILT-IN AND EXT. MODULATION.

KIT \$28.95. WIRED \$39.95.

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DC WIDEBAND 0-4.5 MC FOR COLOR & B & W TV SERVICE & LAB USE. PUSH-PULL DC VERTICAL AMP. BAL. OR UNBAL. INPUT. AUTOMATIC SYNC LIMITER AND AMP.

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FOR BENCH TESTING AUTORADIOS, CB, MOBILE AND TONE EQUIPMENT. VOLTMETER AND A.M. METER. LOW RIPPLE FOR TRANSISTOR EQUIPMENT. 0-8V/0-16V OUTPUTS.

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CRYSTAL CONTROLLED TRANSMIT AND RECEIVE ON ALL 23 CHANNELS. TRANSISTOR POWER SUPPLY. "S" METER. EXCEEDS ALL FCC STANDARDS. A BEST BUY AT ONLY \$189.95 WIRED.

NEW EICO 3566 SOLID STATE FM-MPX STEREO TUNER AMPLIFIER



IN THE HIGHEST QUALITY RANK, WITH 43 TRANSISTORS, 19 DIODES, 6 RECTIFIERS. • **112 WATTS** INTO 4 OHMS • **72 WATTS** INTO 8 OHMS. • 38-40 DB CHANNEL SEPARATION. • AUTOMATIC STEREO SWITCHING. • INTERSTATION MUTING. FRONT-END, IF AND MPX SECTIONS PRE-WIRED AND PRE-ALIGNED. PLUG-IN TRANSISTORS. KIT ONLY \$229.95. WIRED WITH CAB. \$349.95.

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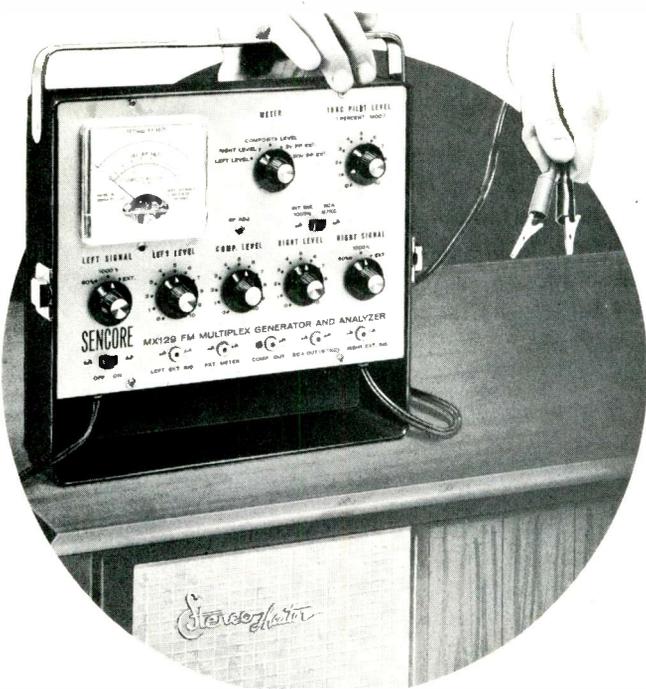
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add an fm-stereo service center
with this one new
sencore unit!



THE SENCORE MX129 FM STEREO MULTIPLEX GENERATOR & ANALYZER

FM-Stereo growth continues to mount and is fast becoming as big a field as Color TV. This means more FM-Stereo service business for you, now and in the future. Is your shop equipped? It can be — completely and economically — with the MX129, the FM-Stereo "Service Center in a Case." The instantly stable, 19-Transistor, crystal controlled MX129 is the most versatile, most portable (only 7½ pounds), most trouble free and efficient multiplex unit on the market — just like having your own FM-Stereo transmitter on your bench or in your truck. Powered by 115 volts AC, it produces all signals for trouble shooting and aligning the stereo section of the FM receiver . . . can be used to demonstrate stereo FM when no programs are being broadcast. Self-contained meter, calibrated in peak to peak volts and DB, is used to accurately set all MX129 controls and as an external meter to measure channel separator at the FM-Stereo speakers. **NO OTHER EQUIPMENT IS REQUIRED.** **\$169⁵⁰** only

SIGNALS AVAILABLE FOR ALIGNMENT, TROUBLE SHOOTING AND ANALYZING:

- FM-RF carrier with composite multiplex audio signal with 38kc suppressed carrier, 19kc pilot and 67kc SCA signals
- Multiplex signal formed by 60 or 1000 cycle internal tones or any external signal
- Full control over left and right channel amplitude (modulation)
- External 67kc SCA signal available for trap adjustment
- Composite signals available for signal injection FM detector

professional quality — that's the difference!

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426 SOUTH WESTGATE DRIVE • ADDISON, ILLINOIS

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TECHNICAL DIGEST

peaked at two different settings. The proper setting should be with the bottom core closest to the PW board. The bottom core can be adjusted from the top of the transformer without pulling the chassis.

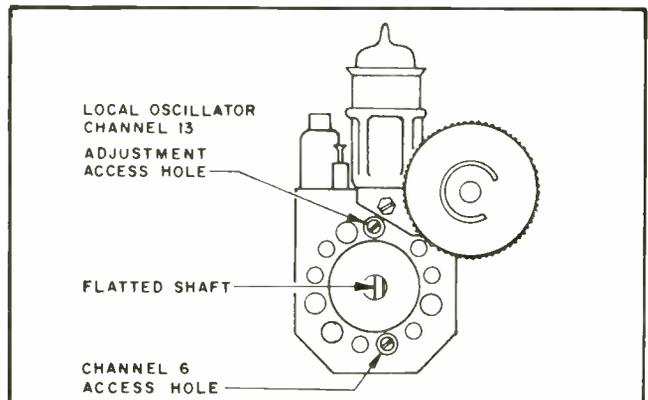
Proper Lead Dress, Sound Det. RFC (L40). RFC L40 located on the video IF panel between lugs M72 and M73 must be dressed up and away from the bottom of the PW board. If it is dressed against the panel, some sync buzz may occur when tuning toward smear.

Vertical Bands or Lines During Blank Raster. The purple lead running from lug M36 on the chroma panel to socket J1 pin 8 should be dressed away from the delay line and copper on the PW board where lug M33 connects to RL network N3. Proper dressing of this lead should remove the vertical bands from the raster during the absence of video.

RCA VICTOR

TV Chassis KC5 152—Local Oscillator Adjustment, KRK 123 Tuner

Only two adjustments are required to track the local oscillator of the KRK 123 tuner over the entire VHF range. The adjustment procedure is as follows:



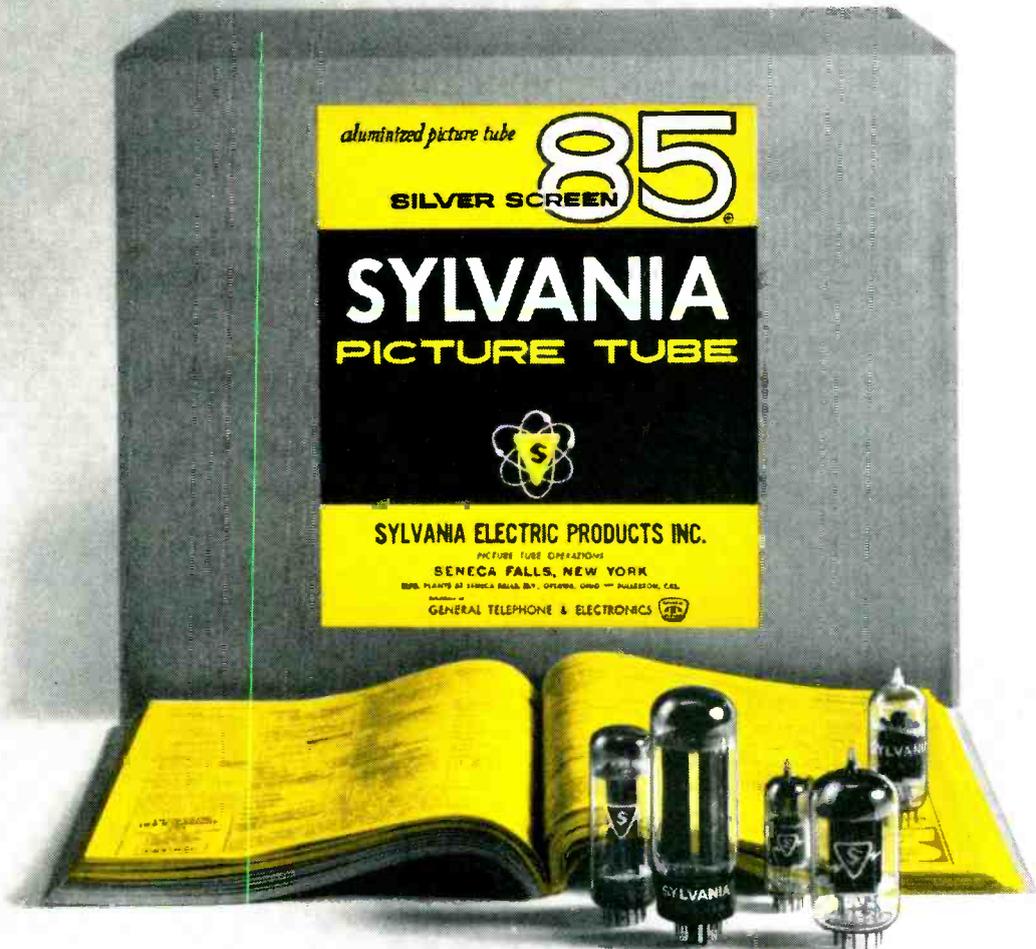
Set the fine tuning control to the approximate center of its range, switch tuner to the highest channel that can be received in the high VHF band, (Channels 7-13). Remove the VHF channel selector knob, and adjust channel 13 oscillator coil for best picture and sound. Without disturbing fine tuning, switch to the highest channel available locally in the low band (channels 2-6). Adjust channel 6 oscillator coil for best sound and picture. Because the thumbwheel fine tuning control is sufficiently broad, all available stations can then be tuned.

SETCHELL-CARLSON

Color Chassis U800—Snivet Interference

"Snivets" are a form of interference produced by high-frequency oscillations in the horizontal output tube. They should not be confused with Barkhausen oscillations, since snivets appear in different parts of the raster as ragged vertical lines or weird distortions

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The Yellow Pages are the first place people look *when they want to buy*. Studies show that 90% of all telephone subscribers consult their Yellow Pages when they want to find a local source for products and services. It's a fact: your potential customers let their fingers do the walking when a TV set needs professional servicing.

Here's a special program that means more customers and extra profits for you. *Our ads appear in your local Yellow Pages*, directing customers to you. Your Sylvania distributor can show you how your own listing may be part of the Sylvania ad.

The new Sylvania Trade Mark Heading will be seen—it's big, attractive, and descriptive. It tells

customers that you sell the dependable line of radio and TV tubes, including famous SILVER SCREEN 85® and *color bright* 85® picture tubes.

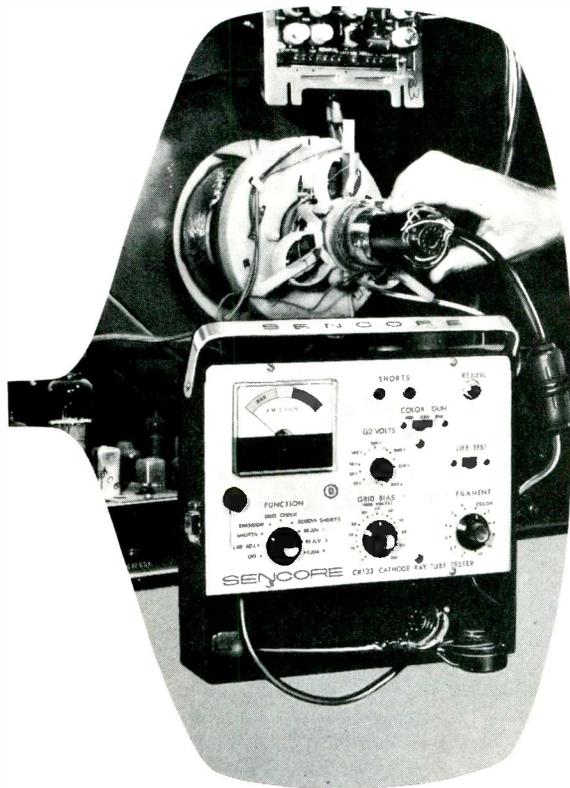
Your Sylvania distributor has full particulars on how you can share in this program designed especially for you. Check with him today.

Electronic Tube Div., Sylvania Electronic Components Group.

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NEW CAPABILITIES IN: ELECTRONIC TUBES • SEMICONDUCTORS • MICROWAVE DEVICES • SPECIAL COMPONENTS • DISPLAY DEVICES

top money maker in
the service business



NEW IMPROVED SENCORE CR133 CRT CHECKER & REJUVENATOR

The new, improved CR133 CRT Checker is designed to test all present picture tubes—and it's ready for future tubes too! Two plug-in replaceable cables contain all sockets required. The compact, 10 lb., CR133 checks CRT emission, inter-element shorts, control grid cut-off capabilities, gas and expected life. Checks all tubes: conventional B&W, new low drive B&W, round color tubes and new rectangular color picture tubes. Exclusive variable G2 Volts from 25 to 325 Volts insures non-obsolescence when testing newly announced "semi-low" G2 CRT tubes. New Line Voltage Adjustment insures the most accurate tests possible. Uses well-filtered DC for all checks to avoid tube damage and reading errors. Color guns are individually tested as recommended by manufacturers. Exclusive automatically controlled rejuvenator applies rejuvenation (ACR) voltage as required by individual tube condition; precisely timed to prevent over-rejuvenation or tube damage. The ACR feature is most useful for color tube current equalization to insure proper tracking. Hand-wired and steel-encased for protection of meter and panel in truck or shop, the new improved CR133 is only . . . **\$89⁹⁵**

The famous CR128 CRT Checker and Rejuvenator is similar to above, but with a three position G2 slide switch and without Line Voltage Adjustment at \$69.95

professional quality — that's the difference!

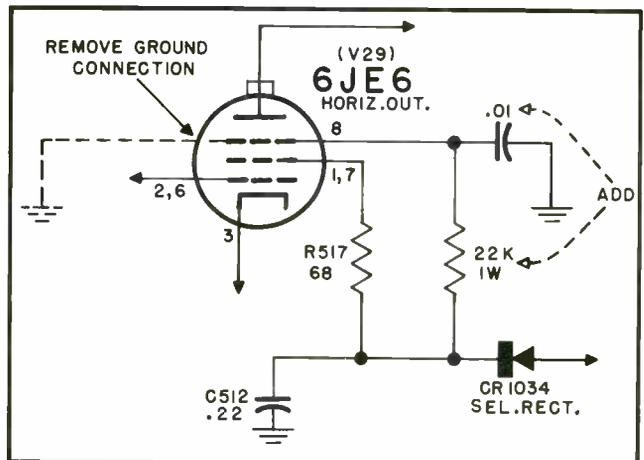
SENCORE

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TECHNICAL DIGEST

of vertical stripes and broken lines. Although snivet interference is usually bothersome only on UHF reception, it may be seen occasionally on weak VHF channels. Snivets may be minimized by placing a posi-



tive potential on the suppressor grid of the 6JE6. The circuit used in current production U800 color chassis, places positive 30v on the suppressor (pin 8). Pin 8 has been disconnected from ground and fed from the screen supply through the 22K 1-w resistor. The .01 μ ceramic disc by-pass capacitor is also added. If a snivet problem exists, check the circuitry of the CF1 unit and modify in accordance with the drawing. In extreme cases, it may be necessary to exchange 6JE6 tubes.

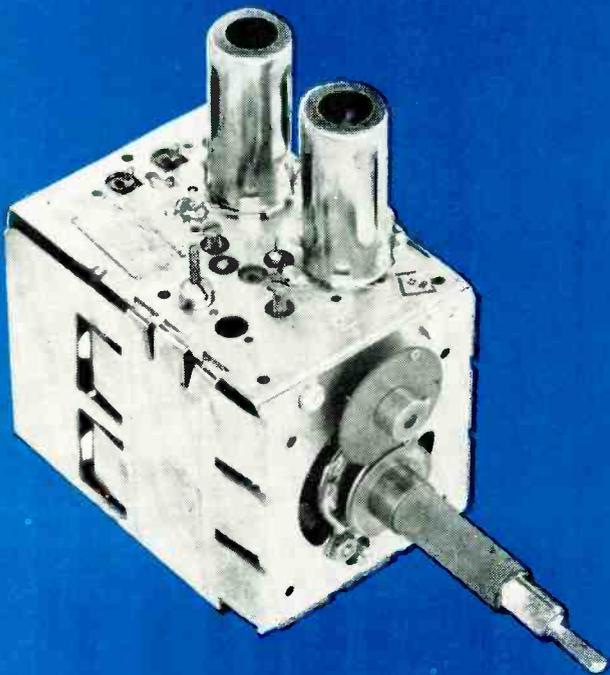
ZENITH

Color TV Chassis 25MC36—CRT Removal

Place cabinet, face down, on a soft surface. Remove all components from the neck of the CRT.

To remove the purity ring and plastic mounting assembly, first loosen the bolt at one end of the mounting cable and disconnect the cable from the hooks at each diagonal corner. Then remove the plastic mounting assembly (with the purity rings). Remove the color clarifier shield assembly by removing its mounting bolts at the two diagonal corners. Lift the shield assembly straight off. Loosen strap using a 5/16 hex head wrench or screwdriver. Loosen the eight screws fastening the mounting brackets to the diecast escutcheon. Remove the CRT. Remove the magnetic shield (if used) from the bell of the CRT by sliding a knife or wire between the shield and tube bell to break the two-sided tape seal. Install the shield on the replacement tube in the same position using four pieces of double coated pressure sensitive tape (Scotch Mount brand No. 4032). Install the new CRT, taking note that the blue gun is on top, correctly positioned. Position the new tube, tighten the strap, and then tighten screws fastening the mounting brackets. Reinstall clarifier shield assembly and CRT neck components.

TUNER REPAIRS



\$9.50

FOR COMPLETE OVERHAUL

**Includes ALL parts (except tubes)
ALL labor on ALL makes**

**24-HOUR SERVICE with
FULL YEAR WARRANTY**

Sarkes Tarzian, Inc., largest manufacturer of TV and FM tuners, maintains two completely-equipped Service Centers to serve YOU. Both centers are staffed by well-trained technicians in this specialized field and are assisted by engineering personnel to assure you of FAST, DEPENDABLE service.

Ⓢ Tarzian-made tuners—identified by this stamping—received one day will be repaired and shipped out the next. A little more time may be required on other makes. Every channel is checked and re-aligned per manufacturer's specifications, not just the channels which might exist in any given area.

You get a 12-month guarantee against defective workmanship and parts failure due to normal usage. Cost to you is only \$9.50 and \$15 for UV combinations, including all labor and parts except tubes. No additional costs. No hidden charges. All tuners repaired on approved, open accounts. You pay shipping. Replacements on tuners beyond practical repair are available at low cost.

When inquiring about service on other than Tarzian-made tuners, always send TV make, chassis and Model number. Check with your local distributor for Sarkes Tarzian replacement tuners, parts, or repair service. Or, use the address nearest you for fast factory repair service.



SARKES TARZIAN, INC.
TUNER SERVICE DIVISION

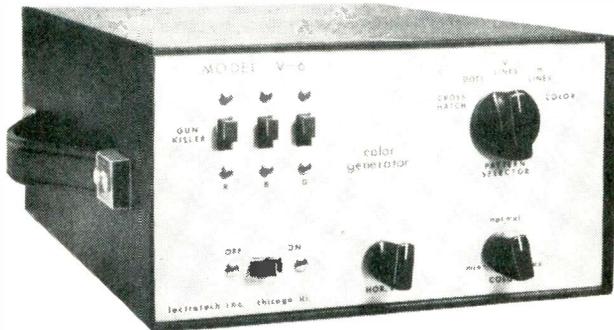
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*before you buy any
color generator...
get all the facts*

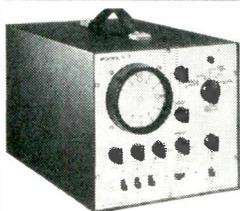


only one has all
these features and
it's only 99⁵⁰*

LECTROTECH V6

Any comparison will prove that the Lectrotech V6 truly stands alone. Provides all of the time-tested standard features plus many Lectrotech exclusives for the fastest, most reliable color installation and servicing. The V6 gives you: Crystal-controlled keyed rainbow color display • All cross hatch, dots, vertical lines only, horizontal lines only • Red-blue-green gun killer (usually extra or not available on other color bar generators) • Exclusive Dial-A-Line feature (Horizontal adjustable 1 to 4 lines wide) • Exclusive solid state reliability • Exclusive voltage-regulated transistor and timer circuits • Exclusive simplified rapid calibration • Off-On Standby Switch • Adjustable dot size • Color level control • Connects to antenna terminals (no connections needed inside of set) • Power transformer—line isolated, to prevent shock hazard • Lightweight and portable, only 4½" H. x 7¾" W. x 10¾" D. Weight, 7½ lbs.

*Except our own V7



V7 Sensational new Lectrotech V7 — the only complete Color TV Test Instrument.

Has all the features and performance of the V6 PLUS Lectrotech's exclusive built-in Color Vectorscope for simplified visual color servicing.

Complete.....only **189⁵⁰**



See your distributor or write for details before you buy any color generator.

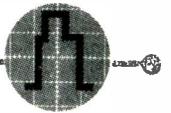
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1737 Devon Avenue • Chicago, Illinois 60626

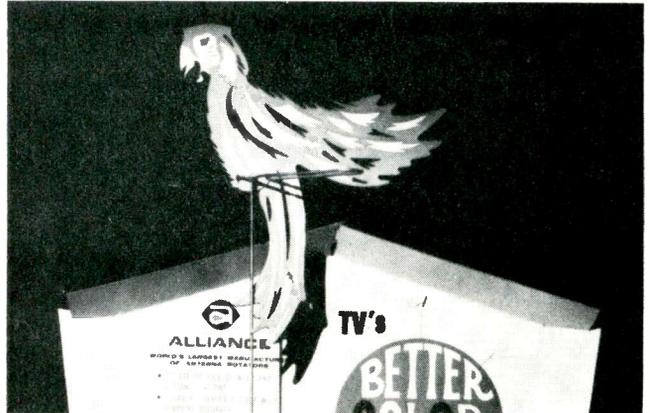
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SYNC ON BUSINESS



Dealer aids are where you find them. This twirling parrot (it could just as well have been a rooster) atop a miniature TV antenna is a combination counter and window display by Alliance. Made of tough cardboard



and printed in bright, eye-catching colors, the display kit comes complete with mounting board for rotator control. It's a fine point-of-purchase display kit that may help you in your rotor business. At your distributor.

• • •

The manufacturer/distributor/dealer relationship, seriously mixed up in some respects for years, appears to be improving slightly in certain areas. United Audio Products, for example, has instituted a franchised dealer and fair trade pricing policy for their "Dual" turntable line. Julian Gorski, president of UAP, feels that the consumer demand for the Dual line has placed it among those select brands which can successfully resist the price-cutting approach to sales which he considers detrimental to the industry as a whole, and most especially to the dealer's ability to operate at a profit.

• • •

Citizens band transceivers, despite the fact that over 2,000,000 have been sold, have never been widely promoted by manufacturers. Now comes Hallicrafters who announces they will be featured on the popular ABC/TV program, "The Price Is Right." Travis Marshall, general sales manager, said "We expect this repeated exposure of Hallicrafters CB and short wave equipment will stimulate much broader public interest . . ."

• • •

An all-transistor Hi Fi power amplifier, the TR-2, is now available from Schober Organ. It's designed for Hi Fi and stereo systems (2 amplifiers), with organs and other electronic musical instruments, and public address systems. It also comes in kit form.

• • •

The Electronic Parts Distributors Show, held yearly in Chicago for the past two decades or more, has been moved to New York this year. It will run from March

NOW

from ALLIANCE—the world's leading antenna rotator manufacturer . . .

NEW

T-45

TENNA-ROTOR®



The new Alliance T-45 Tenna-Rotor® will meet the most exacting requirements of today's TV viewers. It has the same built-in quality that has won millions of satisfied customers for other Alliance products.

A new, patented five wire bridge circuit provides a precision system that's unaffected by motor current, cable length and line voltage variations. This improved electrical system, plus stable indication and expanded meter scale, assures positive antenna direction and readability through a stepless 360° cycle.

The T-45's motor is stronger — has more torque — to support, hold and turn the largest new antennas. Outstanding engineering — and smart styling — make the T-45 America's finest manually operated antenna rotator. Order the T-45 and other quality Tenna-Rotors® from Alliance — the world's leading manufacturer of antenna rotating devices.

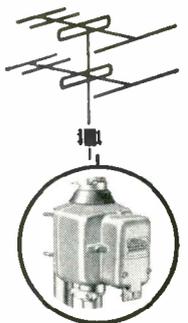
"TV's better color getter"

For Complete Details write . . .

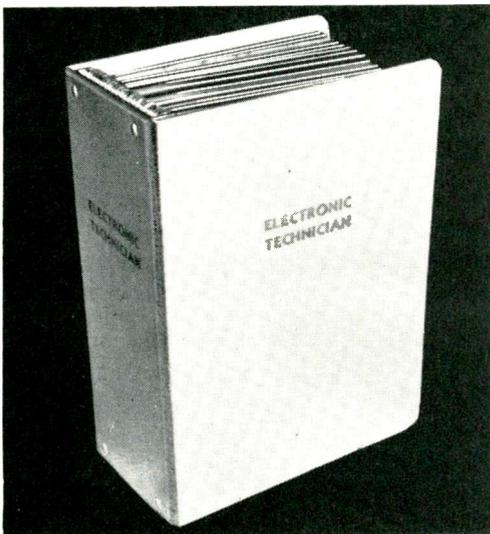


The **ALLIANCE**
Manufacturing Co., Inc.
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Low cost, high performance paging microphone with Turner's unique lift-to-talk feature. List price \$49.50



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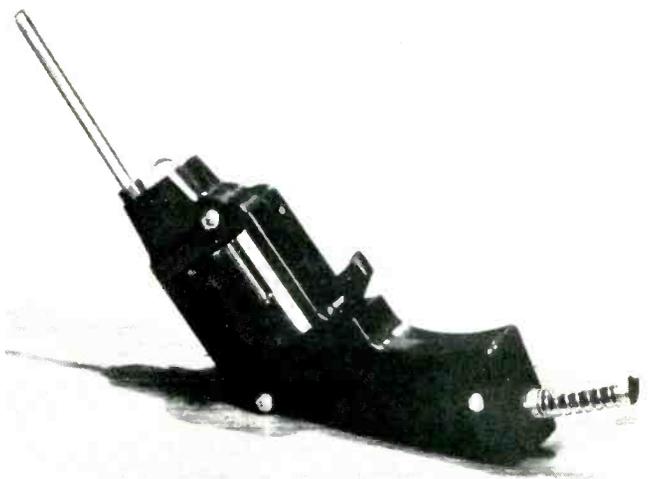
SYNC ON BUSINESS



29 through April 4, in connection with National Electronics Week. Attendance is limited to qualified electronic industry personnel and buyers of electronic products. Badge categories include: exhibitor, distributor, commercial sound, audio/Hi Fi specialist, sales representative, advertising agency, export agency, industrial account, and government personnel. Admission is free to eligible personnel who register in advance for badges. Closing date for registering is March 10, 1965.

• • •

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new Wen product. The Model 75 "pistol" is available at your jobber.

• • •

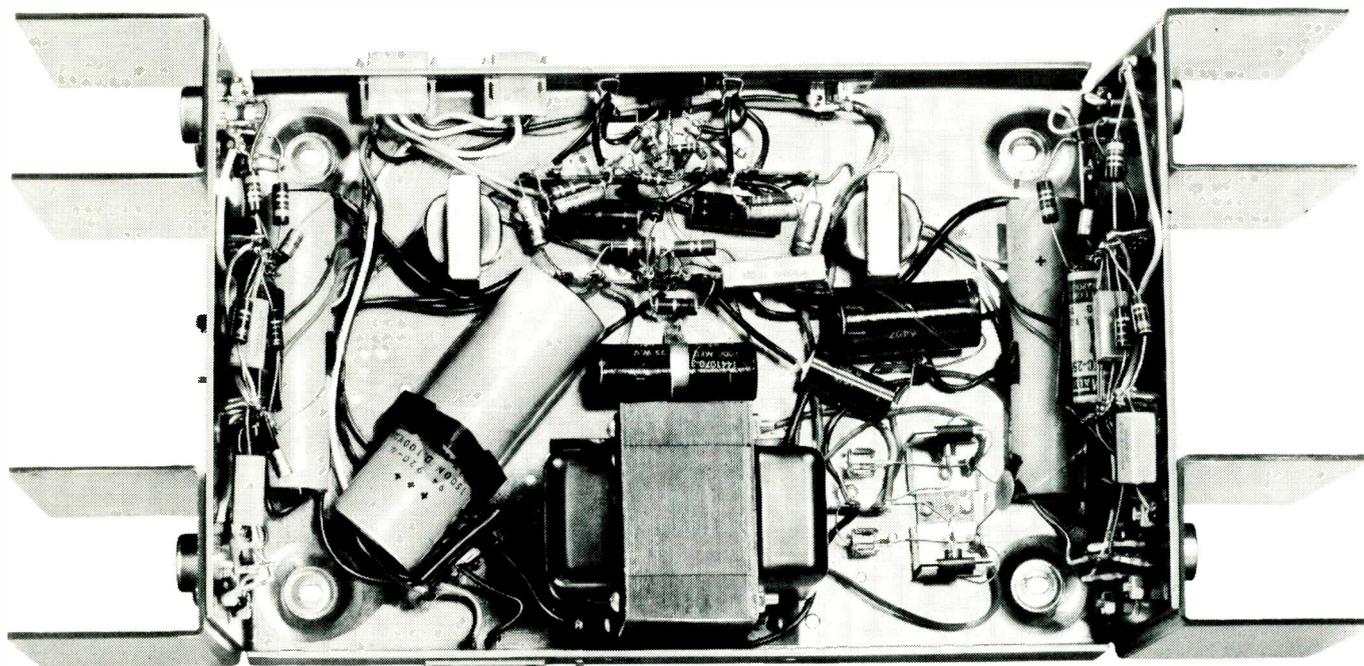
The zener diode is back in the news again. G-E has designated an Int. Rect. Corp. zener diode as a "factory authorized service aid." G-E said the diode provides additional transient voltage surge protection necessary when TV service technicians are required to test the horizontal output circuits in their all-transistorized TR-805 TV set. Lack of protection has caused inadvertent destruction of expensive transistors. The IR zener is No. 69-3429, at your distributor.

• • •

The industry's only "complete solid state line" of Hi Fi components is claimed by Harman-Kardon. The latest addition is a solid state FM receiver.

• • •

Selective franchising of distributors by the Conley Division of Telepro Industries for their Fidelipac continuous tape cartridge is continuing, according to a release from the New York Press Exchange. The product is slanted to the industrial market, audio-visual sales, training, public announcements, department store announcements, music program services, language and audio visual teaching programs.



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ELECTRONIC TECHNICIAN

UHF

'GOES TO TOWN'

by Sam Blakeman

Jerrold Electronics Corp.

**Know your antenna characteristics
and cash in on the ultra high
frequency boom**

■ Service-dealers and technicians can look forward to a substantial increase in UHF antenna sales and installations during 1965 and for some years to come. This increase will be aided by a number of factors.

A major reason will be the VHF/UHF tuner law that became effective May 1, 1964. More UHF tuners in use means more people interested in good UHF reception. Each interested person is a potential UHF antenna customer.

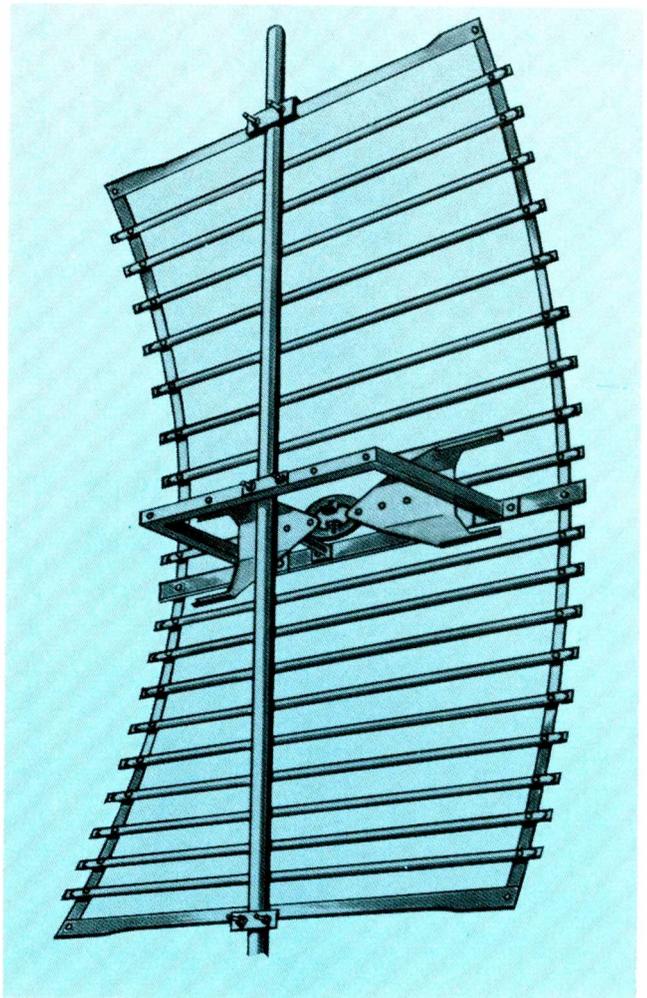
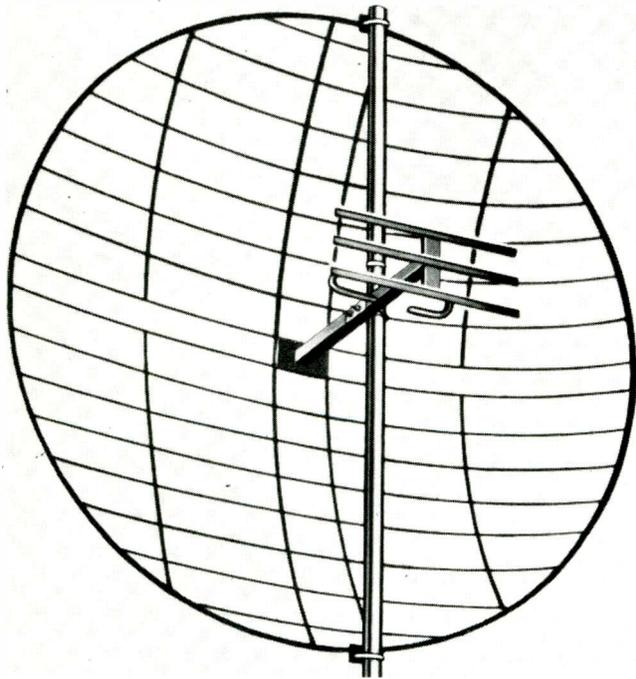
Another reason is the certain increase in the number of color TV sets sold during 1965. Each color TV set-owner is an even better prospect for a UHF antenna than the B/W set-owner.

Still another, and perhaps the most important reason, is the nature of color and UHF. It is more complicated and fewer do-it-yourselfers will be looking for antenna kits. They will be seeking your advice and your services, whether their UHF requirements are for clear black-and-white or glowing color pictures.

The only thing you need to greatly increase your

RIGHT: Fig. 4—Log-periodic type UHF antenna.

BELOW: Fig. 5—Cylindrical parabolic with extended resonance driver.



UHF antenna sales and installations throughout the coming months is complete familiarity with the various UHF antennas on the market, plus the ability to sell and install whichever of them is needed.

UHF Reception Problems

The problems in UHF reception are quite similar to those you've encountered in dealing with VHF. The problems are greater in degree because of the higher frequencies (470 to 890 Mc) used in UHF transmissions. The lowest of the UHF channels (ch. 14 at 470 to 476 Mc) is more than twice the frequency of the highest VHF channel (ch. 13 at 210 to 216 Mc).

These ultra high frequencies refuse to follow the curvature of the earth as well as VHF does. Therefore, UHF reception is even more limited to line-of-sight distances than VHF. In addition, UHF signals are more easily absorbed or reflected than VHF signals. At UHF, even foliage on trees can cause a snowy picture as compared to a clear picture when the trees are bare. At VHF, there is no perceptible difference in picture quality.

The reflected signals from buildings, moving vehicles, etc. can cause more severe multipath or signal-fading problems at UHF than would occur at VHF.

Importance Of UHF Antennas

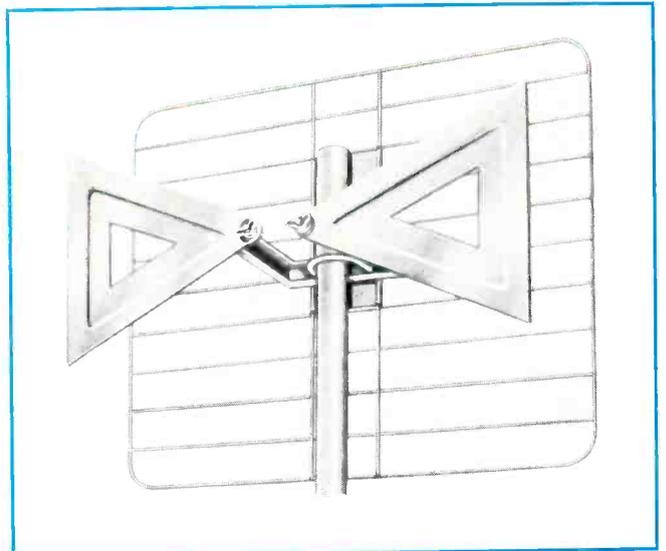
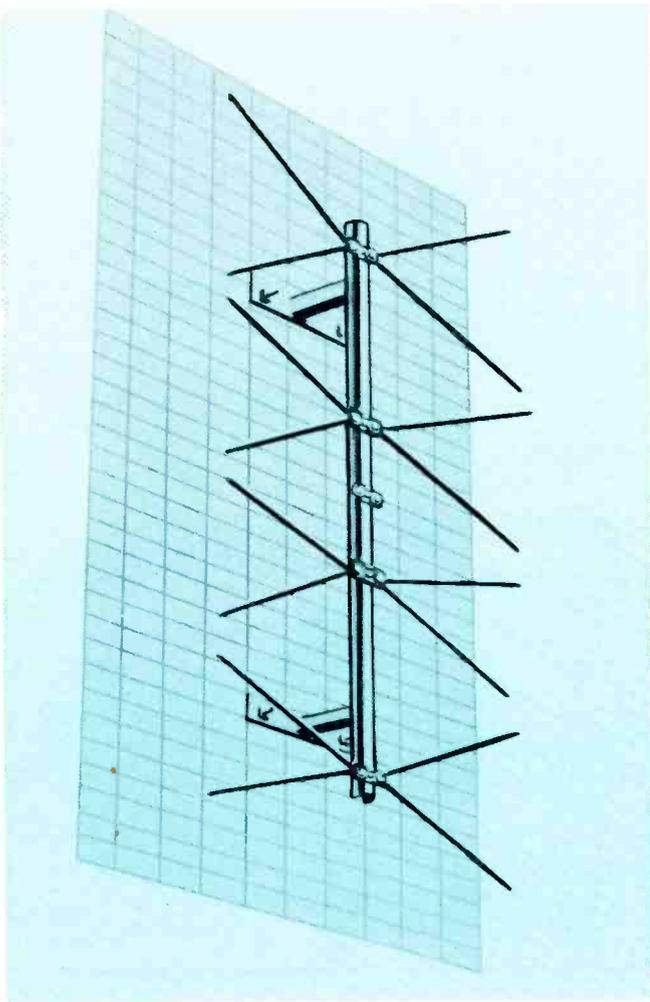
The quality of the antenna installation is more important to good color reception, than it is to B/W reception. But a good antenna, properly located, is also necessary for clear B/W UHF reception.

The location of a UHF antenna is more critical than the location of a VHF antenna because UHF signals are more directional and the layers of signal more sharply delineated than VHF signals. It is not sufficient to orient a UHF antenna in just the horizontal plane, it must also be oriented in the vertical plane. A shift in the vertical plane can be caused by the interaction of transmitted signals with signals reflected from other antennas, metal gutters, or even moving vehicles on the street. A prime requisite for a good UHF antenna is the extent of its vertical capture area.

Which UHF Antenna?

Many types of UHF antennas are on the market. An indoor UHF antenna is useful only in the most favorable signal locations. Even then, there may be a problem in locating it properly within the room.

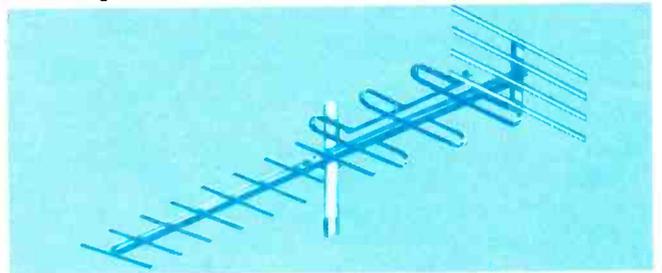
Outdoor UHF antennas usually provide better results and the installation is certainly more lucrative. Let's briefly characterize some outdoor antennas.



ABOVE: Fig. 1—Bow-tie antenna with reflector.

LEFT: Fig. 2—UHF bow-tie array.

BELOW: Fig. 3—UHF 12-element broad-banded-type Yagi.



The bow-tie UHF antenna, complete with a small square reflector screen shown in Fig. 1 has been popular for years for "close-in" areas. This antenna has a small vertical interception area, however, and is therefore subject to sudden fades caused by the shifting of UHF signals in the vertical plane. There can be no guarantee of consistent UHF reception with this type of antenna.

A vertical bow-tie array, shown in Fig. 2 provides a much larger vertical reception area. The dipole is basically unable to cover the entire UHF band; combinations of dipoles possess the same defect. Further, the necessary connecting harnesses are frequency-sensitive which tends to narrow the effective bandwidth even more. Each connection point presents a possible source of corrosion damage, with resultant noise apt to be visible in the picture. Since most dipoles are insulated from ground there is always the possibility of static charges accumulating and causing damage to the TV set.

Last, but not least, since there might well be at least one "dead" spot in the vertical plane occupied by the array, the dipole in that particular spot would be "dead" and act as a load on the other dipoles.

The familiar broad-band yagi type antenna shown in Fig. 3 is specially designed for UHF and can be

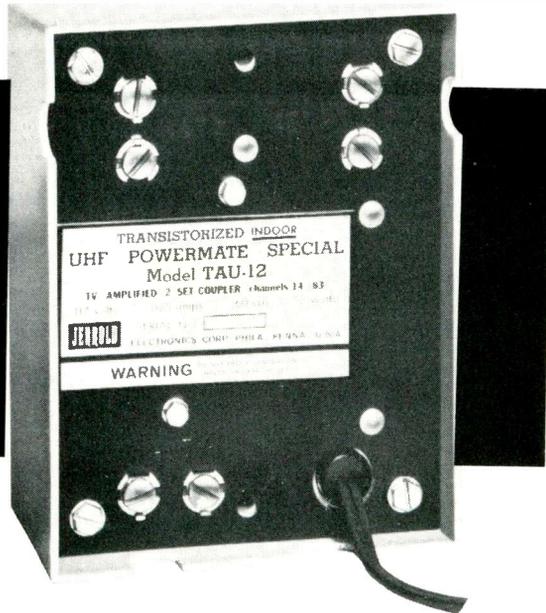
used singly or in a stack for long-range reception. The single "yagi" requires careful orientation and its patterns are somewhat erratic. The stacked "yagis" must also be carefully oriented and have the same disadvantages as the bow-tie arrays. Broad-band yagis provide high gain, but only a small vertical capture area.

The log-periodic type antenna (Fig. 4) has a dish-shaped capture area. Among its advantages are its relatively high gain, large vertical capture area, and the fact that only a single connection point is used. The major disadvantage is the broad H (magnetic) plane lobe which makes it highly sensitive to interference from ground reflections, moving vehicles, etc.

The cylindrical parabolic antenna (Fig. 5) combines a cylindrical parabolic reflector with an extended resonance driver. The extended resonance driver enables the unit to operate effectively over the entire UHF band. It actually changes its electrical length to present a half-wave appearance at the upper and lower ends of the UHF band, providing optimum match and gain from 470 to 890 Mc.

The cylindrical parabolic reflector achieves its gain in the H (magnetic) plane, hence has a very narrow vertical lobe. This provides protection against sudden signal fade-outs caused by moving vehicles in the street, or change in signal path from other sources.

UHF



ABOVE: Fig. 6—Indoor UHF preamplifier.

RIGHT: Fig. 7—UHF mast mounted preamplifiers have remote power supplies.



This antenna exhibits much smaller impedance changes and interference losses when exposed to the normal standing waves in space seen over buildings. The reflector also provides excellent front-to-back ratios with good directivity for high rejection of ghosts.

The need for phasing harnesses is also eliminated in the cylindrical parabolic. A single connection replaces the six to thirty-four connections found in multiple dipole arrays. Since each connection is a possible collection point for moisture which causes corrosion (and hence noisy operation) the advantages of this single connection point are obvious.

Preamps

If your customer is in a really tough UHF reception area, he may need a preamplifier (booster) to provide extra gain for his new antenna. Preamps are available in both indoor (Fig. 6) and outdoor (Fig. 7) models.

The outdoor models may be mounted either on the antenna boom or on the antenna mast; in this case amplification takes place as near the antenna output terminals as possible. The major advantage in locating the amplifier at the antenna is that the signal-to-noise ratio is high and amplification takes place before injection of noise picked up by the lead-in wire. The input to the preamp is a nominal 300

Ω to match the nominal output impedance of the antenna. Power for this solid-state preamp is carried up from the remote power supply (usually mounted on the TV set) via the same line that carries the amplified signal down.

The indoor preamp is connected to the antenna down-lead and is usually powered from any 117 vac source. The unit is mounted in a convenient location near the TV set.

Installation Hints

Ordinary flat 300 Ω twin-lead is not recommended for UHF installations. An encapsulated foam-filled twin-lead is more moisture resistant and less susceptible to direct pick-up of unwanted signals. Plastic stand-offs should be used and care taken against running the encapsulated twin-lead in close proximity to metal. Do not use metal staples to fasten it in place. The additional cost and slightly-higher signal loss in this type of twin-lead is more than compensated for by its advantages of longer life and uniform loss under all weather conditions.

The boom in UHF antenna sales and installations is under way right now. Get your share of the profits, not only for UHF antennas, but for all the associated equipment orders and installation work that will be coming your way. ■

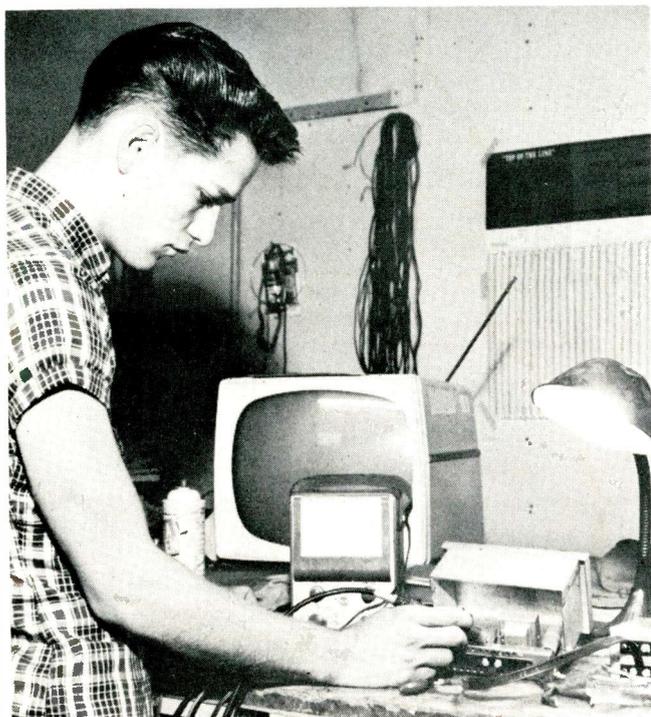


Servicing Topside

Boosters

by Homer L. Davidson

Antenna preamplifiers are making a comeback today and the market is booming in rural and interurban areas



Checking out a topside antenna booster.

■ In the early days of TV telecasting, topside boosters were widely used. Then they gradually disappeared when more TV stations began telecasting. Now topside boosters are making a comeback — especially in fringe-area color TV and FM/stereo installations. Some boosters still use electron tubes but transistors are taking over.

Antenna Boosters

Boosters, generally, consist of two units. The topside unit (preamplifier) that usually mounts close to the antenna terminals, and a remote power supply, usually mounted on the TV receiver rear.

The topside unit is housed in a metal or plastic, waterproof container. And the best TV picture will be obtained when the preamplifier is mounted directly on the antenna mast. But sometimes this doesn't work out so well. Let's take a case in point.

Trouble developed in a typical topside booster about two months after it was installed. The customer complained of "snow." A test showed the unit was defective. This unit was returned to the distributor and another new booster installed. The replacement lasted three months. And when checked, the inside of this plastic topside unit was found to be literally shaken apart by vibration. In this part of the country, the

wind can be gusty and fierce at times. So the next unit was mounted down under the eave. Reception was almost as good and the transistorized topside booster is still performing well. The inside of a transistorized topside booster is shown in Fig. 1 and a transistor pre-amplifier schematic is shown in Fig. 2.

The remote power supply unit has an output of about 15 vac to operate the preamplifier. This voltage is applied through the 300 Ω lead-in wire. A typical ac operated unit is shown in Fig. 3. A schematic of a remote power supply is shown in Fig. 4. A battery supply you can mount in the attic, basement, or on the TV set rear, is shown in Fig. 5.

The ac operated power supply draws less current than an electric clock. There's no need to worry about 300 Ω line polarity when using an ac power supply but the 300 Ω line on the battery units should be reversed if no amplification is produced by the topside booster.

On most power units, dual outputs for two TV sets or FM radio hookup are provided. Some units have up to four and six receiver terminals. Also several series couplers may be added to operate a number of TV receivers. But in the average home, two TV receiver outputs are generally sufficient.

Typical Troubles

Let's jump in the service truck and fix Mr. Jones' set. He complains that the picture has more snow now than it did before the antenna booster was installed. We find all VHF stations are snowy. We switch to UHF channel 21 and the picture is clean as a whistle. What's wrong here? Actually, we could have several troubles.

For one thing, the antenna booster could be bad. We could have a broken lead-in, or a defective front end in the TV.

When the UHF picture is good, this will generally eliminate the possibility of a bad tuner. The next step is to check the booster power supply. First check for a bad fuse. If the fuse is open, snap in a new one. Of course, if the new one blows, you have a short on the line or in the topside unit. Many times the trouble can be repaired by replacing a blown fuse. Several power supplies use a 3/16 amp fuse. Some units do not have a fused power supply.

A quick way to check the power supply is to momentarily short the two antenna terminals with a screw driver. Small flashes of ac will show if the power unit is functioning. Perhaps a better method would be to check for ac voltage at the antenna lead-in ter-

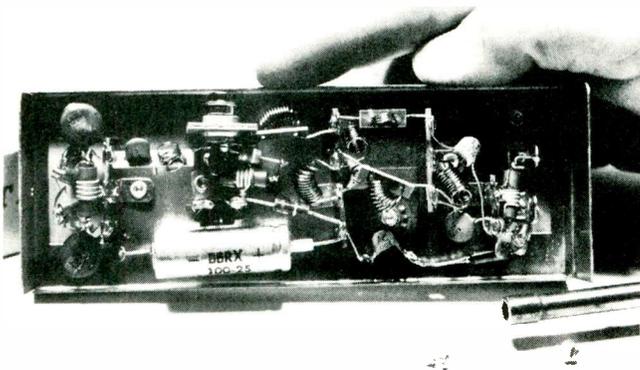


Fig. 1—Inside view of a Jerrold transistorized topside booster.

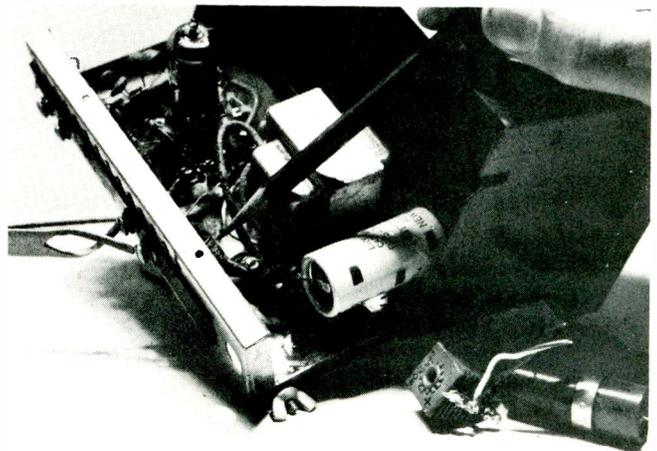


Fig. 6—Pencil points to topside-unit coils that were burned by lightning. Capacitor and selenium rectifier have been replaced.

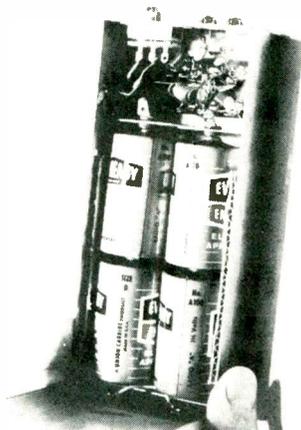


Fig. 5—Booster battery power supply.

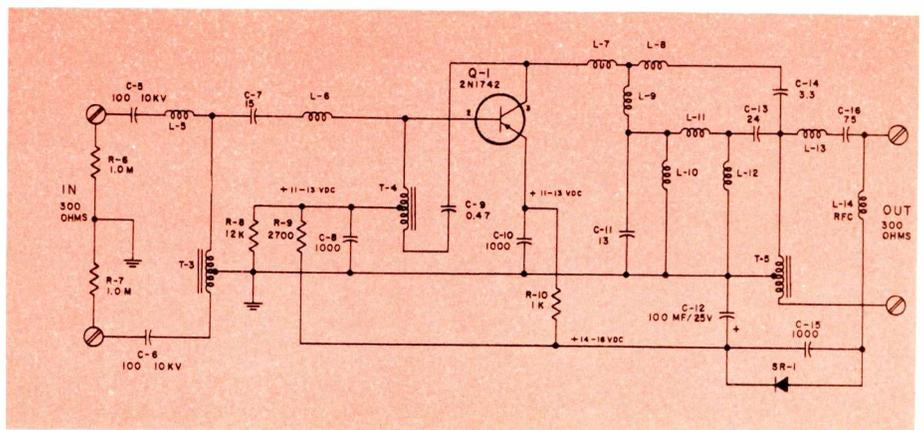


Fig. 2—Schematic of typical transistorized booster.

minals. From 15 to 24 vac will generally be found.

The antenna lead-in wire may be broken and a quick way to check it (if it has a folded dipole driven element) is with an ohmmeter. Another quick way to check the lead-in is to bypass the topside unit, and tie the antenna leads direct to the antenna itself. If the picture becomes good at this point, nine times out of ten the lead-in is good. Incidentally, lead-ins should be replaced every four or five years in fringe areas.

Since the topside booster unit is mounted next to the antenna, the unit is subject to damage by lightning. In many cases the unit will be damaged even though a lightning arrester is used and the TV mast is grounded. The unit shown in Fig. 6 had burned coils, a bad selenium rectifier and filter capacitor, all damaged by lightning.

Sometimes water and moisture get blown inside the topside unit and the selenium rectifier usually goes "swoosh." And before it's replaced, check the filter capacitor for leakage. If the single input filter dries out or opens, a 60 cps hum and black bars will appear on the TV screen. To make sure the topside unit is causing this trouble, simply remove the antenna from the set.

Filtered power output will vary between 80 to 90 vdc on a tube-type booster.

The selenium rectifier in the transistorized unit shown in Fig. 7 was found defective. About 15 vac was going into the rectifier but no voltage appeared at the output. The selenium was corroded and even looked bad. It was replaced with a silicon top-hat rectifier and the output rose to 16 vdc. Be sure and check the single filter capacitor and the small .001 μ f ceramic across the rectifier.

When the trouble in a topside booster is not being caused by a tube or a fuse, it is best to take the unit to the shop where it can be given a proper checkup. If the selenium rectifier is bad, the steel mounting rivet will have to be drilled out. Also the unit can be tested easily in the shop for correct operation.

Check all tubes in tube-type boosters when a unit is in the shop for repairs. Check all transistors in the new units. These small transistors have given us very little trouble thus far. Check the dc output voltage from the rectifier. Make sure all coils are intact.

Some of the topside units with self-tapping screws are easy to take apart. A hot soldering iron can be used to melt loose the sealed plastic units. The plastic pieces

Continued on page 82

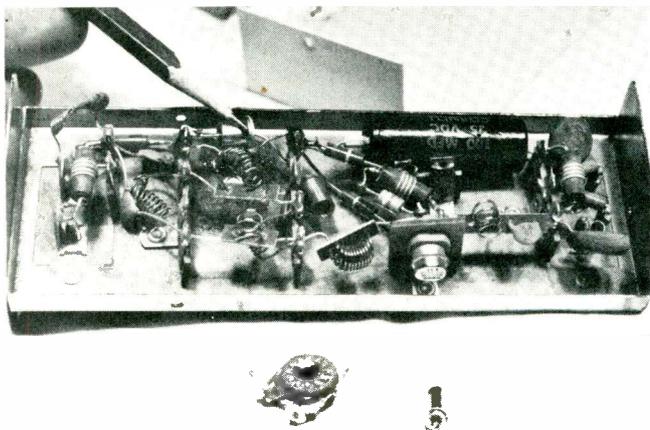


Fig. 7—A selenium rectifier was found defective in this transistorized topside unit.

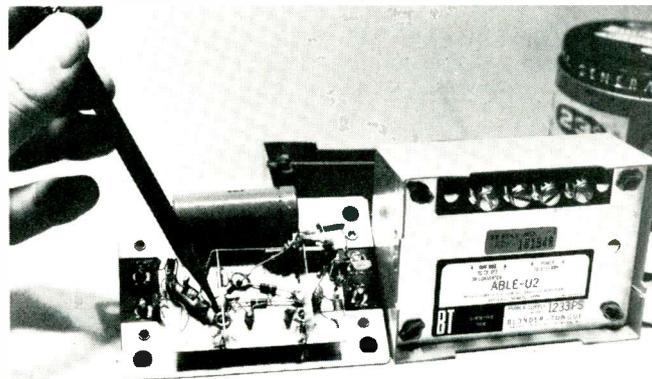


Fig. 8—Topside UHF transistor booster (left). Pencil points to transistor mounted down in chassis. Note very short leads in this unit.

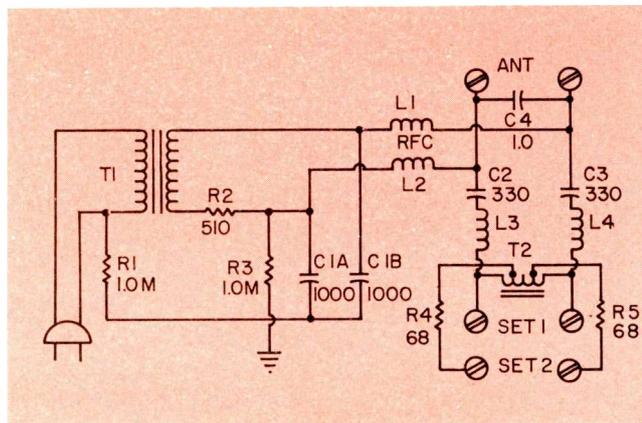


Fig. 4—Schematic of a remote power supply.

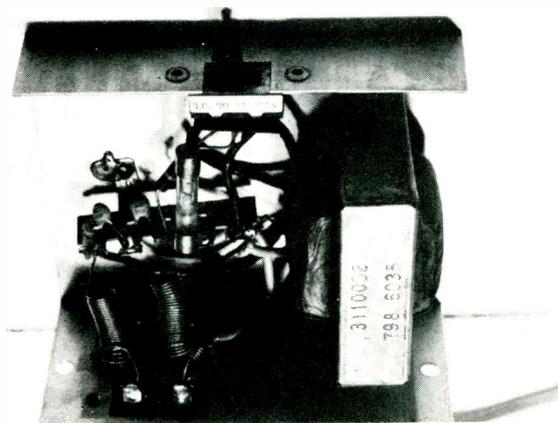


Fig. 3—Typical ac operated remote power supply.

Now You'll Need Better Antenna Lead-In

The path from antenna to receiving set can be a hostile and deadly journey for UHF, color and FM/stereo signals

■ Voluminous data on modern antenna and amplifier developments tend to make us overlook the importance of transmission line. To many, it's just something we use to connect the antenna to the receiver.

But lead-in is still the vital link which can make or break signals — no matter how good the antenna, the amplifier or the receiver. And what's more, you can't guarantee maximum, consistent results on UHF, color TV or FM/stereo unless the most efficient lead-in is used.

To obtain maximum and consistent results, lead-in must maintain its characteristic impedance under all conditions. Attenuation (signal loss) must be minimized. And impedance matching between antenna and lead-in and between lead-in and receiver must be preserved.

Hence, we must take a closer look at lead-in which has been used in the past, but which will not perform satisfactorily at UHF, in critical color TV or in FM/stereo applications.

Basic Considerations

Compare three basic lead-in types available today. Flat ribbon, tubular and encapsulated lines are

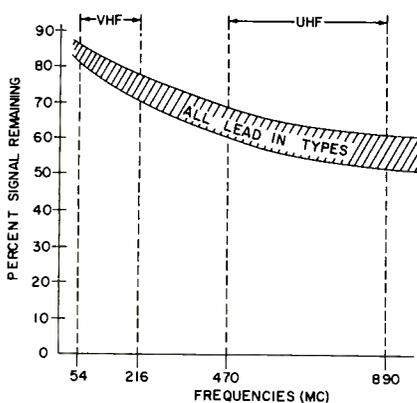


Fig. 2—'Good weather' performance of all lead-in types are approximately the same.

ATTENUATION (db)	SIGNAL REMAINING (PERCENT)	SIGNAL REMAINING (MICROVOLTS)
1	89	450
5	56	280
10	32	160
15	18	90
20	10	50
25	5.6	28
30	3.2	16
35	1.8	9
40	1.0	5
45	0.6	3

Fig. 4—Examples of signal reduction caused by lead-in losses. A 500 uv antenna signal is presumed.

shown in Fig. 1. Both flat and tubular lead-in perform well at UHF frequencies *only* when free from surface deposits. When covered with rain, snow, fog, dirt, smog, salt, industrial deposits, etc., the impedance drops abruptly — signal losses soar and the line reflections cause multiple or "ghosty" pictures. Line reflections cause part of the signal to return to the antenna, then back to the set. Since the original and the reflected signals arrive at the set at different times, they produce a multiple image. And this condition is much more apparent in color reception since the smearing will be a different hue, or color.

Encapsulated lead-in, with exactly controlled conductor spacing in a low loss cellular polyethylene protective jacket, keeps all surface deposits *beyond* the critical signal area immediately surrounding the conductors regardless of weather conditions. This assures signal transmission at a high level. This lead-in remains correctly matched to the antenna and the receiver under all environmental conditions.

We can't, of course, select lead-in cable with the same casualness as we select lamp cord. Radio frequency signals are more complex than ordinary 60 cps. The design requirements for lead-in are much more critical because the signal frequencies are mil-

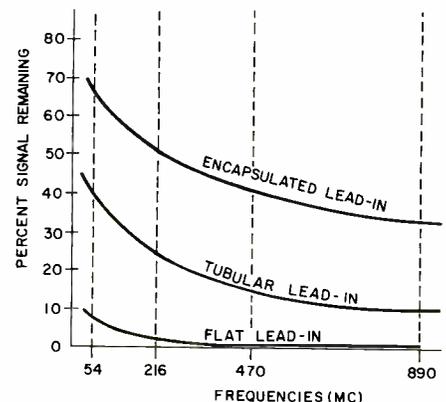


Fig. 3—'Bad weather' performance of encapsulated lead-in is superior to other types.

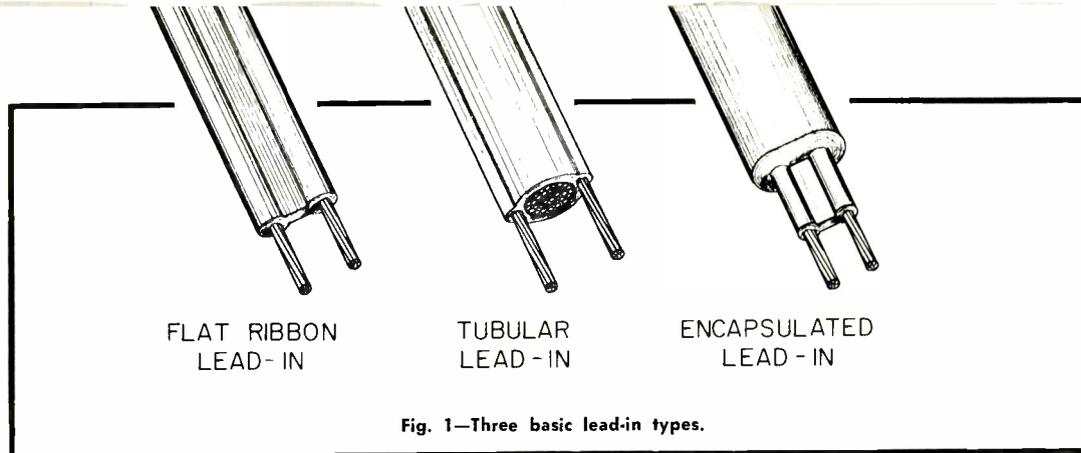


Fig. 1—Three basic lead-in types.

by Roland Miracle

Electronic Engineering Staff
Belden Co.

lions of times higher. UHF requires constant 300Ω impedance which can only be maintained when two conditions are met. First, the proper conductor spacing must be maintained, and second, the electro-magnetic field surrounding the conductors must travel through low loss insulation. Nearly all lead-in types meet these requirements *under laboratory conditions*, but outdoor conditions are quite different from those in the laboratory. Therefore, a total receiving system is required which will provide sharp pictures and good FM reception under all weather conditions. To be meaningful then, a comparison of lead-in signal loss characteristics must include "bad weather" performance data. Laboratory, or "good weather" lead-in performance is shown in Fig. 2. The attenuation losses are so similar that any line could be chosen and no difference in receiver performance could be noted. This assumes, of course, that good installation practices are followed.

Let's examine the problem from a more realistic viewpoint, as shown in Fig. 3. We see that TV lines, for example, which have performed satisfactorily for B/W VHF reception *cannot* be used for color or UHF-channel reception. Signal losses become intolerable in bad weather for ribbon and tubular lines, while the encapsulated lead-in continues to deliver a strong signal.

Bad-weather tests have shown that encapsulated line delivers 33 percent of the antenna signal to the receiver at channel 83 frequencies. This is more signal than the best tubular lead-in transfers at channel 13 frequencies and four times more signal than any flat line provides at channel 2 frequencies. Although tubular lead-in will deliver 25 to 42 percent of the available VHF signal, the picture changes rapidly at UHF — the signal level drops to around 9 to 14 percent. And ribbon lines deliver less than 1 percent of the UHF antenna signal to the TV set!

Installation Techniques

Actual installation of lead-in plays a major part in receiving system performance. Twisting (transposing) the lead-in during installation, using long stand-

offs, etc. have been followed in the past. Sometimes we do these things from habit and lose sight of the serious problems which can be created unless we protect the lead-in from "proximity effects," for example.

Routing a TV lead-in near metallic or glossy surfaces (masts, gutters, downspouts, roofing, wet lumber, etc.) creates severe signal losses, as well as line reflections. Ghost pictures and smearing of vertical picture edges are frequently the result of routing transmission line near harmless-looking objects.

Signal losses shown in Fig. 3 can be applied to proximity-effect losses just as they apply to bad weather and dirty surface coatings on the line. Both conditions absorb and reflect television signals, reducing the amount of signal that arrives at the set to a small percentage of that available at the antenna. Examples of signal reduction caused by lead-in losses are shown in Fig. 4.

Encapsulated line offers service technicians a chance to minimize signal losses caused by proximity effects. The major portion of the TV signal is confined *within* the cellular outer coating. This thick insulation acts as a barrier to foreign objects which would otherwise be in the signal area—seriously reducing signal strength and hence picture clarity.

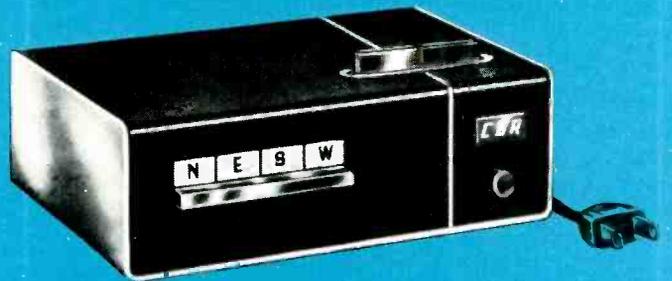
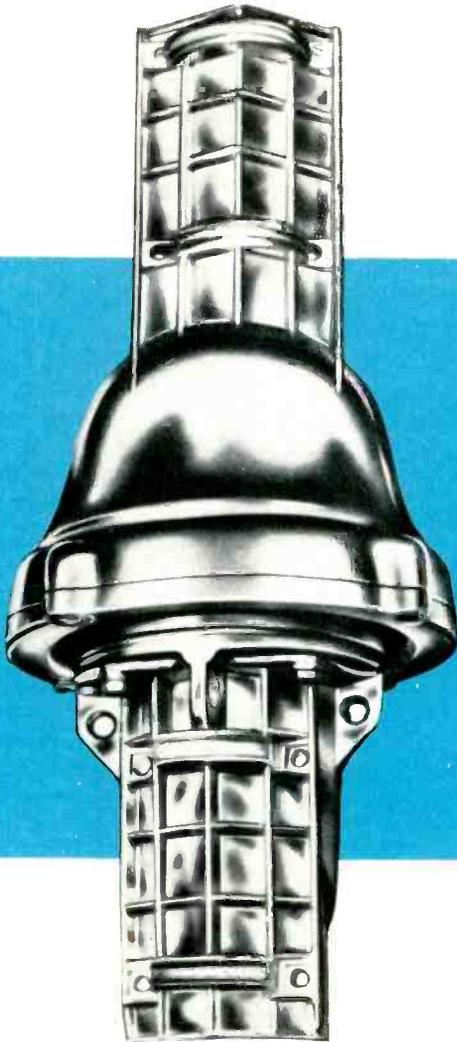
The practice of using long stand-offs and transposing the lead-in must still be observed with this line. This new lead-in will help weak signals produce a quality picture even when the line runs close to metal objects that would affect old-style lead-in. This feature makes encapsulated line the only present choice for applications requiring in-wall installation.

The general public has little knowledge of the added difficulties created by color and UHF telecasting, nor the top-quality antenna requirements for good FM/stereo reception. Consequently, customers naturally expect quality reception comparable to VHF B/W and monophonic FM.

If you want to build a profitable and lasting business, select the best lead-in available for every color, UHF and FM/stereo antenna installation. ■

The Rotor

Today's market stretches across new



by Glenn Rook

Cornell Dubilier Electronics

■ The opportunity to sell rotors today is far greater than it was yesterday, when channels were few, weak, and far apart — and fringe-areas were vast and inhabited by many unhappy TV and FM set owners. Set owners gladly bought rotors if they helped to bring in another channel — if an especially desirable show could be brought into the living room.

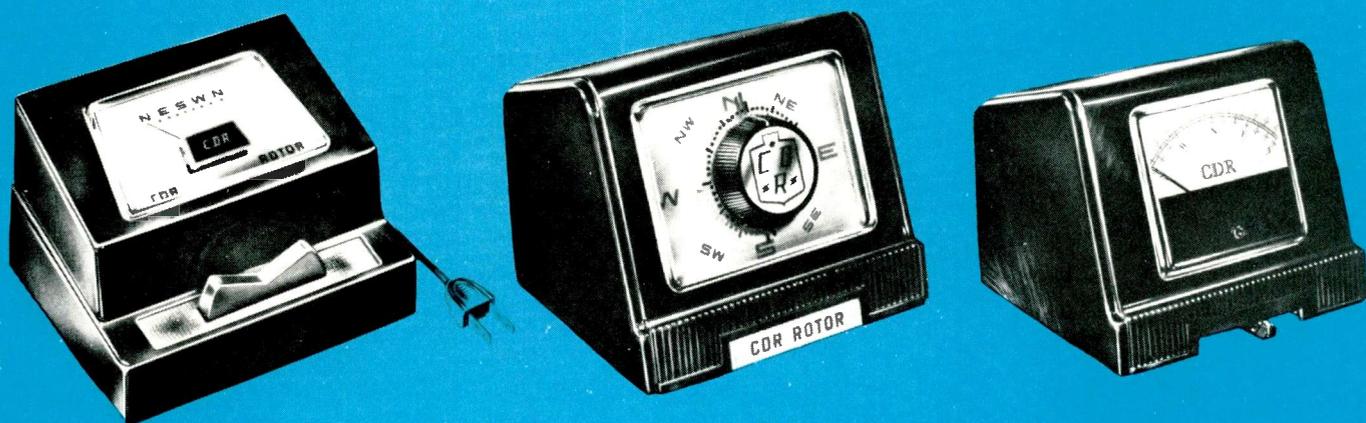
It was easy to sell rotors then, but the *opportunity* to sell them is greater today. Many more channels are now on the air. Many UHF stations are going on the air every month. Color TV sales and service are booming. It is probable that two million new color sets will be sold this year. And with the strides now being made in FM/stereo, another large market for antenna rotors is already here.

Yes, the opportunity to sell rotors stretches over new frontiers that extend from coast-to-coast, from border-to-border across the land.

Of all the items handled by service-dealers and

Opportunity

frontiers from coast-to-coast, from border to border



technicians, the rotor is one of the least understood by laymen. When you have sold and installed one rotor, however, this one sale will lead to many more as neighbors see and hear the better reception resulting from an accurate rotor and a good high gain, directional antenna installation.

And many sales-aids are available to help service-dealers and technicians tap this highly profitable market. Let's review some of them.

- Two recent issues of Consumer Reports have been used by many alert technicians to bone-up on the rotor market and become familiar with rotor advantages and disadvantages.

- Manufacturers literature. One booklet describes in clear layman language the reasons for installing a good directional antenna and rotor. It explains the principles of broadcasting and reception, defines seven basic antenna designs and argues the rotor case convincingly. Most of this literature is free for the asking and when

left with prospective customers, it becomes an invaluable sales aid.

- Home-made sales tools. These include antenna polar patterns, a map showing the locations of TV and FM stations in your area — stations that come within the reach of your customers when rotors and high-gain antennas are used.

- Demonstrations. A rotor is perhaps the most dramatic "Show Me" item you can use in your antenna business. (See articles in September 1964 *ELECTRONIC TECHNICIAN*.)

But the most valuable sales tool of all is your own knowledge of signal reception facts which you can easily convey to your customers and prospects.

Yes, nobody wants a rotor until you explain what it can do to improve their reception and entertainment enjoyment.

It's time to begin telling 'em. It's time to start showing 'em. ■



Antennas For

Select a unit with sufficient gain to produce

by Marvin Fastman

JFD Electronics

■ Color programs are increasing and we are now experiencing a boom in color TV receiver sales. FM/stereo stations are multiplying and the audience for FM/stereo is growing rapidly. Good color and FM/multiplex reception require antennas with high gain, flat response and high front-to-back ratios. If insufficient signal is being received, faded color hues and distorted music will result. This is particularly true for near-fringe, fringe and deep-fringe reception areas.

The day has gone when you could walk into a distributor's establishment and pick antennas blindly and at random. If you want to keep the "new breed" of TV viewers and FM/stereo listeners happy — keep the business you now have and increase it — you'll have to learn more about selecting antennas and how to install them for best results. You'll have to compare antenna specifications and check-out results in actual practice before you can get the best antenna for a given job. And you'll find it necessary to be more selective with hardware, lead-in and other accessories.

Here are some of the things you'll need to consider if you want to keep up with the forward surge and growth of color TV and FM/stereo — if you want to get your share of this new business.

Basic Considerations

Let's understand at the beginning that weak signals and ghosts are more noticeable in color TV reception than in black-and-white. FM/stereo receivers require more signal voltage than monophonic FM receivers to produce the same quality sound. And multipath signals (ghosts) can cause serious distortion to stereo/multiplex sound.

The signal strength of TV and FM stations decreases rapidly as distance from the transmitter increases. Longer distance reception requires higher antenna gain — but not at the expense of bandwidth response.

And space transmission losses increase with frequency. If, for example, the same power is transmitted on channel 7 as on channel 2, the former channel will have approximately one-third the range of the lower frequency channel. For this reason, stations of VHF high band channels frequently transmit with two to four times as much effective radiated power (ERP) as transmitters on channels 2 to 6. UHF

transmitters telecast with even more power in many cases — ranging from 10 to 20 times the ERP of VHF stations.

Regarding local terrain, when the receiving antenna is blocked from the main transmitted signal by mountains or hills, the signal strength will be greatly reduced. The hills and mountains will absorb and reflect the signals. And this condition grows worse at UHF.

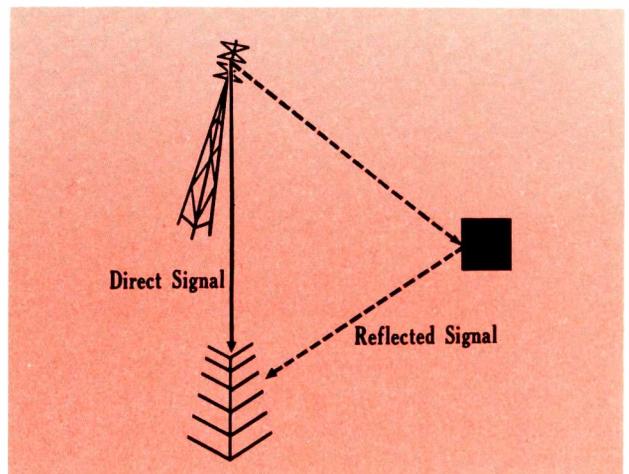
If the antenna is blocked by trees or other dense vegetation, the signal strength will be greatly reduced during spring and summer.

Selecting the Antenna

If you are about to install a TV or FM/stereo antenna in one of the previously mentioned primary areas — or even in many difficult metropolitan-area locations — you should make a survey of the site with a good portable field strength meter. And if you want the data you obtain to be meaningful, the meter should be equipped with an adjustable half-wave dipole.

When you have found out what gain you need, channels to be covered, and the particular conditions of the local terrain, you're ready to select the antenna. Some things you'll need to know about the antenna are as follows:

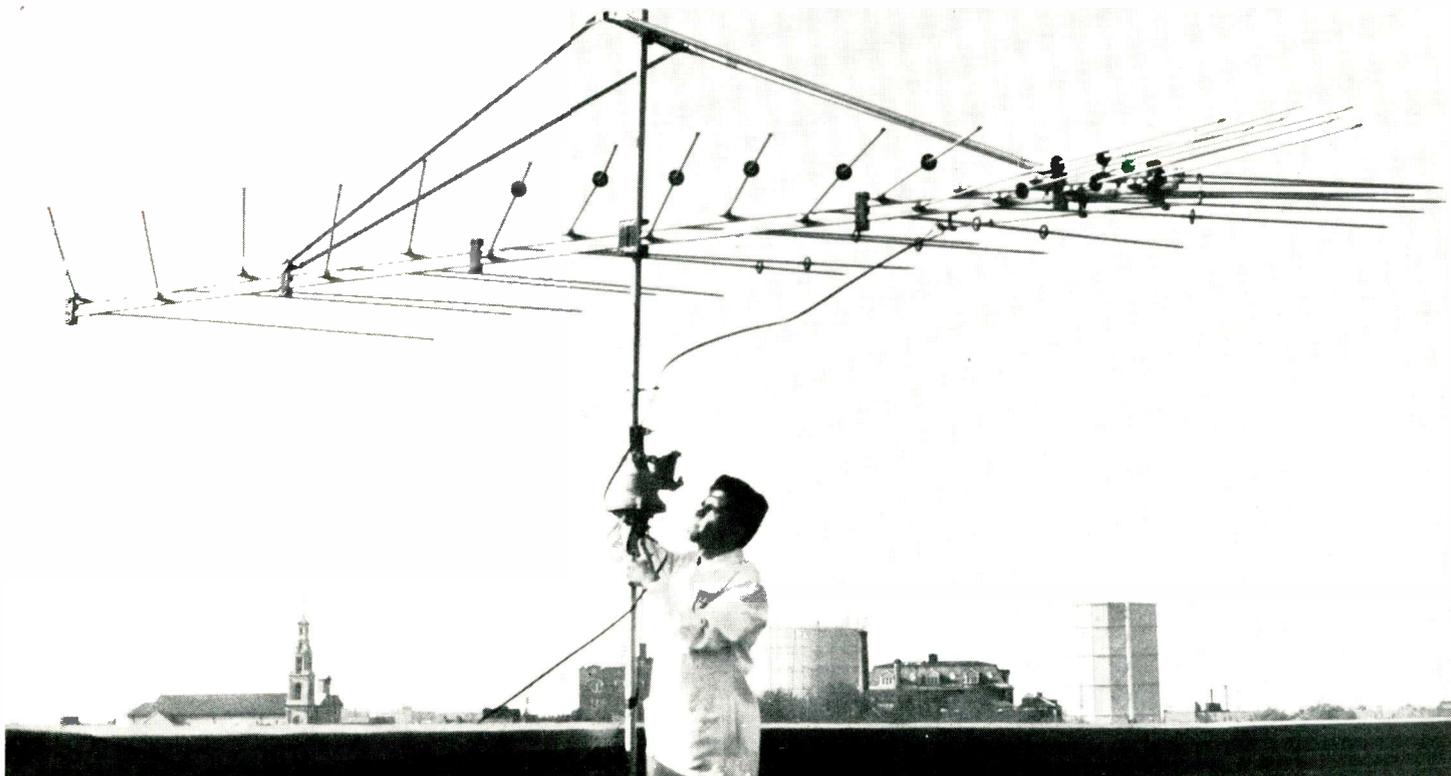
1. Front-to-back ratio.
2. Response across each channel to be received.



Ghosts are caused by reflected signals that arrive out of phase with respect to the main signal.

Color TV and FM/Stereo

snow-free pictures and top-quality music reproduction



Ghosts can be minimized sharply with antenna rotators.

3. Characteristic impedance at each channel to be received.
4. Polar pattern configurations for each channel to be received.

Generally, the TV antenna selected should have uniform gain on both the VHF low band and high band channels and the FM antenna should have high gain, flat response, across the entire FM band. In some cases, however, the antenna may require greater gain on VHF high bands than on VHF low bands. And still higher gain antennas may be required for UHF.

If ghost reflections are prevalent in a given location (because of reflected signals from mountains, hills, high buildings, etc.), select the antenna that has a sharp, narrow frontal lobe and low minor lobe level

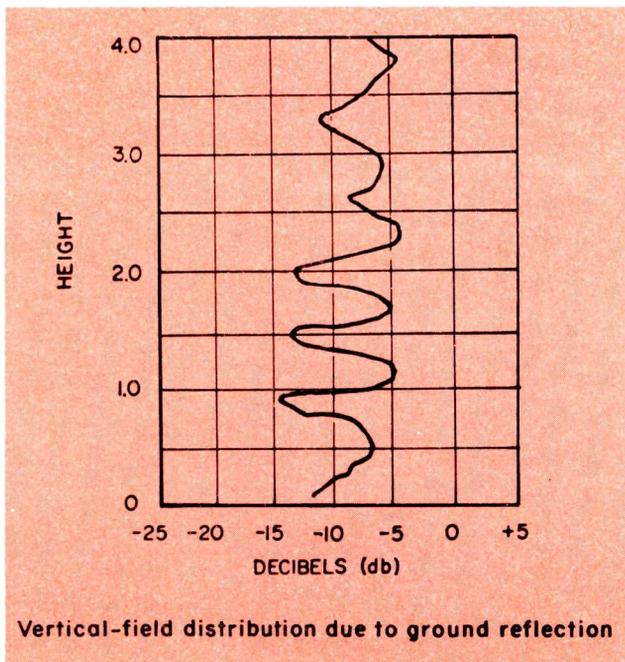
to reject reflected signals. Since reflections can occur in both vertical and horizontal planes, it is essential that the frontal-lobe width and minor lobe level be maintained in both these planes.

Installation Precautions

If possible, the antenna should be placed above the local terrain. If this is not practical, it should be adjusted at an angle to the horizontal. The transmitted signal will sometimes be diffracted or refracted over, around, or through obstructions. Adjusting the antenna at an angle to the horizontal will frequently enable you to receive the signals more effectively.

A small, battery-operated portable TV, with hooded screen, can serve as an ideal accessory to your field-strength meter when making final antenna adjust-

...Antennas



The field intensity may vary sharply with height. Carefully position the antenna for maximum field strength.

ments. And you can determine reception quality easier when choosing the mounting spot for the antenna.

The antenna should be placed above tree tops or in an unblocked path between trees. This is particularly important with UHF antennas.

If the installation is near the sea-shore or industrial area, deposits of salt or chemicals will frequently form on the antenna elements, mast, insulator brackets and lead-in. Especially during rain, chemicals will ionize and the signal strength will fall sharply. Deposits of salt or chemicals on the lead-in will increase its VSWR. The antenna elements, mast, insulator brackets and all metal parts of the antenna should be protected against corrosion in these areas to prolong the installation's effectiveness. And the lead-in should be a cellular polyethylene type to minimize signal losses.

If your field-strength measurements show signals in a particular location to be marginal, a mast-mounted preamplifier may be necessary. But make certain that the preamplifier has a signal-to-noise ratio greater than the TV or FM receiver. A mast-mounted preamplifier cannot improve the antenna signal voltage level when it is less than the receiver's sensitivity.

Antenna positioning for UHF channels 14 to 83 may become critical in certain areas. A change of only a few inches in the antenna location may decrease or increase the signal voltage by 50 percent or more. Field-strength may also vary sharply with respect to antenna height.

To minimize ghosts caused by lead-in reflections, make sure you install the highest quality transmission

line. Some sub-standard twin leads do not have good 300 ohm characteristic impedances to begin with and others will not maintain impedances over a period of time. The insulation of these lines will dry, crack and absorb moisture and atmospheric impurities. Their impedances change, signal losses occur and mismatch-ghosts result.

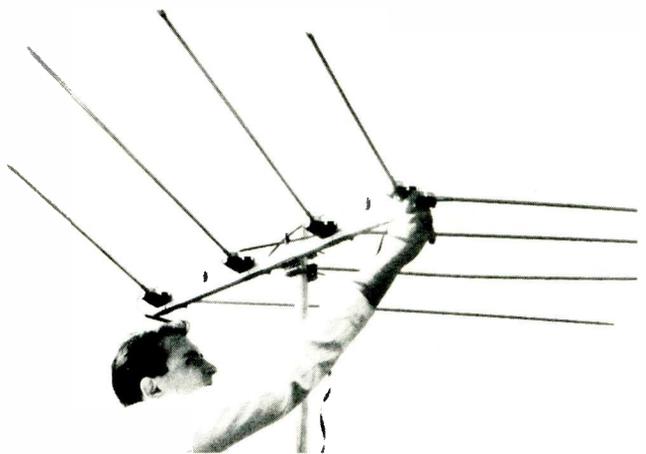
All lead-ins should be transposed (twisted 360 deg) once every ft or 18 in. of its length to minimize direct-signal pickup which also causes ghost reflections.

In many antenna installations a rotator will offer maximum advantage in quickly positioning antenna directivity and side lobe levels. Ghost reception can be minimized by changing the antenna's direction slightly with respect to the main and reflected signals. And if two stations are to be received from different directions on a single antenna, a rotor also proves ideal.

Ghosts caused by ground-plane reflection can be minimized by orienting the antenna with respect to the ground — at an angle to the horizontal. Adjustable angle U-bolts may be used to orient the antenna at angles to the horizontal.

Some ghosts are produced at local transmitters. A mismatch between the impedances of the transmitter — transmission line and transmitting antenna — produce reflections. If sufficient signal is being received from these transmitters, the ghosts can be minimized or even eliminated entirely by placing a variable attenuator (pad) in the lead-in at the receiver. Since the ghost signals are weaker than the main transmitted signal, the ghost signal can frequently be attenuated below the receiver's sensitivity level — leaving a clear, snow- and ghost-free picture on the screen.

The money a customer spends on a good color TV or FM/stereo set can be effectively wasted if an inadequate antenna is installed with it. Satisfactory reception requires a high-quality antenna, the same kind of lead-in, and careful professional installation. ■



Orient the antenna carefully to minimize ghosts.

A Lesson in Color

by L. C. Powell

Automatic degaussers offer little challenge to well-informed technicians

■ One feature peculiar to current model color sets is automatic degaussing circuitry. Let's look at some of the things you'll need to know to troubleshoot and repair automatic degaussers.

Two Types

Numerous color set makers are presently building automatic degaussers into their sets. If the trend continues most TV sets manufac-

tured will soon have degaussers built in.

All degaussing systems now being used operate on the same basic principle but two different types may be encountered. One system uses two coils and the other, four coils. The two coil system employs a thermal cutout switch which automatically turns the degausser off after the set has warmed up. The four coil model relies on strictly non-mechanical, electronic circuitry.

In both systems the degausser operates only while the set warms up. When the set is off or during normal operation the degaussing circuit is inactive. Naturally, you can expect some trouble from these circuits; they are no less immune to trouble than any other section of the set.

Only time will tell what troubles will be most common to these circuits but we can examine most of

the problems since the circuitry is simple and there are few parts. First, however, we need to understand the operating principle in each of the two basic systems.

Thermal Cutout System

The thermal cutout system is employed on the two-coil sets. A simplified schematic of the system is shown in Fig. 1 (Page 60).

The degaussing coil is connected across a thermistor in series with the power transformer primary. A switch in series with the coils is opened when the thermistor reaches normal set-operating temperature.

When the set is first turned on the thermistor is cold and has a high resistance. Because the filter capacitors in the power supply are discharged, the initial current flow through the degaussing coils is heavy. As the capacitors charge, the current through the transformer

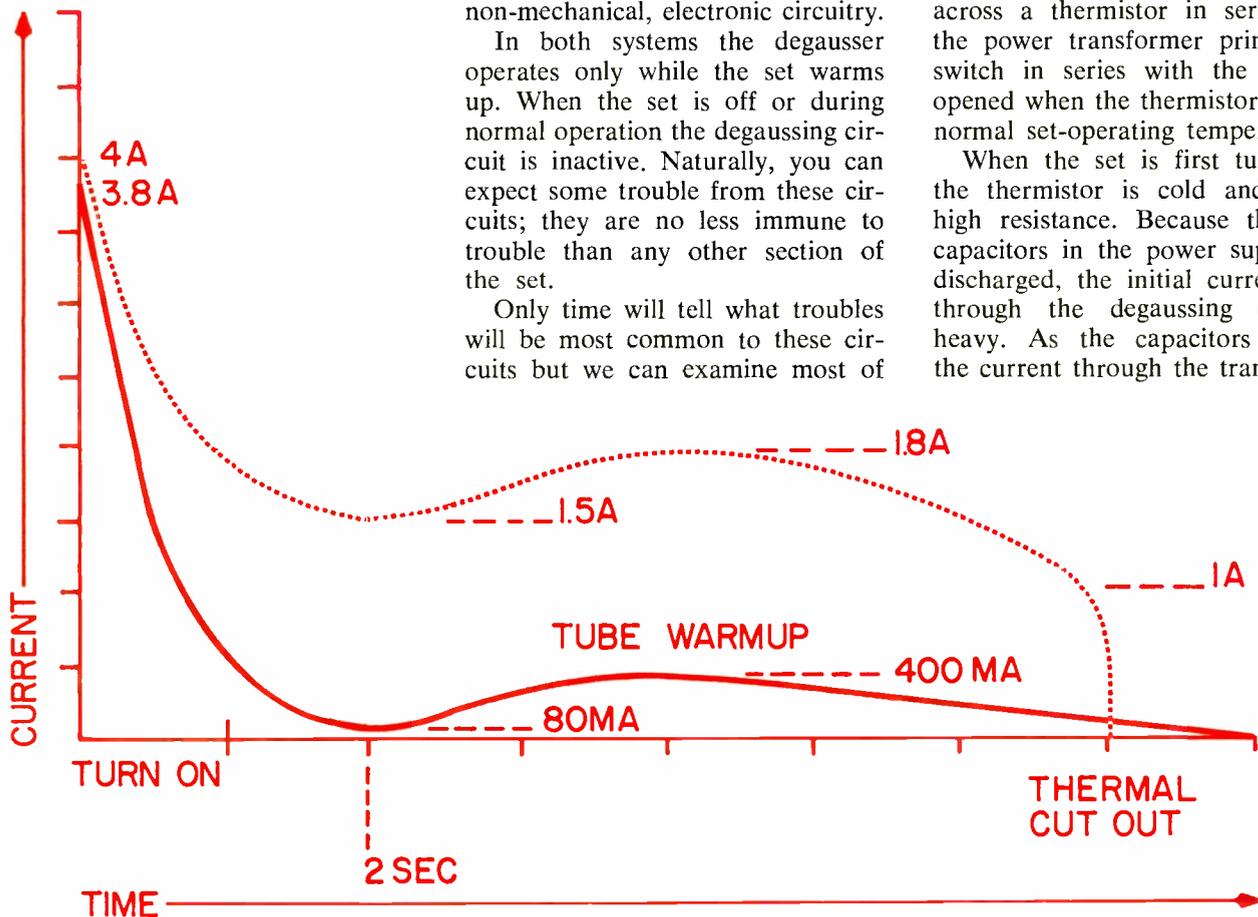


Fig. 2—Current flow through degaussing coils of the two basic systems in use.

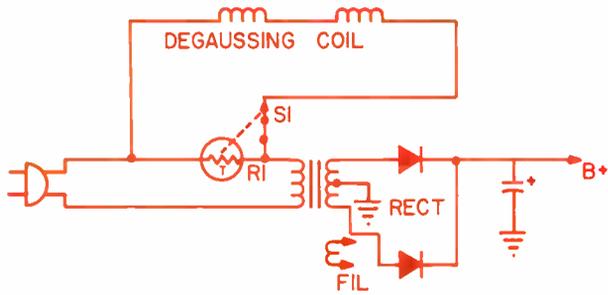


Fig. 1—Schematic of automatic degaussing system using thermal cutout switch.

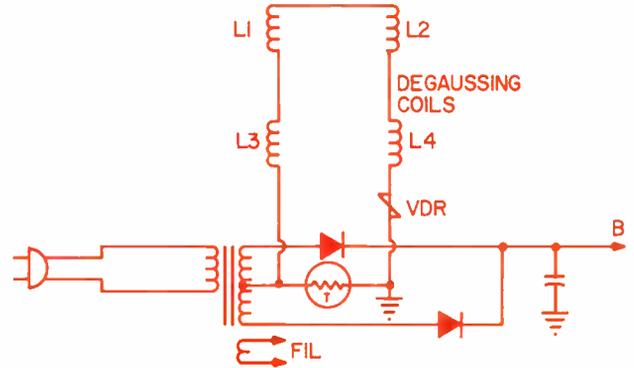


Fig. 4—Schematic of automatic degaussing system employing thermistor and VDR.

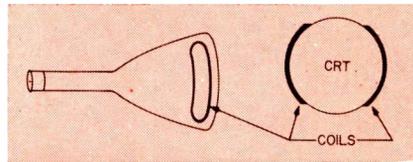
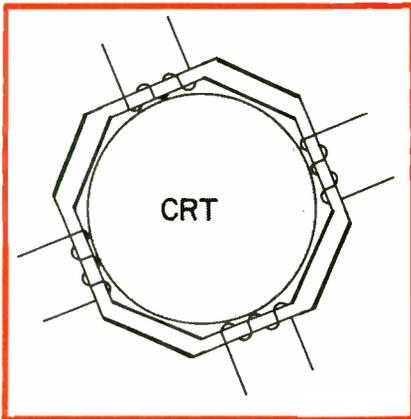
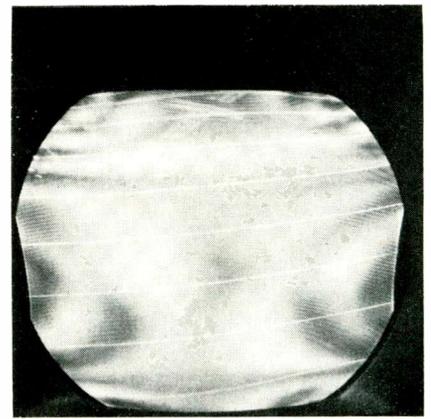


Fig. 3—Location of coils on CRT for two coil degaussing system.

Fig. 5 (left)—Coil location around CRT on four coil degaussing system.

Fig. 6 (right)—Set in operation with 30 vac applied to degaussing coils.



decreases and as the thermistor warms up the voltage across the thermistor drops, decreasing the coil current.

As the tubes in the set begin to warm up, the set draws more current, the voltage across the thermistor again increases slightly and then decreases as the thermistor gets hotter and becomes lower in resistance. When the thermistor reaches normal operating temperature the heat "trips" the thermal switch and opens the coil circuit. At the time the switch opens, current through the coil is relatively light and no noticeable field is left in or around the tube.

The dotted line in the graph (Fig. 2, Page 59) shows the current through the degaussing coil circuit using a thermal cutout.

Physically, the coils are located to the left and right of the CRT. Their appearance is very much like the familiar "portable" degaussing coil which has been "mashed" to an oblong shape about four in. wide and long enough to form-fit on either side of the CRT. The actual coil location with respect to the CRT is shown in Fig. 3. The coils

are necessary only on the sides since lateral magnetic force lines are the ones which cause screen contamination in the average installation.

VDR System

The second system employs a *voltage dependent resistor* (VDR) to let the current in the degaussing coil down more gradually than the thermal cutout switch. A schematic of this system is shown in Fig. 4. Note that the coil is connected in the secondary of the power transformer circuit.

Again, the coil is connected directly across the thermistor which operates in the same manner as the preceding example. Instead of a mechanical cutout, however, a VDR is substituted. The principle of the VDR is that its resistance decreases as the voltage applied to it increases. Consequently, when the set is cold and is turned on, the voltage across the thermistor is great and the VDR resistance is very low. As the thermistor warms up, the voltage across it decreases and causes the VDR resistance to increase.

Thus, both the thermistor warming up and the increase in VDR resistance cause the coil current to decrease. A graph of the current through the degaussing coil in this system is shown in Fig. 2 (solid line, Page 59).

The four coils are situated at the four "corners" of the CRT and are attached to the CRT shield. The resultant force-lines are the same type as those in the two-coil system. All four coils are wired in series and their polarity must be observed. The coil locations are shown in Fig. 5.

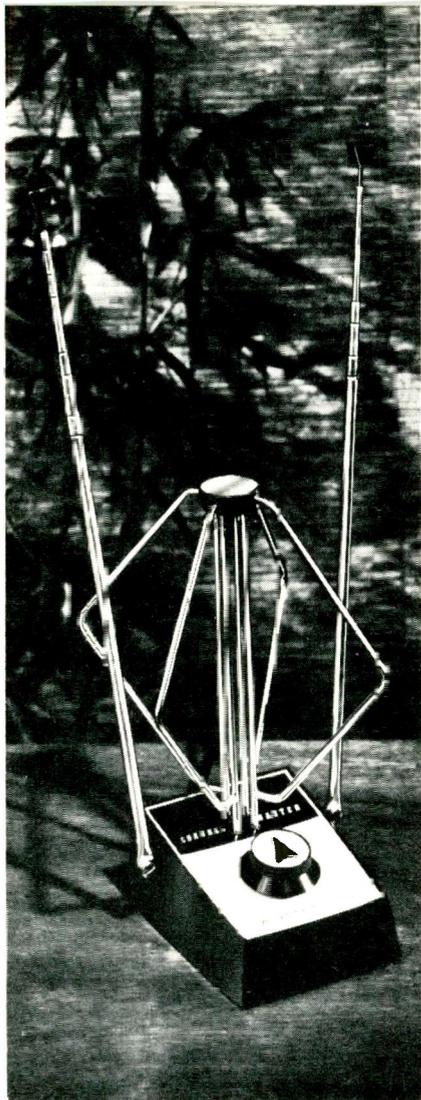
Symptoms and Repair

The most common symptom experienced with both systems will probably be a magnetic field remaining after the normal warm up time. In the thermal cutout system, this could be easily caused by the thermal switch being stuck or opening too soon. In the VDR system, the same symptom could be caused by either a faulty VDR or a defective thermistor. If the picture is tinted like it is on normally impure screens, the system is probably shut

Continued on page 95

The Indoor Antenna Boom

Take advantage of this 'easy-sell' market that extends from metropolitan reception areas to near-fringe and beyond



■ Spurred onward by the all-channel TV-tuner law, the growth of UHF and FM/stereo broadcasting and demands for a better indoor antenna for color reception, the "rabbit-ears" antenna has recently undergone some drastic design changes. The new indoor antennas are solving many poor reception problems in both strong and weak signal areas by incorporating basic outdoor antenna principles into compact, top-of-the-set structures. And a boom in new indoor antenna sales is gathering momentum.

One new innovation is the all-channel indoor antenna with a built-in UHF converter. Others employ built-in low-noise-figure transistorized amplifiers to boost the signal. Considerable demand for these antennas is now coming from owners who have old VHF-only TV sets. In fact, in many areas, the all-channel tuner law appears to have stirred up more interest in UHF converters and antennas than it did in all-channel TV sets. Some service-dealers and technicians have reported selling thousands of converters and antennas in areas where UHF stations have recently opened.

Some new, all-channel indoor antennas have separate UHF and VHF lead-ins to be attached to separate inputs at the set's tuner. Some have "diplexer" circuits for high front-to-back ratios and switches for reversing the polar pattern, eliminating the need to rotate the antenna by hand. Others have impedance-compensating switches for electronically adjusting this di-

pole to the proper channel frequency.

Both built-in, low noise, high-gain transistor amplifier and no-amplifier type antennas are being designed and manufactured for FM/stereo reception too.

Many technicians have found it easy to sell FM antennas after demonstrating actual music-quality improvement resulting from using these antennas. Improvements in music quality over that obtained with ordinary rabbit-ear and even many medium-gain outdoor antennas is generally noted.

It is frequently helpful for service-dealers and technicians to explain briefly the difference between FM/stereo signals and monophonic FM signals. As we know, the FM/stereo signals are not near as strong as mono signals. The loss that takes place in a multiplex adapter is considerable because of the *subtractive* separation process. The right and left stereo signals are derived by taking the difference between the two signal components transmitted. Thus, the actual range of similar effective radiated power of FM/stereo transmitters is about half that of regular monophonic FM transmitters. The easiest way to compensate for this is with higher gain antennas.

TV/FM accessories that can be sold like "hot cakes" are few and far between. Indoor antennas are another "natural" that no service-dealer or technician can ignore. *Illustration credit: Channel Master Corp.* ■



PART 2

Visual Symptoms

Upgrade your service image by 'following-through'

■ Many TV repair shops are losing reputations — and money — by inept service “follow through.” They get tired of the job at hand before all possibility of “side effect” error has been completely investigated. *Be sure you don't “build in” malfunctions when replacing component parts.* A continuation of our review of horizontal oscillator problems will point up a few headaches such servicing can create.

The Multivibrator

Because of its flexibility, horizontal multivibrator circuits are a favorite with the industry. The basic layout of this oscillator is shown in Fig. 1. At least a dozen variations of the multivibrator are known, each with its own peculiarities.

How G-E has employed it is shown in Fig. 2. A “fine hold” control is used in the AFC plate circuit. Another version eliminates the AFC control and places the control in the grid circuit of the second half of the oscillator tube, (dotted lines, Fig. 2) so that a sampling of B+ could be applied to the grid, thereby changing the discharge time. This control was often available only through a small hole in the chassis deck near the oscillator tube socket. Still another variation has both controls in the circuit. Here, in most cases, the grid control is tied to ground and varies the negative bias on the discharge section. Of course, the AFC tube also gave way to the selenium diode as phase detector.

In some older G-E chassis confusion is still created by two different tubes being used in these circuits. One model has a 12AU7 as oscillator, while another model with a similar chassis lay-out has a 12AT7. If the wrong tube is installed, horizontal instability results. It's a sound policy to check the tube layout because malfunction may have been created by a do-it-yourselfer tube job and you'd only be contributing to it by putting in the same wrong type tube.

Most common problems in these older G-E receivers is unfamiliarity of factory “hybridizing” of different chassis types, or when some one discovers the “hidden” grid control and begins experimenting. With maladjustment of this control, the time constant is changed, and the “ringing coil” then creates a “bucking” condition, and the oscillator will tend to

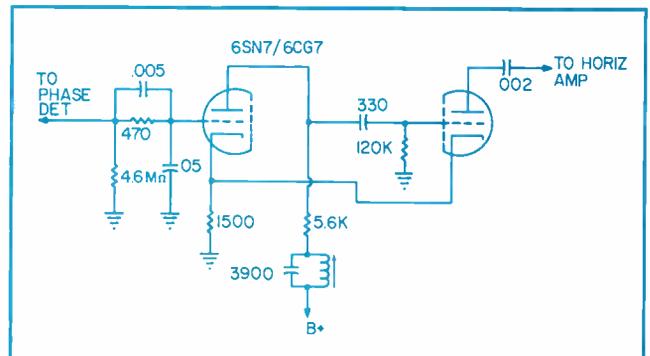


Fig. 1—Basic multivibrator circuit.

“flop” out. The design calls for the grid control to be set at, or very near, center range. A gassy tube, or thermal deterioration of the selenium diode is usually the other cause of instability.

Open RF Decoupling Choke

A routine service call brought an older G-E console, with a bad service history, into the shop. Poor horizontal stability and soft vertical was the complaint. When the chassis was pulled it was clear that almost every capacitor and resistor in the horizontal phase and oscillator circuits had been replaced.

A scope was used to determine if an error of omission had been inadvertently made. It revealed some clipping ahead of the sync separator. The detector was clean; so was the video amplifier. But going further down the line, it was discovered that the noise inverter, 12AT7, had an RF decoupling

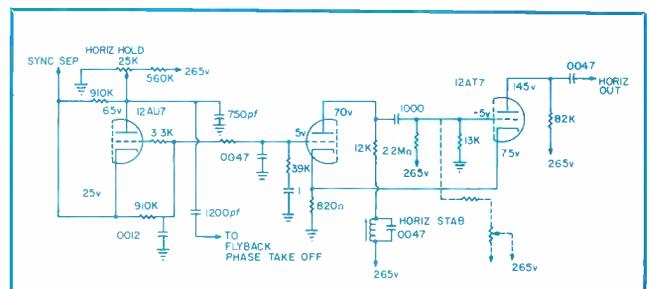


Fig. 2—One version of horizontal multivibrator originated by G-E.

Will Tell You

on each service job

by Jay Shane

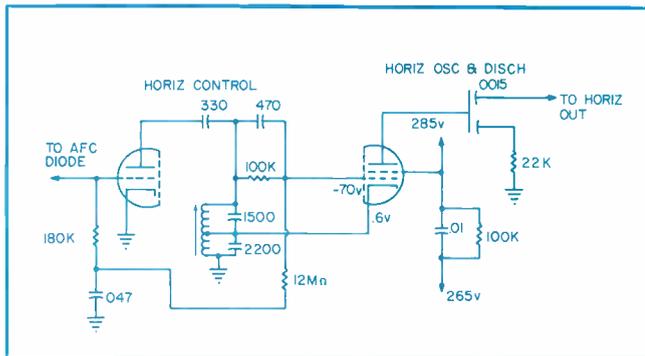


Fig. 3—Horizontal multivibrator circuit used in a number of TV sets.

choke in the cathode leg. It was open. Replacement of the choke corrected the trouble.

Horizontal Hold Affects Sync

A Traveler, model 921-SP-925B was picked up for poor vertical hold and jitters. This indicated the problem was a possible combination of sync and vertical. Tubes were substituted. No change occurred. The 3BU8 clipper plate was scoped. Vertical sync was practically nil. A voltage check showed the 3BU8 cathode was tied to the 95v B+ line. A factory modification showed a 15K 2-w resistor tied from cathode

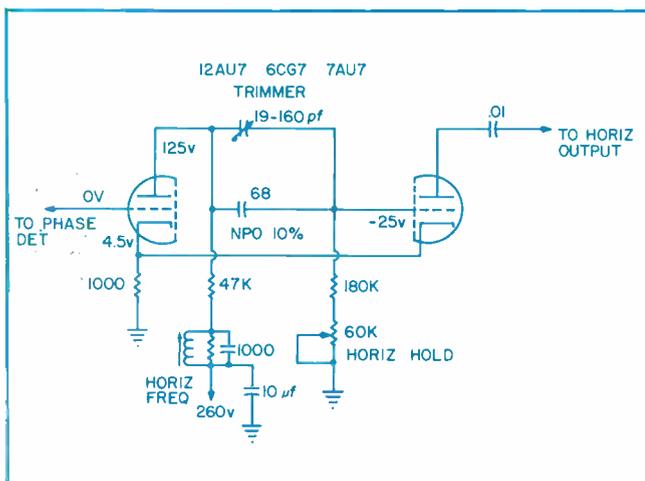


Fig. 4—Hartley oscillator used by Zenith and G-E in some models.

to ground for clamping purposes. This was installed. Only negative results were obtained. The vertical would still roll several times, straighten out awhile, and repeat the process.

The horizontal dropped out, so the ringing coil was adjusted. This also changed the vertical sync output of the clipper. By turning the horizontal hold, vertical sync was either completely removed from the clipper plate or fully restored. When the horizontal was "out" vertical sync was good, but the picture jittered up and down.

Since this appeared to be a reflecting condition, filters and capacitors were substituted.

The receiver remained on the end of the bench a few days while some memory-jogging took place. The owner came in and said he'd spent \$95 for a new CRT and a flyback four months ago. He'd only spend \$25 more on the set. Could it be fixed? An attempt to do something for it was promised.

With renewed diligence — and a deep suspicion that the trouble had been "built" into the set during a previous repair — wave shapes and amplitudes were observed on the scope. The AFC winding of the flyback was putting out a spike far greater than the receiver called for. It wasn't hurting the keyer, but it was affecting the phasing network which, in turn, was reflecting into the clipper. Any changes made in the AFC-keyer line to bring the spike amplitude down adversely affected keying. The flyback, four months or so old, according to the owner, already showed signs of poor drive; warranty replacement was out. The customer wouldn't go for another new one.

Perhaps going further afield might turn up something. The video detector did not have a decoupling choke but fed through a 6.8K resistor to ground. A choke was inserted. The keyer pulse line was a common piece of neoprene hookup wire. This was replaced with a shielded lead. We were on the right track, for horizontal hold did not affect vertical sync near as much. There remained an optimum point, however, just off trip-out, where the horizontal did not bother the sync at all. Not even a jitter.

Now if the horizontal oscillator's range were increased, we'd get away from that transient peak. An 8.2K 1/2 w resistor was bridged across the ringing coil, so that five or six turns of the slug were required to trip it out. Sync now remained clean and vertical hold was good.

The receiver cooked on the bench for two days before it was placed in the cabinet. All buttoned up, it ran another day without fault. Next morning, with everything cold, the set was fired up and allowed to run until 4-o'clock delivery time. Last heard from, the customer was still quite happy with his TV, and he's sent a few new customers around.

Other Oscillators

Westinghouse employs the multivibrator shown in Fig. 3. Coupling between the two oscillator sections is a padder which changes the time constant (TC).

Continued on page 82

Microwave equipment expands system's effectiveness

What About Piggy-Back Emergency Communications?

by Frank L. Garkus

■ Serious thought is being given to communications systems by responsible persons in public safety services. It is imperative that communications be maintained between the different branches of the public safety devices in the event of a disaster, man-made or natural. If a transmitter-receiver site, or a control point, is seriously damaged, confusion would result and effective communications would be lost. With some advanced thinking, a plan to resume immediate control of the system can be prepared; a method which would not only gain centralized control in coordinating the units of one service, but would also coordinate the different services of the various departments.

Opposition exists to appropriations for special expensive communications equipment that stands unused, and is of questionable value and dependability when needed for an emergency. Tax payers and responsible policy makers in city and state governments have a sincere interest in keeping a sane spending record; but, on the other hand, provisions for public safety in an emergency must be contemplated.

A Proposed Plan

One plan involves the purchase of a large bus or mobile van for about \$8000, then outfitting this mobile van with custom fitted radio equipment for say another \$20,000. In addition to possible malfunction, which could occur because the equipment is not under constant usage and maintenance surveillance, there is the chance of its complete loss in an earthquake, fire, or any other conflagration.

To more adequately and economically meet the need of civilian defense, in the instance of an emergency, here is a 'piggy-back' approach — a plan which uses existing vehicles and radio equipment. This plan could be effectively used by any municipality whose public safety service vehicles (police, fire, water, transportation, health) have two way radio equipment.

To institute such a plan (refer to sketch) the investment requirement would be small:

1. A small economy type car-bus, compact in size for Command Control.
2. A small trailer-engine-gener-

ator, which would be towed by the Command Control. This engine-generator would supply lighting power for the radio operators in the Command Control bus. It would supply a charging current from the key car to the Command system to sustain its battery during the emergency operation. And it would supply power to a few 117 v outlets for soldering guns and radio test equipment.

3. A small microwave system and microwave antenna would be used as a link with the telephone company. This tie-in would expand the system's effectiveness.

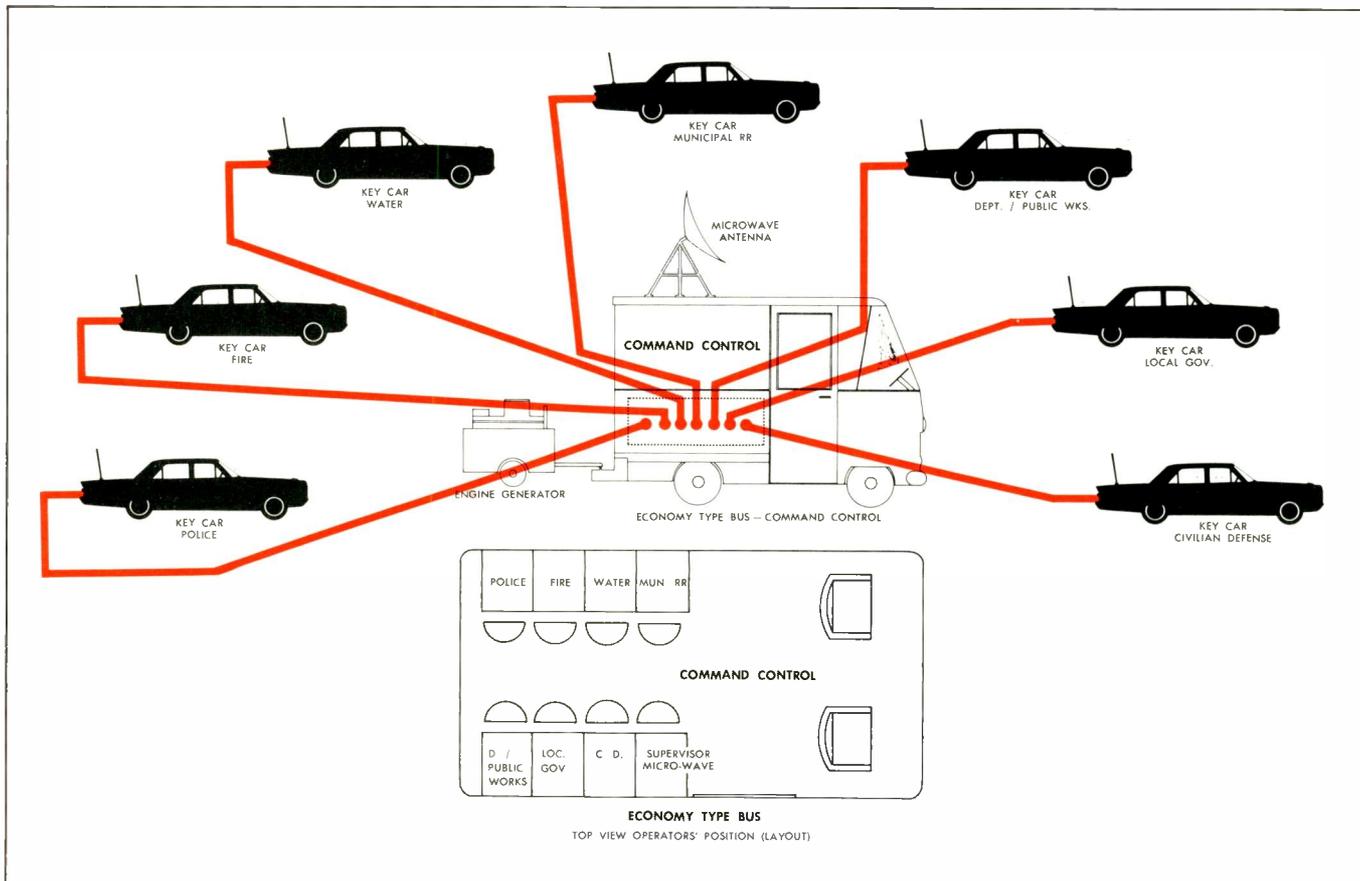
4. Each key car, in its 'piggy-back' function would need:

- a. An adaptor panel to accommodate a control cable to transpose the radio control facilities from the key car to the Command Control bus.

- b. Channel and tone coded squelch switching.

- c. Receptacles to accommodate microphones that are removed from the key cars and placed in this new control operating position.

- d. Outlet jacks for earphone operation.



How It Works

Operation of the 'piggy-back' emergency communications system would normally proceed in the following manner:

The key car of each of the public safety services would rendezvous with the Command Control car at a designated location. The control cable from the adaptor panel of each key car would be connected to the Command Control car to transpose the radio control facilities from each key car to the Command Control bus. All services would then be operating from a centralized location coordinating their activities, but receiving and transmitting messages to their own personnel. Each service would have its control panel and writing position in the Command Control bus (refer to sketch), the number depending on how many services are involved. These functions would appear on a vertically mounted control panel at the back of a desk top which would be the writing work space. The illustration shows seven positions plus one additional position for microwave communications.

The 'piggy-back' emergency communications plan has distinct advantages:

1. Low cost.
2. Existing radio equipment and vehicles can be employed in the system.
3. Radio replacement based on an attrition basis, and not on an antiquation basis such as in a mobile van or a one package system that stands by for emergencies only.
4. Dependability would always be known, for the radio gear would be used daily and serviced as needed.

This plan is presented as a concept, its details could be worked out by qualified technical personnel to suit specific needs, however any amount of sophistry can be worked into the system. All channel frequencies should be field tested under these proximity conditions. An evaluation should be made of receiver desensitization, intermodulation, and over-all system degradation. If some adjacent channel degradation is experienced, a light portable pole should be carried to the improvised operating site

with a few ground plane antennas for quick installation. Another approach would be to erect a few wooden telephone poles in strategically potential operating locations and have a simple antenna array worked out based on actual operating conditions.

This system would require first class coordination among the people manning the key cars from the various services, and a full understanding should be had by each man of his exact part in critical emergencies. Team operation should be developed through regular drills supervised by a responsible head.

A system of this type would meet emergency communications needs and still be economical. Even if the system were never used for an emergency, the investment would be almost inconsequential. In these times of changing defense concepts, the more practical the plan for emergency communications, the more familiar the equipment and its operation becomes, the greater the possibility of the equipment and the personnel functioning at top efficiency during all critical emergencies. ■

You can make your customer's equipment outperform comparable gear if you have a good working knowledge of basic techniques involved

Noise Figure Measurement Fundamentals

by H. Olson and H. Howard

Stanford Electronics Laboratories

Part I

■ The 25 to 450 Mc spectrum embraces most of the two-way services with which we are here concerned, including citizens band and public safety radio. Noise figure measurement is the only reasonable way to predict receiver performance — especially at the high end of the spectrum.

In the design of receivers for frequencies higher than about 100 Mc, manufacturers usually weigh performance, reliability and serviceability against each other. This results in an optimum noise figure even for a well maintained system, serviced according to its own maintenance manual. But the same system, serviced by personnel with a good working knowledge of noise figure measurement and adjustment, will consistently outperform others of its type.

Preliminary Considerations

In many service and installation cases a simple system sensitivity check is adequate to determine if the equipment is up to manufacturers' specifications. A specific output level from a signal generator is coupled to the receiver through a standard dummy load or termination and either the AGC voltage or some other output is measured. Unfortunately, this tells only if the system has sufficient gain at a single frequency when connected to a proper termination; if the gain is low, this can be easily corrected by increasing the intermediate fre-

quency gain adjustment. The net effect, although seeming to bring the receiver up to specifications, is to seriously degrade the performance — the real item of interest is the minimum detectable signal-to-noise ratio in a given bandwidth. This says that routine sensitivity checks on a receiver will show if one stage or some stages are slowly deteriorating, but will say very little about the receiver's performance as a device to process intelligence efficiently.

Noise figure can be expressed numerically, in db, or as an equivalent input temperature, in deg Kelvin. The relation was defined a number of years ago by the Institute of Radio Engineers and is available in the literature.

When a directive antenna is connected to a good receiver, a reasonable practice is to try to achieve a receiver noise figure approaching that equivalent to the lower cosmic noise limit. Temperature, noise figure, and cosmic noise relationships are shown in Fig. 1. This should be helpful in deciding on a noise figure target. For receivers used with reasonably non-directive antennas a figure of 3 db (290° K) is a good choice.

Technicians are usually interested in what noise figure should be attainable with the front end at hand, and how to measure this performance. All reference here to noise figure will be in db since this is the way it is generally expressed.

Getting the optimum noise figure is a matter of good engineering practice and compromise — with reliability being the prime target, as previously mentioned. As service techniques advance, these compromises will become less and less severe and commercial system performance will no doubt improve.

Assuming that a receiver is well-engineered in regard to adequate shielding, decoupling, impedance matching, low VSWR, adjustment of levels, and proper neutralization, its noise figure will be determined primarily by first-stage tube or tubes.

As a receiver ages and its gain diminishes, the natural tendency of the operator or service technician is to increase the IF gain control setting (frequently labeled RF GAIN) as dictated by the sensitivity measurement. This increasing of IF gain, however, does not make the required compensation where it is of most importance: in the RF section, where system noise figure is sharply determined by gain.

Neutralization and tuning sometimes required during tube replacement cannot be done well without measuring noise figure, because highest gain and best noise figure do not, in general, exactly coincide.

Tube Considerations

The noise developed by a stage can be represented by a fictitious resistance, R_{eq} , between the control grid and cathode.

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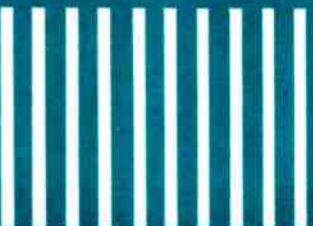
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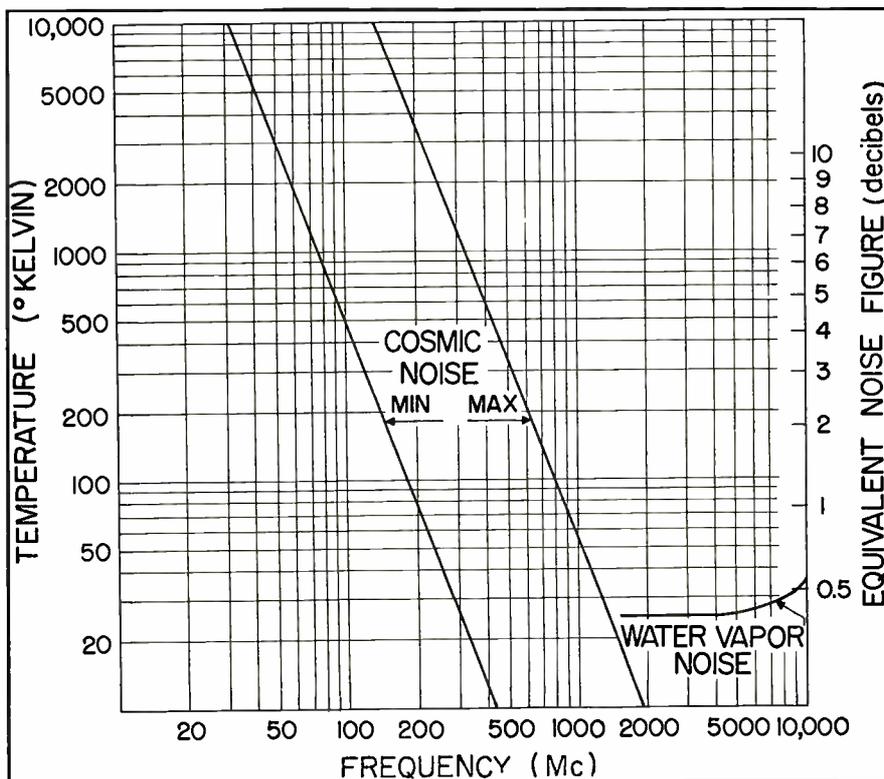


Fig. 1—Temperature, noise figure, and cosmic noise relationships.

TABLE I

Tube Type	Application	Transconductance μ mhos	Req. Noise-equivalent Resistance	
			Calculated (ohms)	Measured (ohms)
6AG7	Pentode Amplifier	9,000	720	600 to 760
6AC7	Pentode Amplifier	11,200	220	200
6SJ7	Pentode Amplifier	1,650	5,800	5,800
6SK7	Pentode Amplifier	2,000	10,500	9,400 to 11,500
6J5	Triode Amplifier	2,600	960	1,250

TABLE II

Tube Type	Application	Transconductance μ mhos	Calculated (ohms)
954	Pentode Amplifier	1,400	6,600
6AK5	Pentode Amplifier	5,000	1,850
6BA6	Pentode Amplifier	4,400	3,700
6CB6	Pentode Amplifier	6,200	1,400
6BC5	Pentode Amplifier	5,700	1,350
955	Triode Amplifier	2,000	1,250
6AK5	Triode Amplifier	6,670	385
6C4	Triode Amplifier	2,200	1,140
676*	Triode Amplifier	5,300	470
6AF4	Triode Amplifier	6,600	380
6AJ4	Triode Amplifier	10,000	250
6AM4	Triode Amplifier	10,000	250
6AN4	Triode Amplifier	10,000	250
6BK7*	Triode Amplifier	9,300	270
6BQ7*	Triode Amplifier	6,100	400
6BZ7*	Triode Amplifier	5,600	450
5842	Triode Amplifier	24,000	104

* one section of dual triode

This follows from the properties of the tube and the definition of noise figure. For most triodes, it is equal to 2.5. This relation is slightly more

gm complicated in pentodes because of the presence of more grids and partition noise effect, but can be calculated with good accuracy.

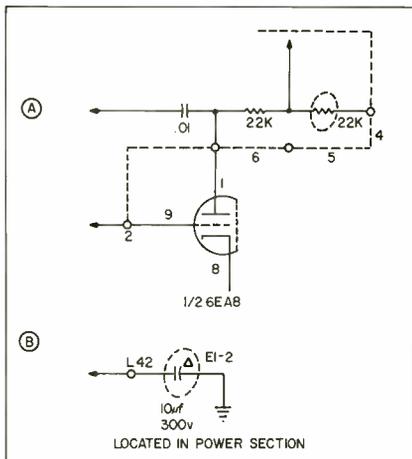
The main point is, as gm goes up, Req — and hence noise figure — go down. The agreement between these calculations and actual practice can be within a few percent, as shown in Table I. Table II shows the calculated value for a number of the most common present-day tubes. By using the simple input resistance equivalent relation, it is possible to get a good idea of the best noise figure attainable with any given tube, assuming that the associated circuitry is well designed and performing properly.

A glance at Table I and II shows that pentodes are definitely not the best for low noise service; in fact, they often improve in performance when triode-connected. Also, there are a number of triodes shown at about the \$3.00 price level with gms around 10,000 (all designed for

Continued on page 94



Difficult Service Jobs Described by Readers



Defective screen bypass electrolytic and open couplate component (22K resistor) contribute to vertical roll in Philco 11N51 chassis.

Defective Screen Bypass

The complaint on this Philco chassis 11N51 was intermittent vertical roll with a somewhat unstable horizontal. The set was brought into the shop after tube substitution in the home produced negative results. The first thing done on the bench was to replace all tuner, IF, video and sync tubes. The problem still existed after this was done. The vertical roll was more pronounced after the set had warmed up for some time. In checking voltages in the noise inverter stage (6EA8) it was found that there was no voltage on pin one (the plate). One section of the couplate, a 22K resistor was found to be open. We did not have an exact replacement for the couplate so it was made up of standard parts and installed. The vertical roll problem still persisted after installation of the equivalent couplate. Scope waveforms in the sync circuits and at the vertical oscillator appeared normal. A complete voltage check of the sync and AGC circuits was made. The readings were normal except for a slight variation in the AGC gate circuit. This variation gave me a clue to possible trouble in the video amplifier stage. The picture rolled more at a lower con-

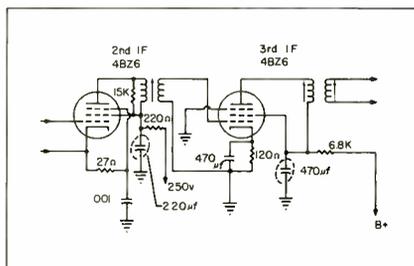
trast setting. The video amplifier voltage readings were within prescribed limits. While probing near the video amplifier socket I noticed that an electrolytic capacitor located in the power section had been leaking and was dried up. Further checking disclosed that this capacitor was being used as the screen bypass for the video output stage. Vertical roll ceased and normal operation was restored after this capacitor was replaced.—*Fred L. Thompson, Tucson, Arizona.*

Intermittent Trouble

I realize that few troubleshooting problems can really be classified as "tough dogs." Let's face it—most tough jobs get that way because (1) incorrect troubleshooting procedures are used or (2) one or more "bugs" are put in the set by errors made by technicians while testing, clipping out and substituting capacitors and resistors or while disconnecting and reconnecting wires. A true tough dog, as I understand it, is a problem that refuses to be solved even *after* all organized and proper troubleshooting procedures are used. Otherwise, what is frequently called a tough dog, is only an ordinary, everyday troubleshoot job.

Despite all this, here is an intermittent trouble that I recently ran into that most TV shops can do without! If you can't use it as a tough dog, forget it.

A Zenith 15A25Q chassis was



Two defective screen bypass capacitors cause intermittent dog.

brought into the shop. According to the owner, it would sometimes work for hours, or days, and then go "blank-o," "kaput,"—just plain out. Only a raster remained. Nothing happened when the AGC control was turned through its range, so we concluded first that it was probably AGC trouble—after tuner, IF and AGC tubes were substituted two or three times with new ones. But when we disconnected the AGC line and placed a bias pack in the circuit, still nothing happened. So we changed our minds and started checking elsewhere.

But this did not work out so well. The set would start functioning normal all of a sudden before we could follow up on our checks. Since we did not have a test setup or other method of detecting intermittents, we let the set cook. When it "konked" out we set to work checking and substituting parts in the IF section.

With this haphazard method, we finally located two bypass capacitors (shown in schematic) which apparently were going bad and then healing themselves. When they were replaced, the set worked fine.—*Walter Anderson, Homewood, Ill.*

TOUGH DOGS WANTED

\$10.00 paid for acceptable items. Use drawings to illustrate whenever necessary. A rough sketch will do. Photographs are desirable. Unacceptable items will be returned if accompanied by a stamped envelope. Send your entries to "Tough Dog" Editor, ELECTRONIC TECHNICIAN, 1 East First St., Duluth, Minnesota 55802.

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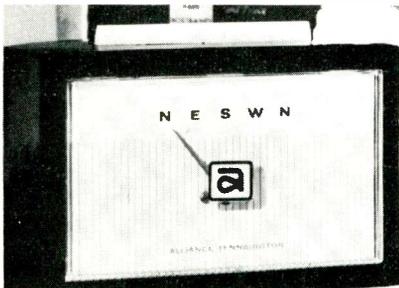
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NEW PRODUCTS

FOR MORE INFORMATION CIRCLE NEW PRODUCT NUMBERS ON POSTCARD INSIDE LAST COVER.

ANTENNA ROTATOR 200

An antenna rotator with a new five-wire circuit allows operation unaffected by motor current, cable



length or line voltage variations, the manufacturer says. The control unit, operates through a finger-pressure control bar to direct the antenna rotator over 360 deg. Rotation speed is one rpm. Alliance.

MARINE RADIOPHONE 201

A transistorized 100-w ship-to-shore radiotelephone for two-way communications on any eight crys-



tal controlled channels is announced. In addition, the full broadcast band is available for listening to news, weather, and general programs. Transistorized audio amplifiers cut the receiver's battery drain to only 1.1 amp. Apelco.

TRANSISTOR TRANSCEIVER 202

A fully transistorized, compact citizens band transceiver has been announced. The five-channel unit,



model CB-10, provides full modulation with 3.5 w of audio output through the three-stage transmitter. Power requirement is 1.0 amp maximum. The unit uses 14 transistors, 6 diodes, and 2 zener diodes. Receiver sensitivity in less than 1 μ v for 10 db S/N. Chassis dimensions are 2 $\frac{5}{8}$ x 6 x 9 $\frac{1}{2}$ in. Shipping weight 5 $\frac{1}{2}$ lb. The transceiver is supplied with push-to-talk microphone, mounting hardware, and channel 11 crystals. \$149.95 list. Hallicrafters.

SPEECH CLIPPER/FILTER 203

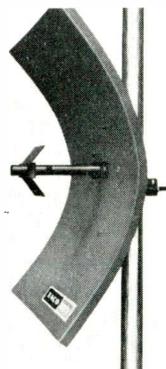
A speech clipper filter that requires no modification for microphone or transmitter, is introduced.



It provides preamplification for full clipping when used with high or low level crystal, ceramic or dynamic microphones. It has all solid state printed circuitry and no external power is needed. Clipping current is monitored on a front panel, eliminating the need for an oscilloscope. Operation without clipping is indicated when the current meter remains at zero on voice peaks, the announcement said. Sarron.

PARABOLIC ANTENNA 204

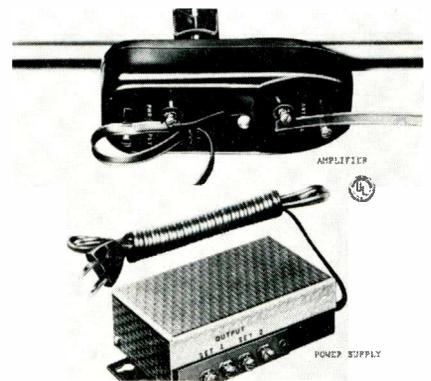
A cylindrical parabolic antenna is specifically designed for Educational TV service (ETV). It covers the frequency range of 2500-2690 Mc. This solid surface antenna measures 10 x 16 in. and



weighs less than 10 lb. The ECPA-1 cylindrical parabolic antenna uses a broad-band dipole type driver to cover the entire ETV band, specifications indicate. Taco.

ANTENNA AMPLIFIERS 205

A series of antenna amplifiers called the "Tele-Amp" is announced. The amplifiers feature



transistor and nuvistor design. The housing is factory-sealed with a bead of silicone sealant, injected along the mating edges. The amplifier circuits are biased for high signal-to-noise ratio. High frequency matching transformers at both input and output provide an impedance match for maximum signal transfer, the announcement said. The transformer-operated power supply isolates the amplifier and power supply, thus removing any shock hazard. JFD.

COLOR BAR GENERATOR 206

The Model 990 color signal generator provides crystal controlled keyed color bars for alignment and



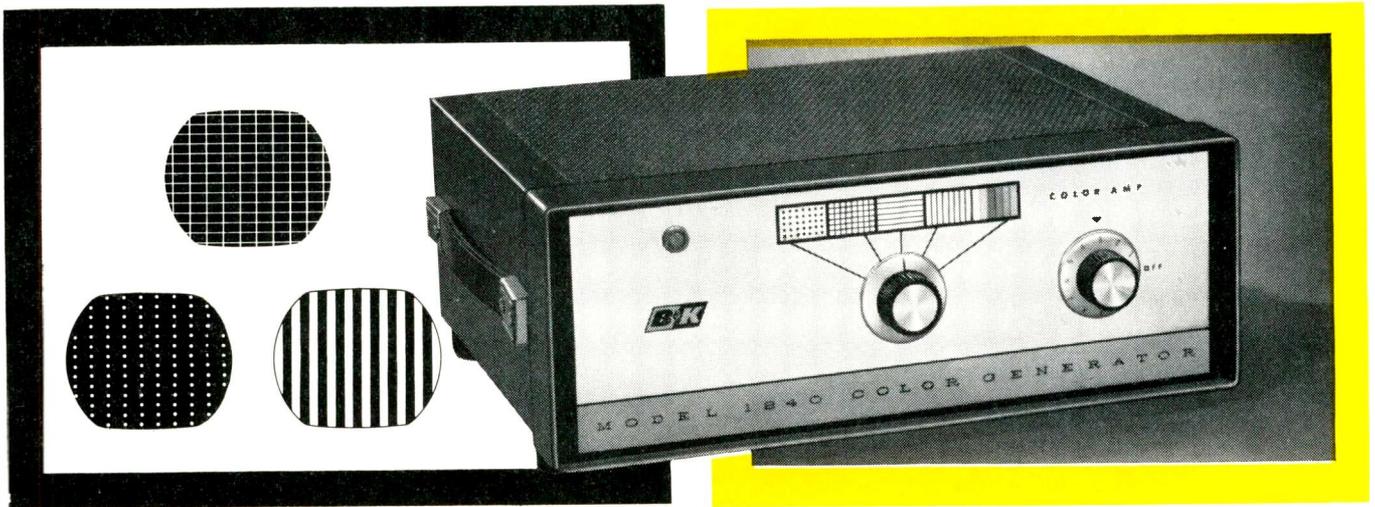
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Provides crystal-controlled keyed rainbow color display on TV screen to test color sync circuits, range of hue control, and align color demodulators. Shows ability of TV receiver to display color values.

Provides dot pattern, crosshatch, horizontal and vertical lines. Highly stable crystal-controlled count circuit with small-step count assures greater reliability and stability of color, dots, and lines. All horizontal lines and

dots are just one raster scanning line thick. Lines begin off-screen and end off-screen, with no break in line. Dot brightness is adjustable with easily accessible control. Chroma Level Control simplifies color sync trouble-shooting.

Operates on channels 3, 4, and 5, and adjustable without removing cabinet. No connection inside TV set is needed. Power transformer operated and line isolated to prevent shock hazards. Operates reliably on 105-125 VAC, 60 cps. (Color Gun Killer is available as optional accessory.) Extreme lightness and portability (9 lbs.) make it ideal for in-home servicing.



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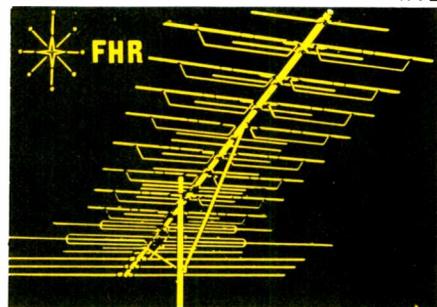
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NEW PRODUCTS



40, 20, 15, and 10 meter amateur bands; dual conversion above 10.0 Mc; six position crystal filter plus adjustable slot filter with up to 60 db attenuation; adjustable BFO for SSB and CW. A 1 μ V sensitivity gives 10:1 S/N ratio, the manufacturer says. Hammarlund.

BASE STATION ANTENNAS 209

A series of colinear gain omnidirectional base station antennas for commercial two-way services in the



150 and 450 Mc ranges is announced. The array consists of half-wave dipole radiators fed in-phase with RG-8AU cabling harness. Available in high and medium gain models for both 150 and 450 Mc bands, with over-all lengths varying from 8 to 21 ft. Weights range from 10 to 35 lb with power ratings from 250 to 500 w, depending on model. Mark Products.

MATV SYSTEM CONVERTERS 210

A solid state UHF to VHF converter for master antenna TV systems has been introduced. Each UC-3 is custom designed for a specific conversion (UHF Channel 38 to VHF Channel 7, for example). The unit has a 75 Ω input and two 75 Ω mixing outputs. The built-in mixing network permits mixing with other non-adjacent

rainbow color pattern can also be selected to supplement keyed color bar tests. Color gun killer switches allow service technicians to actuate any combination of color guns. Variable dot pattern of 54 or 144 dots can be selected for dc or static convergence. Variable crosshatch pattern of 6 or 16 horizontal bars and 9 vertical bars can be selected for dynamic convergence, overscan and linearity adjustments. Dynamic vertical convergence controls can be adjusted with 6 or 18 variable horizontal bars. Dynamic horizontal convergence controls can be adjusted by using 9 vertical bars. Gray raster can also be selected. Two clip-on antenna leads hook the unit up to the TV set. It is factory adjusted to Channel 3 and can be tuned to Channels 2 or 4. \$149.50. Seco.

TRANSMISSION LINE 207

An all channel television transmission cable is introduced. The cable, known as DURAFOAM, is



a flat VHF/UHF lead wire. The manufacturer claims that laboratory and field tests show that the cable has low loss under both wet and dry conditions. The cable is available in 1000 and 500 ft spools, and 50, 75 and 100 ft coils with factory installed terminals on one end. Columbia Wire.

COMMUNICATIONS RECEIVER 208

The model HQ145AX receiver is said to offer a choice of 11 crystal controlled channels selectable from the front panel for any frequency in the receiver's tuning range of 540 kc to 30.0 Mc. General specifications are: 540 kc to 30 Mc tuning in four bands; calibrated electrical bandsread on 80,



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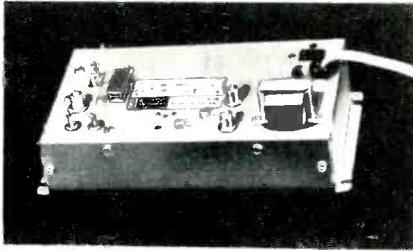
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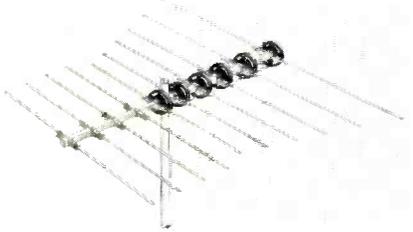
NEW PRODUCTS



VHF channels, without requiring additional equipment. Blonder-Tongue.

FM ANTENNAS 211

Three FM antennas have been added to this manufacturer's line.



Multi-path distortion is the most common obstacle to good FM reception. According to the manufacturer these antennas, known as FM Paralogs, are highly directional. They increase pickup of the direct signals, while rejecting unwanted reflections. Jerrold.

ANTENNA BOOSTER 212

A high-gain, low noise VHF/UHF antenna booster is announced. Called "Genie-Color Booster," the



device combines an insertion gain of from 10 to 12 db, with a noise factor as low as 4 to 6 db, the manufacturer claims. The booster comprises a transistorized amplifier

with universal mounting for any antenna boom or mast, or for wall or window frame installation. It is energized by a remote power supply unit which also functions as a two set coupler. Alliance.

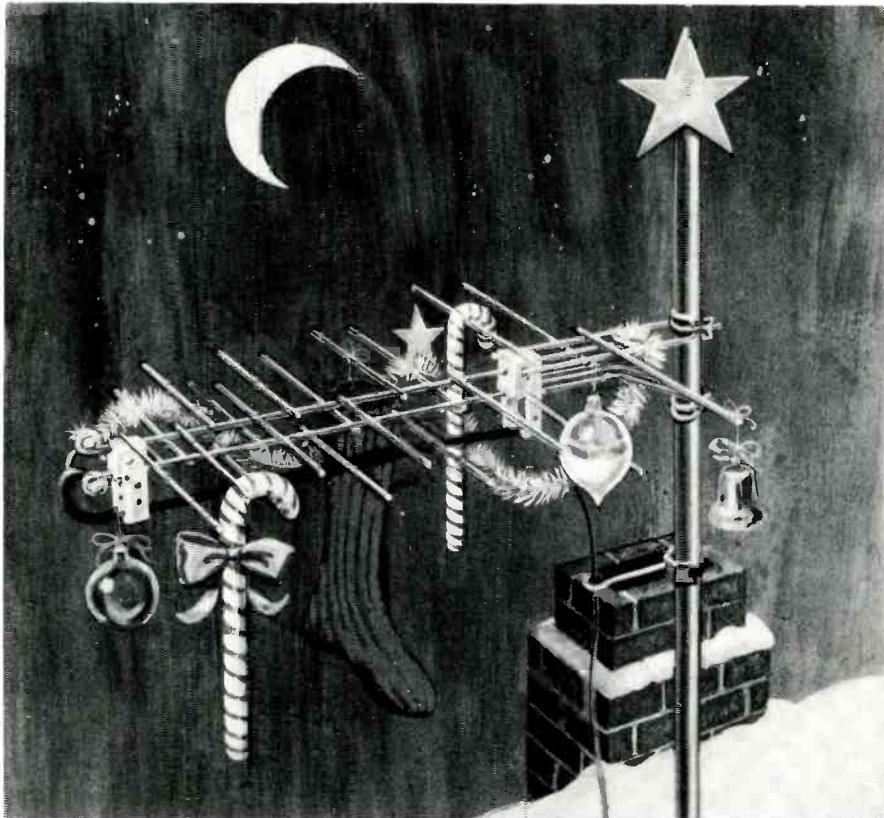
COLOR GENERATOR 213

A transistorized color generator which produces instant, service-ready standard color bars, cross-



hatch, white dots and individual vertical and horizontal bars is announced. It has color gun interrupters on front panel, an unmodulated video for chroma circuit trouble isolation and unmodulated sync pulses, the announcement said. Sencore.

The Golden Dart is the world's finest outdoor UHF antenna. It uses the Periodic design principle to deliver peak performance on all channels. For the finest indoor UHF antenna, use the Blonder-Tongue Golden Arrow. Blonder-Tongue, Newark, N.J. 07102

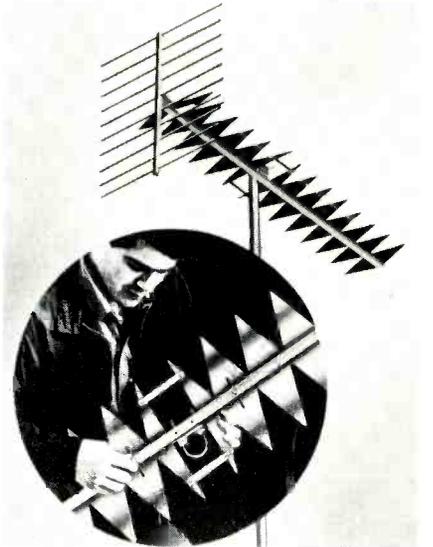


nearly everybody uses the Blonder-Tongue UHF Golden Dart

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UHF ANTENNA 214

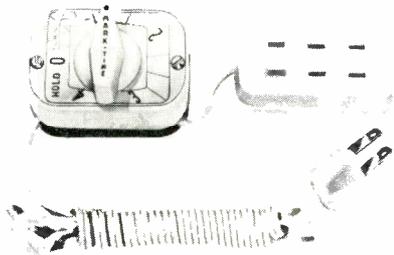
It is said that an adjustable band-span antenna provides high gain, broad-band UHF reception.



The "Sawtooth" shaped antenna can be set and adjusted for peak gain in a given section of the band, according to the manufacturer. Channel Master.

EXTENSION CORD 215

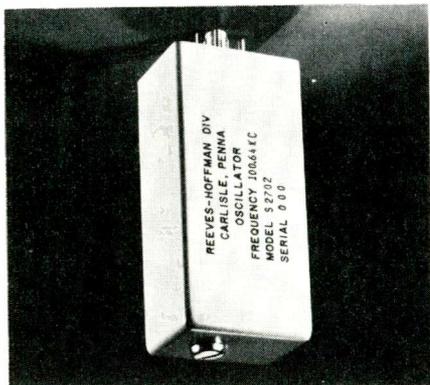
An extension cord-timer shuts off anything electrical at a pre-selected



time. One, two or three devices can be selected for control. Timing extends from 1 minute to 4 hours. When the time is up, the switch will automatically shut everything off, the report said. A six-foot cord is rated at 10 amp 125 vac. Price \$6.95 plus postage. Value Village.

FREQUENCY STANDARD 216

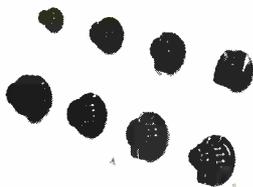
The model S-2702 oscillator frequency standard for 100 kc and nearby frequencies is announced.



Its output is a sine wave, 1 v rms minimum into a 1000 Ω load. Internal impedance is approximately 700 Ω and harmonic distortion is less than 10%, the announcement says. The unit dimensions are 1.88 x 1.44 x 4.33 in. and uses octal plug mounting. Reeves-Hoffman.

INSTRUMENT KNOBS 217

A line of instrument knobs is announced. Seven basic types including round, bar and pointer



versions are available in small and medium sizes. Combinations are

used to make up four additional concentric arrangements. The knobs are usable in both industrial and military applications. All knobs have metal inserts, a set of two mounting screws, and bodies are high impact plastic, according to information furnished by the maker, North Atlantic Industries.

VOLTAGE CALIBRATOR 218

A new series of solid state ac voltage calibrators is announced. The voltage ranges are from 1 mv

to 1000 v and frequencies from 60 cps to 5 kc. Accuracy of 0.25% of dial setting for a period of six months is reported by the manufacturer, Holt.

SILICONE RUBBER 219

A precatyzed RTV silicone rubber in liquid form is announced. The material, RTV-112, is designed for production line application, especially in the electrical and electronics field. It is available in three and twelve oz collapsible aluminum

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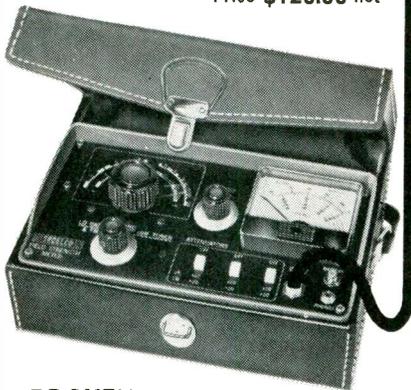
The UA-1 is a low noise, highly accurate UHF Receiver, individually calibrated for field strength measurements. Completely self-contained with its own regulated battery supply. WILL WORK WITH ANY VHF METER.

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Input 75 ohm • UHF Channels 14-83
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Semiconductors . . . 3 transistors ;2 diodes

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- Weighs only 18 ozs. • Tunable plug-in probing antenna • UHF 300 to 75 ohm matching transformer • Holding Bar for quick snap on facility • Built in Battery Meter.

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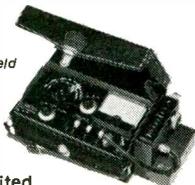
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NEW PRODUCTS



tubes, in six oz polyethylene cartridges for dispensing from caulking guns and also in bulk containers. G-E.

OPTICAL PYROMETER 220

An automatic optical pyrometer is designed for high temperature research and engineering work. It covers the entire incandescent temperature range with high accuracy and relative freedom from emissivity error the maker says. High optical resolution permits measurements of objects as small as 0.013 in. One output is provided for recorders and a second ultrafast output (100 msec) is provided for scopes. Ircon.

ELECTRICAL TAPE 221

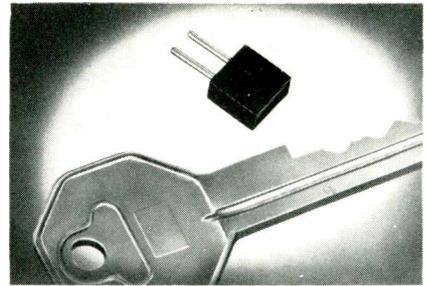
An electrical tape designed for outside cold weather applications as well as warm weather and indoor use, is announced. The tape conforms to MIL-I-7798A. It has a



dielectric strength of 10,000 volts and insulation resistance of more than 100,000 M Ω. IRC.

CURRENT LIMITERS 222

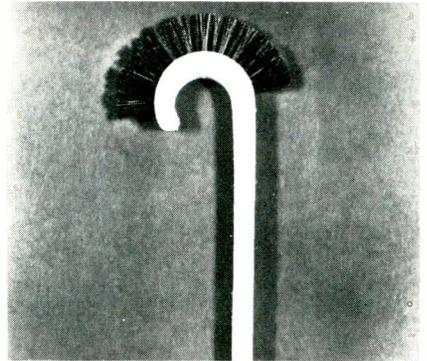
A solid state current limiter, offering protection for semi-con-



ductor devices is introduced. Cold resistance of the device is 0.022 to 13.5 Ω and 10,000 M Ω (nominal) after firing. The unit measures 0.250 x 0.250 x 0.125 in. and is said to be rated at 1/16 to 5 amp. Electra.

HAIR FILAMENT BRUSH 223

A new cleaning brush designed for the telecommunication, telephone and electronic industries is



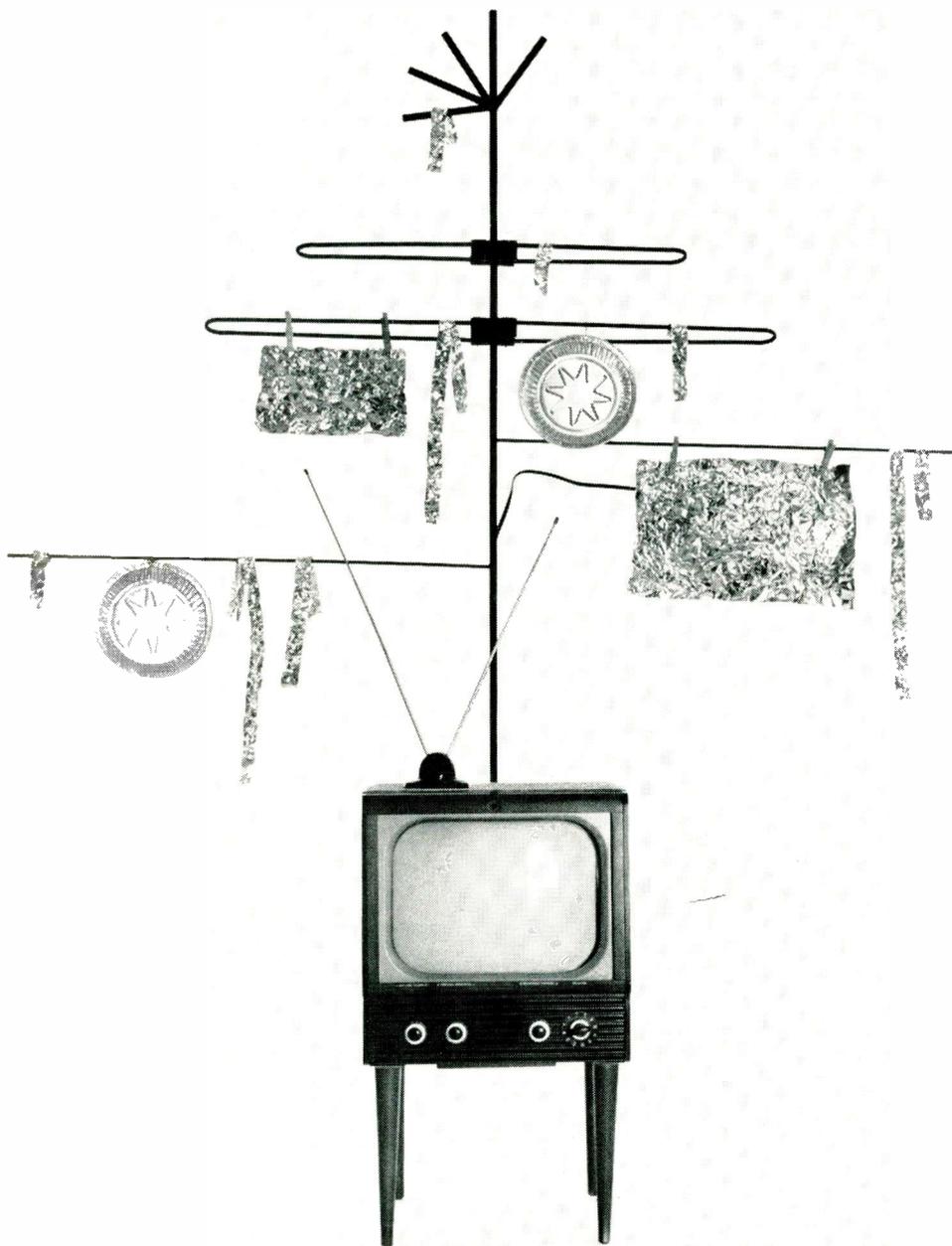
announced. The brush can be used for cleaning rotary-type selector switches, dial banks, selectors, terminals, connectors and other delicate electro-mechanical components. The diameter of the face is 3 in. and the over-all length is 8 in. Jonard.

RELAY CLEANER 224

A solution for cleaning station selectors, relays, contacts in switchboards, automatic pinball or bowling machines, rocket and satellite circuitry is announced. Available in a 6 oz pressurized can, the cleaner can be used as a degreaser and general solvent for cleaning gummy deposits from electrical and electronic equipment. GC Electronics.

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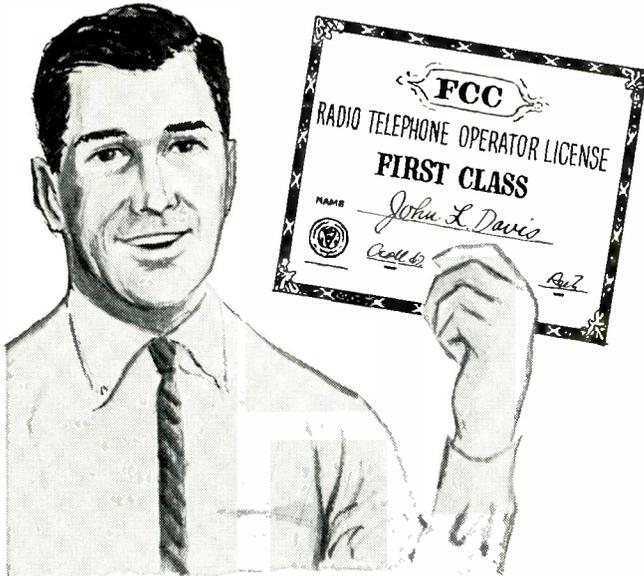


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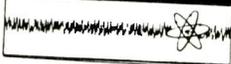
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NEW PRODUCTS

OUTLET BOXES

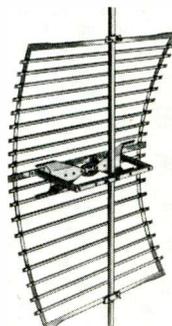


225

Electrical outlet boxes designed to provide fast and safe power distribution for laboratories and shops are introduced. The model 602 series provides five

"U" ground outlets and either a six or 15 ft neoprene cord set. An all-steel case is finished in silver gray textured hammertone. Also available are three related master power controls utilizing the same case. The 603 has four "U" ground outlets and a fuse or push-to-reset circuit breaker; the 605 has three outlets, pilot light, ON/OFF switch, and fuse or circuit breaker; while the 606 contains two sets of switches, pilot lights and outlets, plus either the fuse or circuit breaker. All are equipped with either the six or 15 ft neoprene cord-set. All units are rated at 15 amp, 130 v continuous duty. Waber.

UHF ANTENNAS



226

A line of five UHF antennas is announced. Featuring cylindrical parabolic reflectors, these antennas are called "Paracyls" and have a large vertical reception area, the maker says. The antenna has an extended resonance dipole driver which is said to be effective across the entire UHF band. Mounts are "cycloc" insulated and aluminum alloy tubing insures a rigid structure and a protective conducting coating prevents corrosion, as stated in the announcement by the manufacturer. Jerrold.

TRANSCIVER TESTER



227

An in-circuit transceiver test instrument for two-way service technicians permits normal antenna connections during tests, it is said. Testing facilities include measurement of RF power output, relative field strength, standing wave



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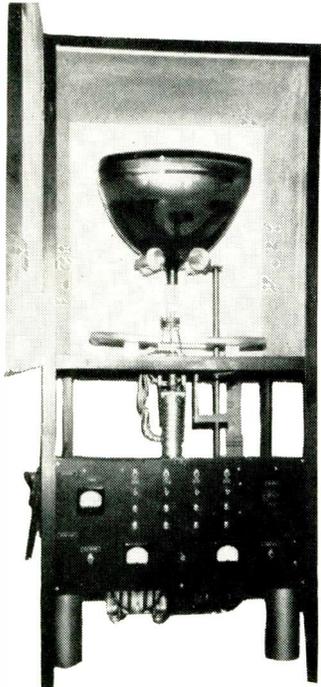
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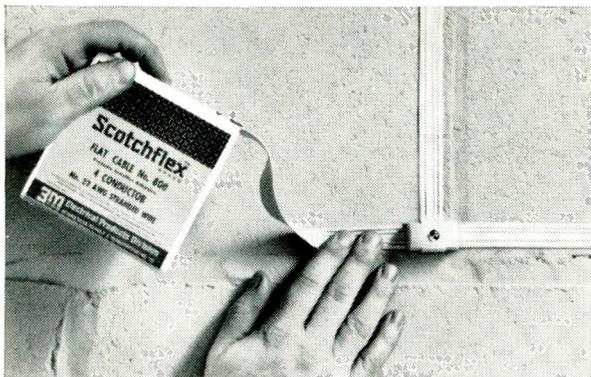
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NEW PRODUCTS

ratio, percent modulation and relative crystal activity. The device generates a crystal controlled RF signal, modulated audio and 1 kc audio signal. A 9-v battery and 30-in. telescoping antenna is included. Lafayette.

DUAL HORN



conventional horns combines the outstanding dispersion characteristics of a rectangular horn with the power producing advantages gained in using two drivers, the manufacturer says. LTV University.

228

A dual horn driver trumpet comprised of two horn sections forming one rectangular shaped bell with each section being driven by its individual driver is announced. This departure from

COMMUNICATIONS KIT

Designed to provide instant two-way radio communications, a self-contained communications kit has been introduced. Each kit contains two hand-held transceivers

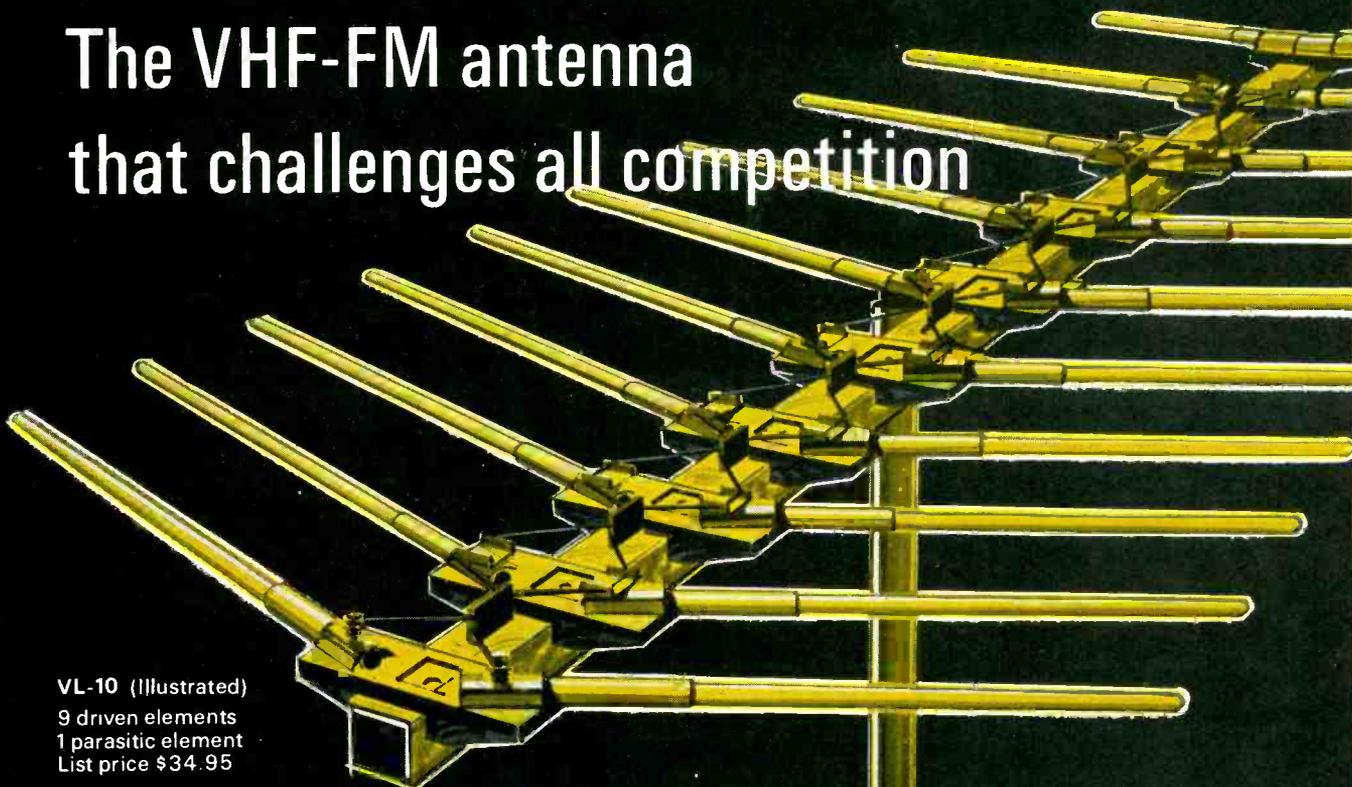


with rechargeable nickel-cadmium batteries, leather carrying case and flexible, 11 in. fiberglass antennas, plus two extra rechargeable batteries. The transceivers are FCC type accepted for the 25 to 50 Mc range in the Public Safety, Industrial or Land Transportation radio services. Although self-sufficient in hand-held applications, the kit can also be used along with an existing system for communicating with mobile or base station units. An accessory mobile clamp-on antenna and antenna adapter also permits the unit to be used in a mobile installation. It was said that the set had been approved by the U. S. Department of the Interior, Bureau of Mines as safe for operation in hazardous areas where explosive gases are present. E. F. Johnson.

229

with rechargeable nickel-cadmium batteries, leather carrying case and flexible, 11 in. fiberglass antennas, plus two extra rechargeable batteries. The transceivers are FCC type accepted for the 25 to 50 Mc range in the Public Safety, Industrial or Land Transportation

The VHF-FM antenna that challenges all competition

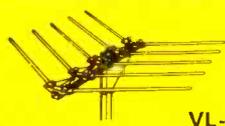


VL-10 (Illustrated)
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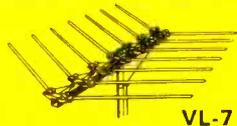
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VL-18

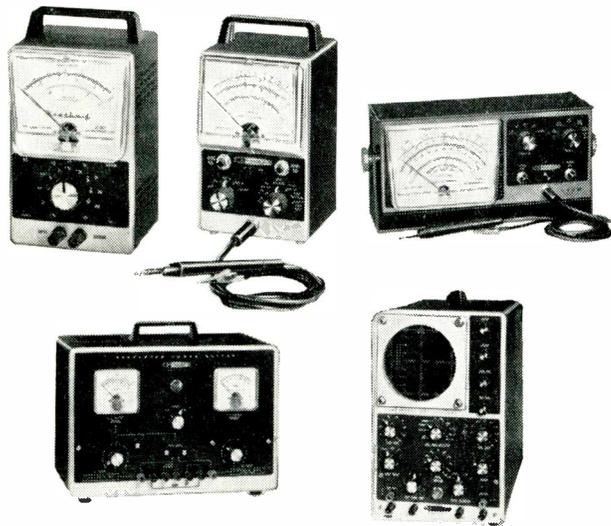
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Heathkit IM-11 VTVM... World's Largest Selling VTVM!

• 7 AC (RMS & Peak to Peak), 7 DC, 7 Ohms ranges • Wide frequency response ± 1 db, 25 cps to 1 mc • Easy-to-read $4\frac{1}{2}$ " 200 UA meter • 1% precision resistors • Single AC/Ohms/DC probe with switch.

Kit IM-11, 5 lbs... \$24.95 Assembled IMW-11... \$39.95

Heathkit IM-13 "Service Bench" VTVM!

• 7 AC, 7 DC, 7 Ohms ranges • Separate 1.5 & 5 v. AC scales • ± 1 db, 25 cps to 1 mc • Large 6" 200 UA meter • Tilts to any angle • 1% precision resistors • Single AC/Ohms/DC probe with switch • Mounts anywhere.

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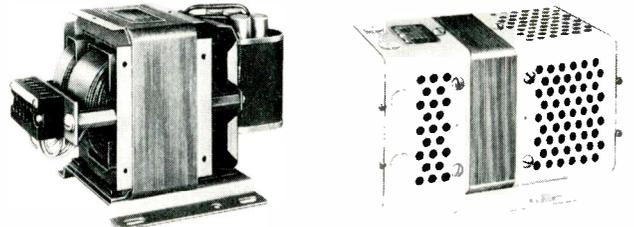
- - - for more details circle 30 on post card

NEW PRODUCTS

VOLTAGE STABILIZER

230

A line of constant voltage stabilizers incorporates the latest in core techniques and improved insulation materials, it is claimed. The ferroresonant transformer employs a capacitor terminated control winding on the secondary portion of the core which induces flux saturation confined by a magnetic shunt to the secondary



portion of the core. The manufacturer indicates that the stabilizers have a semi-square wave output, which it is contended, lends itself to more effective filtering, with less ripple, when used as a regulated supply source to solid state rectifiers for a direct current power supply. Available in ratings from 30 VA through 5000 VA; all standard input voltage ranges with stabilized outputs of 120, 240, 480 v. Acme.

... SERVICING TOPSIDE

Continued from page 51

can be sealed up again with a hot soldering iron. Be careful not to burn holes in the plastic so moisture can enter. Drill out the rivet in metal units and reassemble with a small machine screw, lock-washer and nut.

Special Boosters

Since the TV field is now UHF conscious, a few UHF topside boosters are now on the market. These units are generally transistorized. A UHF unit is shown in Fig. 8. When trouble develops in these units — defective transistors or tuned cavities — it is best to send them back to the factory for repair.

Before the topside booster is to be taken back to the owner and installed, check the unit on a TV receiver. Find a weak UHF TV signal and see if the booster amplifies it. Bypass the booster with another lead-in wire and compare the amplified signal with the direct signal. Of course, if there's man-made interference, this interference will be amplified in the picture. It is wise to place the topside booster above the noisy area and amplify the TV signal for a higher signal-to-noise ratio.

When the booster is being installed on the mast, check the TV antenna. Be sure there are no loose elements. Check the lead-in for bad spots. If the lead-in is over five years old, replace it. Be sure the antenna mast is grounded. Inspect the guy wires and tighten the turnbuckles, if necessary, while on the roof.

Continued on page 99

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ADVANCED SERVICING TECHNIQUES, 2nd Edition

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HOW TO LOCATE AND ELIMINATE RADIO AND TV INTERFERENCE

by Fred D. Rowe

This completely revised and up-to-date book contains the latest techniques for locating and eliminating radio and TV interference. The latest electronic components are discussed at length, and their applications analyzed. Extremely practical in its approach, this book tells you what to look for, what to do and how to do it. 168 pages, illustrated, paper—\$2.90.

REPAIRING TRANSISTOR RADIOS

by Sol Libes

Presents methods for the repair of transistor radios. Includes basic transistor theory transistorized circuitry, design and superheterodyne radio receiver principles. Cover step-by-step procedures, trouble check points, charts, test equipment and tools. 159 pages, illustrated, paper—\$3.50.

HOW TO SERVICE TAPE RECORDERS

by C. A. Tuthill

Gives you complete information on tape recorder repairs. Contains lucid discussion on the basic principles of magnetic recording, tape recording, mechanisms, circuitry and troubleshooting procedures. Explains the tape recorder and its operations with many fine illustrations. 160 pages, illustrated, paper—\$2.90.

ITS EASY TO USE ELECTRONIC TEST EQUIPMENT

by Larry Klein and Ken Gilmore

Various techniques for using electrical and electronic test instruments are completely explained in this up-to-date book. An extremely wide range of test instruments are covered, from very simple VOM to the distortion analyzer and oscilloscope.

More than 100 illustrations provide a full grasp of the test instruments and their various applications. 192 pages, illustrated, paper—\$4.00.

MODERN ELECTRONIC VOLTMETERS

by Sol D. Prenskey

This text will provide a thorough understanding of modern electronic voltmeters. It first reviews fundamental principles of the basic instrument, then covers the well-established, service VTVM and transistor voltmeter test procedures. The author also investigates, in detail, the more advanced voltmeters used in shop, industrial and scientific work. Many examples of testing are covered for radio and television applications and industrial electronic systems. 224 pages, 5½ x 8½, illustrated—\$4.95.

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by Rufus Turner

This brand new, two-volume handbook, introduces the oscilloscope and explains its applications—without using technical jargon—for technicians, radio operators, servicemen and hobbyists.

The first volume covers operation principles, structure and characteristics of the instrument. In addition, step-by-step instructions explain general tests and measurements in current, frequency, phase and specialized applications, such as receiver and transmitter testing. Vol. II clearly explains specific tests and measurements. The book avoids theory wherever possible and uses simple diagrams instead of detailed circuits. 240 pages, illustrated, paper—\$5.90, cloth—\$6.95.

MATHEMATICS FOR ELECTRONICS AND ELECTRICITY

by National Radio Institute Staff

Beginning with a complete review of arithmetic, the book progresses through algebra, trigonometry, Boolean Algebra, and the binary number system. It relates every topic to its electronics applications such as finding resistor tolerance with percentages, and solving complex vector problems with trigonometry.

There are several other valuable sections which help you to save time in setting up equations, simplifying a-c and d-c circuit calculations, constructing and applying many types of widely used graphs, etc. Example problems throughout are worked out in detail. 256 pages, illustrated, paper—\$3.95, cloth—\$5.60.

HOW TO TROUBLESHOOT TV SYNC CIRCUITS

by Ira Remer

A practical, valuable book which covers the many variations in monochrome and color television sync circuits and possible troubles that might occur in them. Discusses fundamentals of sync circuits, takeoff, clipping, limiting, noise cancellation and time consultants. The section on output circuits includes integration and horizontal circuit signals. 128 pages, illustrated, paper—\$2.90.

HOW TO READ SCHEMATIC DIAGRAMS

by David Mark

Of particular use to beginners in the field of electronics, this compact volume covers all the essential symbols and abbreviations used in schematic diagrams for electronics work. Thoroughly practical in approach, it progresses in easy-to-understand stages from individual components right up to complete receivers and similar equipment. All major components and circuits are identified and explained, including C-C and A-C circuits, electronic equipment power supply circuits, and audio amplifier circuits. Of special interest is the section on interpreting complete schematics for radio and tv circuits. 160 pages, 5½ x 8½, illustrated, paper—\$3.50.

HOW TO USE GRID-DIP OSCILLATORS

by Rufus P. Turner

Deals with the construction and use of this versatile instrument as well as its application to all kinds of radio and television receivers. Chapters include: Principles and Circuits; Grid-Dip Adaptors; Resonant Circuit Measurement; Capacitance Measurements; Inductance Transmitter Applications; Antenna and Transmission-Line Tests; Applications; Commercial Grid-Dip Oscillators. 112 pages, illustrated, paper—\$2.50.

HOW TO SERVICE UHF TV

by Allan Lytel

Explains some of the peculiarities and special characteristics of uhf, so that the serviceman will have no trouble with its trouble-shooting. First, the book treats the general characteristics of uhf signals and then discusses in detail essential equipment features, uhf tuner and converter circuitry, special uhf channel strips and completely illustrated, step-by-step servicing procedures for different uhf tuners and converters. 127 pages, 5½ x 8½, illustrated, paper—\$3.50.

METALLIC RECTIFIERS AND CRYSTAL DIODES

by Theodore Conti

In comprehensive style, this book presents basic information for understanding and applying these components with sure results. Discussion includes construction of metallic rectifiers and crystal diodes, their characteristics and notation, basic design data, applications, troubleshooting, repair and replacement. 164 pages, illustrated, paper—\$3.50.

LASERS AND MASERS

by Stanley Leinwoll

In his new book, the author introduces a fascinating area of technology. He clearly explains what lasers and masers are, how they work, and what they can be made to do in the future. Mr. Leinwoll begins with the development of the maser. Then he discusses the ruby, gas and injection laser with applications to medicine, biology, chemistry, weapons systems and communications. The last chapter discusses the various lasers that are commercially available, as well as some of their component parts. Includes information of do-it-yourself kits. 96 pages, illustrated, paper—\$1.95.

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**ELECTRONIC
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Magazine

OJIBWAY BUILDING,
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NEW PRODUCTS

SERVICE CARTS

231

A heavy duty service cart is designed for easy movement of tools, equipment and finished goods from



one place to another. Available with handy drawers which can be locked and with an 18 x 30 in. or 24 x 36 in. tray size. Bay.

PLASTIC TWEEZERS

232

A glass-filled plastic tweezers makes an ideal tool for TV-radio technicians and all electronics

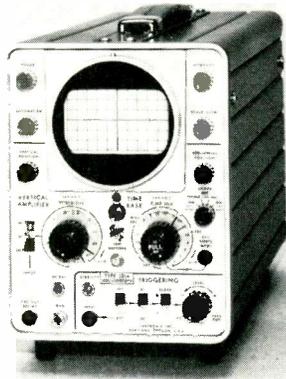


workers. It is noncorrosive and resists acetone and alcohol, etc. Designed with flat or pointed tips. Hagenlocher.

PORTABLE OSCILLOSCOPE

233

A portable oscilloscope for field or laboratory applications is announced. The type 321 A is 5¾ x 8¼ x 16 in. and weighs 18 lb. It operates from 4 to 4½ hr on internal rechargeable batteries (recharging circuit), from any dc source of 11.5 to 35 v, or from any common ac source, 50 to 800 cps, the report states. Passband is dc to 6



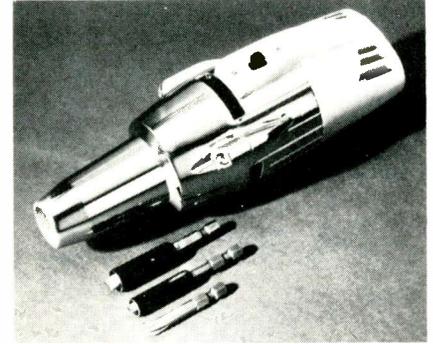
Mc, and maximum calibrated sensitivity is 10 mv/¼ in. div. A wide range time base provides calibrated sweep speeds to 0.5 μ sec/div; a X5 magnifier extends this sweep to approximately 0.1 μ sec div. Tektronix.

ELECTRIC SCREWDRIVER

234

An electric screwdriver is designed to drive number 4 through number 12 slotted-head and Phillips-head screws. A positive clutch controls the tool's driving power. The device uses a high 100-1 ratio reduction gear to convert the motor's power to a slow, driving force. The

tool's 3.0 amp motor is controlled by a momentary ON/OFF switch, located on the side of the housing. A separate reversing switch on the

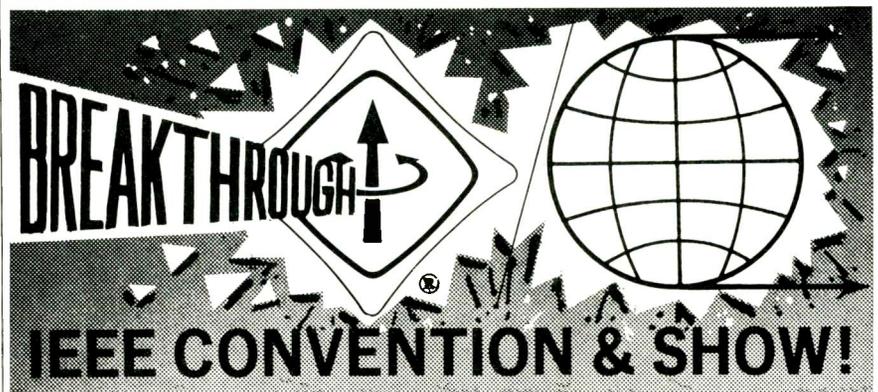


rear of the housing gives instant control for screw removal and driving screws and bolts with left-hand threads. Weight is about 2½ lb. Price \$29.95. Portable Electric Tools.

DOT BAR GENERATOR

235

A television dot bar generator for producing selected patterns on a TV CRT is announced. This generator provides patterning for TV systems with scanning rates of 525 to 945 horizontal lines. An output



March 22-26, 1965

ELECTRICAL-ELECTRONICS

- ◆ Exhibit hours (4 days): Monday & Thursday, 9:45 a.m.-9 p.m.; Tuesday & Wednesday, 9:45 a.m.-6 p.m.
- ◆ Technical sessions (5 days) 10 a.m.-5 p.m. (Hilton, Tuesday to 10 p.m.)
- ◆ 80 subject-organized technical sessions presenting 400 vital "break-through" papers.

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◆ Registration: \$2.00 IEEE Members, \$5.00 Non-members. High School students admitted Thursday afternoon only, \$2.00 if accompanied by an adult (not over 3 per adult).



NEW YORK COLISEUM and the NEW YORK HILTON

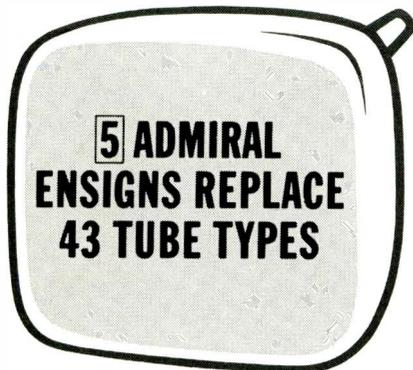
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How to cut inventory, increase profit on picture tubes!



Save space, save dollars! Reduce your basic tube inventory to the 5 Admiral Ensigns. They replace 43 different tube types.

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ENSIGN 21AMP4A REPLACES	21ACP4 21ACP4A 21AMP4	21AQP4 21AQP4A 21CUP4	21BSP4
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ENSIGN 21CBP4A REPLACES	21FLP4 21ALP4 21ALP4B 21ANP4 21ANP4A	21ATP4 21ATP4A 21ATP4B 21BAP4 21BNP4 21BTP4	21CBP4B 21CMP4 21CVP4 21CWP4 21DNP4 21CBP4
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ENSIGN 24CP4A REPLACES	24ADP4 24CP4 24QP4	24ATP4 24VP4 24VP4A	24XP4
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ENSIGN 24AEP4 REPLACES	24DP4A 24YP4	24ANP4 24ZP4
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NEW PRODUCTS

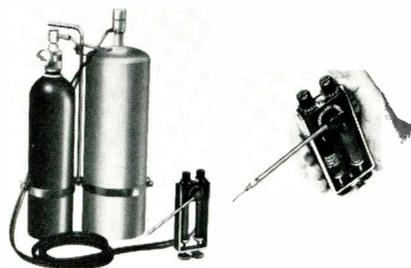
selector switch provides either positive or negative polarity. Front panel controls are also provided for



adjusting the thickness and number of horizontal and vertical bars or dots. The unit is designed for checking TV system linearity and is used with a linearity test pattern. Cohu.

GAS WELDING TORCHES 236

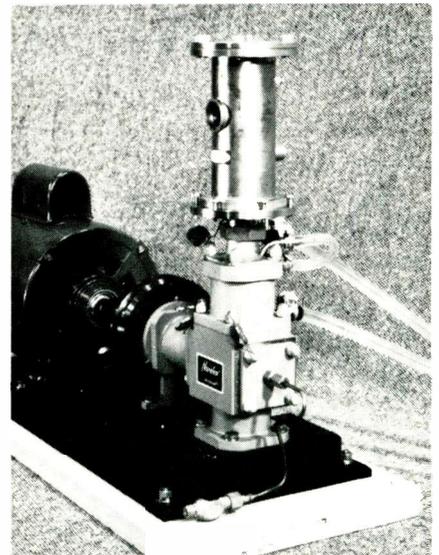
A gas welding torch, available as a self-contained miniature set or as a larger capacity set, is an-



nounced. The miniature set uses two small compressed gas cartridges (oxygen and LP gas) to produce a welding flame of over 5000° F. It is used for lightweight welding, brazing and soldering. The larger set consists of the miniature set, plus large capacity oxygen and LP gas tanks, valves, hoses and adapters. Microflame.

HIGH POWER LASER 237

A CW semiconductor laser which operates on household current is announced. The unit weighs 45 lb and has its own closed cycle cooling system. The RSL4 delivers an output of up to one-half watt of continuous power at a wavelength of



8400 Å in the infrared region. Operating temperature of 30° K is achieved with a closed-cycle cooler driven by a 1/2 hp electric motor. Ordinary tap water is employed in the heat exchanger for the cooler. Raytheon.

ADJUSTABLE TIMER 238

A timer with a time delay relay, an adjustable dial and progress pointer is introduced. The timer, designated as series 5, has automatic reset and is rated 20 amp at 115 or 230 vac. Times: 15, 30, 60 and 120 sec. Bristol.

TUNING FORK OSCILLATOR 239

A tuning fork oscillator for timing and control purposes in military and industrial equipment is in-



roduced. The output of type FS-11 is a limited sine wave of 3 v P-P min into 30k Ω. Standard input voltage is 28 vdc with units of lower input available. The unit is in a flat can 1 1/2 x 1 1/2 x 3/8 in., with a 6 pin termination for circuit board applications. Operating temperature is -5 to 85° C and it weighs 1 1/2 oz. Bulova.

ADVANCED SERVICING TECHNIQUES, Volume One. By Paul B. Zbar and Peter W. Orne. Published by John F. Rider Publisher, Inc. 298 pages, hard cover. \$8.25.

This comprehensive book contains well organized information on TV troubleshooting methods and procedures. An abundant amount of theory is integrated with the servicing material. The authors treat the color set as a black and white receiver to which specialized color circuits have been added. The receiver is presented as a system of related functional sections that must be individually analyzed. Trouble symptoms arising in each section are presented with procedures for finding the defects they represent. Each section is fully illustrated with representative circuit diagrams. The color circuits are thoroughly explained with the aid of many illustrations. A complete chapter is devoted to transistorized TV sets. Every segment of a TV receiver including the tuner, video IF, video amplifier, sweep circuits, sync portion, sound and chroma channel is fully explained. Test equipment used in troubleshooting and aligning each section is also examined. This book, ideally suited for both the advanced student and the working technician, provides valuable information for understanding and servicing color and B/W receivers. It can be a very valuable addition to any technical library.

HOW TO SERVICE UHF TV. By Allan Lytel. Published by John F. Rider Publisher, Inc. 127 pages, soft cover. \$3.50.

This book covers all phases of UHF and provides technicians with an adequate theoretical background for doing practical UHF work. General UHF signal characteristics are covered in detail at the beginning. Transmission lines, antennas, converter and tuner circuits, tuner strips and single-channel converters are detailed. Tuner and converter servicing take up two chapters. Schematics, photos and drawings are used liberally to clarify the text

material. This book can prove helpful to those who work in UHF telecasting areas.

A PROGRAMMED COURSE IN BASIC ELECTRONICS. By the staff of Electrical Technology Department, New York Institute of Technology. Published by McGraw-Hill Book Company. 416 pages, soft cover. \$6.95.

This book is the second in a series of three volumes developed by

faculty members of the Electrical Technology Department of New York Institute of Technology. The unique method of presenting information — called “programmed” learning — offers the student a logical method of study. The major portion of the text is in the form of questions about electronics. The reader analyzes each question before answering. The answer is printed before the start of the next question. In describing, for example, a certain circuit function the text will pose questions in organ-

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Fading dull picture tubes bounce back pronto with Perma-Power Briteners

Give new life, new brightness to aging picture tubes—and watch your customer's confidence in you bounce back, too, when you sell a \$4.00 britener instead of a \$70.00 tube. (Then you're a cinch for the tube sale later.)

It's easy with Perma-Power's **Tu-Brite**. Handsomely packaged for instant acceptance, color-coded by base type for instant selection. The right voltage is assured. With Tu-Brite, *if the base is right, the boost is right*. Make sure you have all three models in stock.

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ized sequence enabling the reader to understand every phase of the operation. With the addition of simplified diagrams, electronic theory is astutely presented. Additional theoretical information is supplied in the form of panels, containing descriptive text, scattered throughout the book. These panels offer the reader an explanation of some of the more difficult theoretical questions. This book, in our opinion, offers the new electronics student an interesting approach to the subject. It is also must reading for TV technicians who desire to brush up on basic electronic circuitry.

RCA RECEIVING TUBE MANUAL, RC-23. *Published by Electronic Components and Devices, Radio Corporation of America. 60 pages, soft cover. \$1.25.*

This edition of the receiving tube manual has been expanded to 60 pages. The technical data section is restricted to detailed coverage of active RCA receiving tubes. Renewal and discontinued types are combined for easy reference in a 50-

page tabular section. The application guide for receiving tubes has been revised to include 42 specific function classifications. In addition, data is provided for picture tubes for monochrome and color TV receivers, voltage-regulator and voltage-reference tubes. Other features include text chapters, circuits section and resistance-coupled amplifier design charts.

NEW LITERATURE

ENCODERS AND DECODERS 300

A group of four brochures contain specifications and special features for a line of selective signaling devices. Reach.

CB CRYSTAL CHART 301

A four page booklet features a crystal interchangeability chart for CB equipment. The booklet also

lists the National CB Standard 10 Codes. Semitron.

HV CAPACITORS 302

A four page brochure gives design and rating information on a line of high voltage capacitors. Aerovox.

PANEL METERS 303

A 20-page bulletin lists specifications and prices for over 1300 types of panel meters. Also includes information on shunts, current transformers and multipliers. Simpson.

MASTER TV SYSTEM 304

This 16-page booklet describes equipment used in a master antenna system. Equipment described includes amplifiers, converters, sound inserters, filters, traps, matching transformers and mixers, plus a full line of distribution equipment. The material listed in this book can be used for distribution systems in

great profits



that's about the size of it

Microminiaturization has come to cartridge design in the new Sonotone Micro-Ceramic[®] Cartridge — a king-sized profit-maker in a tiny case. This remarkable new cartridge updates to 1965 performance almost any phonograph using a ceramic cartridge produced within the past 20 years.

The Sonotone Micro-Ceramic Cartridge embodies all the advantages of miniaturization and light weight. Designed for low mass, lightweight tonearms — it weighs less than 1 gram (without bracket). Superb stereo performance is assured by — high compliance; ability to track at the low forces required by today's modern record changers; excel-

lent separation and a smooth, clean response over the full audio range. To top it off, all Micro-Ceramic cartridges are equipped with the virtually indestructible Sono-Flex[®] stylus. For ease of installation, three different standard mounts are available.

Four Micro-Ceramic cartridges cover all of your replacement needs; the "27T," a high capacitance model for transistorized phonographs; the high compliance "25T" for deluxe stereo units; the "26T" and "28T" for replacement in a wide range of popularly priced phonographs.

For comprehensive Cartridge Replacement Guide, write:

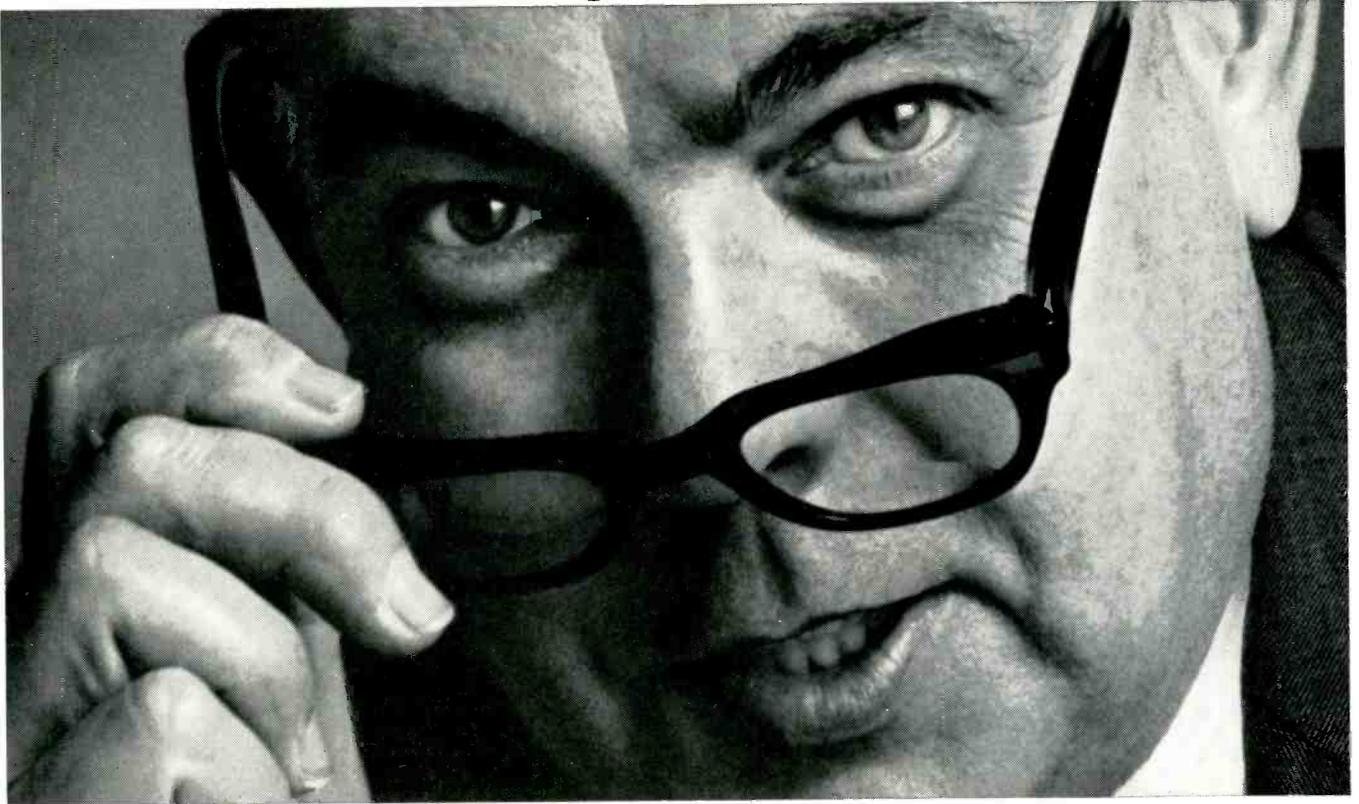


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Save hours and minutes! Save dollars and cents!

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PITTSBURGH— CLEVELAND	13	2 hrs. 55 min.	1.80	2.05	2.40
INDIANAPOLIS CHICAGO	10	4 hrs. 15 min.	1.90	2.20	2.55

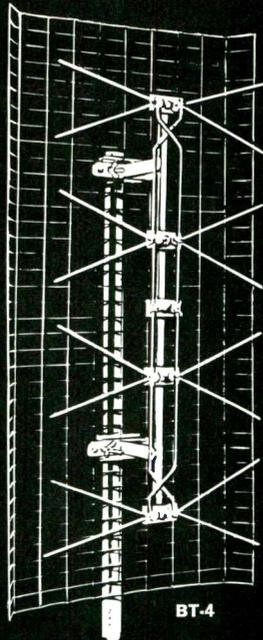
*Other low rates up to 100 lbs.



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UHF ANTENNAS
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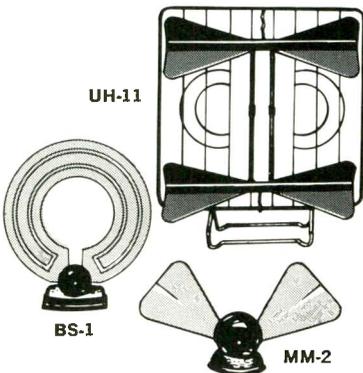
BT-4

OUTDOOR ANTENNAS...

BT-4—Four-bay model, solidly assembled and wired. Engineered with outstanding high gain and excellent front and back ratio. ALL ALUMINUM Front with unitized screen reflector. Has optimum line-matching on all UHF Channels. Ideally suited for best color and black-and-white reception. Considered the best by those who know.

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BT-1—Single-bay model, as above.



UH-11

BS-1

MM-2

INDOOR ANTENNAS — Uniquely designed to blend with current room decor ... requiring minimum space for a maximum of reception perfection.

UH-11—Two black "bow ties" set off by attractive golden grid, both durably finished. Attaches to back of any TV set. Clear, sharp reception assured.

BS-1 and MM-2—Two attractive units with wide adaptability. Economically priced to stimulate sales in both the new and old UHF market. Ideal for promotional type selling.

Dept. ET2

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NEW LITERATURE

hotels, motels, apartment houses, schools, dealer showrooms and homes. Jerrold.

CAPACITORS 305

This 28-page handbook contains physical and electrical characteristics of molded and dipped mica capacitors. Arco.

RELAY SPECIFICATIONS 306

Specifications and dimensions of a line of relays are contained in this 50 page catalog. Descriptions of time-delay, plug-in, power, latching and snap action relays are included. Magnecraft.

SHOP EQUIPMENT 307

A line of steel shop equipment and shelving is described in a 36 page catalog. Bay.

VIBRATOR REPLACEMENTS 308

This eight page guide contains a listing of vibrators used in two-way communications equipment. Listings are referenced to manufacturers name, and part number. Cornell-Dubilier.

MOTORIZED WINCH 309

Bulletin describes features on a motorized winch for crank-up antenna towers. Rohn.

POWER TRANSISTORS 310

A six page guide contains a selection chart and cross reference guide for about 1000 power transistors. Motorola.

WIRE/CABLE/SWITCHES 311

Ordering information and technical data on wire, cable, switches and electronic hardware are included in a 32 page catalog. Daburn.

CAPACITORS 312

Electrical characteristics and

performance data for a line of electrolytic capacitors especially designed for use in transistorized circuitry are contained in this six page brochure. Mallory.

METROPOLITAN ANTENNA 313

This four page brochure contains theoretical descriptions and performance ratios of a metropolitan VHF/FM antenna. Channel Master.

TIME DELAY RELAYS 314

Complete engineering specifications, wiring diagrams and operating characteristics of time delay relays are included in a 12 page catalog. Potter and Brumfeld.

CRYSTALS 315

A complete line of crystals for various frequencies is described in an eight page catalog. Texas Crystals.

STEREO PHONOGRAPHS 316

An illustrated book introduces a line of stereo Hi Fi phonographs. The book contains 30 pages of color illustrations which contribute to its usefulness as a sales aid. Sylvania.

MICROPHONES 317

A one page bulletin describes both general and electrical specifications for a series of communication microphones. Euphonics.

ELECTRONIC COMPONENTS 318

A 22 page catalog covers a line of electronic component parts for replacement use. Oneida.

FM/STEREO ANTENNAS 319

An eight page brochure contains gain charts, polar patterns and technical descriptions of a line of FM/Stereo antennas of the log periodic design. The brochure also lists a number of antenna accessories. JFD.

CB MICROPHONE 320

This data sheet lists specifications

MORE EXCITEMENT FROM QUAM!



New Quam Multi-Tap Speakers in 5"x7", 6"x9", and 4"x10" sizes. Taps for 10, 20, and 40 ohm impedances.

QUAM

**you can easily handle
any auto radio
speaker replacement**

**with Quam speakers and rear seat kits —
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Eight speaker *sizes* handle virtually any auto radio replacement—but size alone is not enough. You need the right voice-coil impedance—and QUAM has it! Choose multi-tapped models for stocking convenience; or, for specific applications, one of the 25 Quam *exact* replacements. (In addition, any Quam speaker may be special-ordered with any voice-coil impedance for an extra \$1.00 list. This service is a QUAM exclusive.)

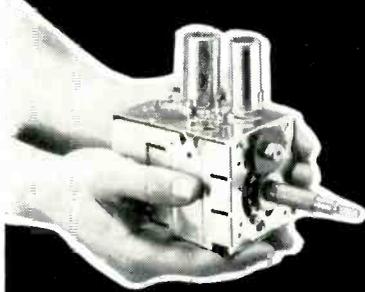
Write for your free copy of the Quam Auto Radio Speaker Replacement Guide, which gives you complete replacement information on front and rear seat speakers for auto radio models from 1955 to 1963.

QUAM-NICHOLS COMPANY, 234 EAST MARQUETTE ROAD, CHICAGO, ILLINOIS 60637

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Simply send us the defective tuner complete; includes tubes, shield cover and any damaged parts with model number and complaint. Your tuner will be expertly overhauled and returned promptly, performance restored, aligned to original standards and warranted for 90 days.

UV combination tuner must be single chassis type; dismantle tandem UHF and VHF tuners and send in the defective unit only.

Exact Replacements are available for tuners unfit for overhaul. As low as \$12.95 exchange. (Replacements are new or rebuilt.)

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CANADA: 136 Main Street, Toronto 13, Ont.

*Major Parts are additional in Canada

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NEW LITERATURE

and a frequency response curve for a citizens band microphone. American Microphone.

ANTENNAS 320

This 16-page brochure contains comprehensive performance information on a broad range of antennas designed specifically for military use and civilian emergencies. Sylvania.

CERAMIC SPEAKER 321

This bulletin contains pictures, product information and detailed specifications on a coaxial type speaker with a ceramic magnet. Specifications on a series of commercial type speakers are also included. Oxford.

RESISTOR KIT 322

A kit containing two resistors, a thermistor and a varistor, used

in color TV sets is described in a one page bulletin. Workman.

REPLACEMENT CARTRIDGES 323

A replacement chart cross-references a line of six replacement crystal cartridges with 146 popular types.

CABLES 324

A 33-page catalog describes and illustrates a wide variety of power, apparatus and control cable. Continental Wire.

WIREWOUND RESISTORS 325

A booklet gives complete electrical and physical specifications of a line of wirewound resistors. Engineering data and purchasing information are also included in the catalog. Precision Resistor.

LEAK DETECTION 326

A number of interesting articles on ultrasonic leak detection are contained in this four-page bulletin. Future issues of the monthly publication will include comments from readers and descriptions of experiences in the maintenance of pressurized cable systems. Delcon.

CB TRANSCEIVER 327

A brochure describes the Globe President VIII, a citizens band transceiver. GC Electronics.

MOBILE ANTENNAS 328

This 34-page catalog contains descriptions of a group of mobile communications antennas for a number of frequency ranges. Antenna Specialists.

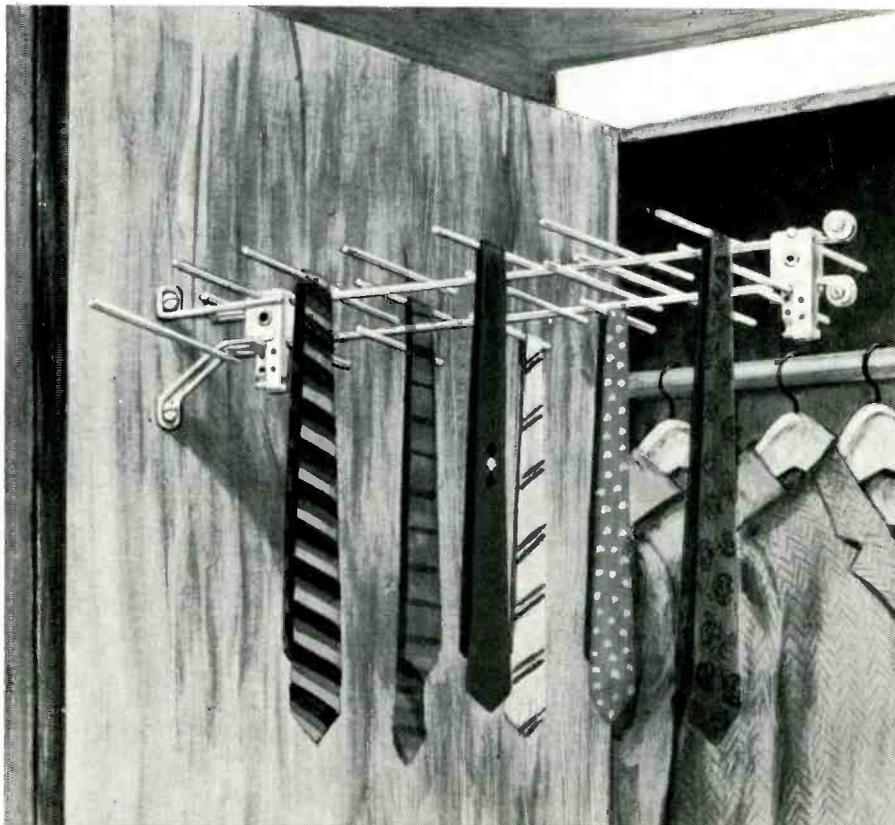
CAPACITORS 329

Electrical characteristics of a line of snap-in electrolytic capacitors are described in this brochure. Mallory.

CB TEST EQUIPMENT 330

This 12-page brochure includes basic specifications and prices on frequency meters, signal generators portable test sets, ac and dc voltmeters, tone and pulse generators, wattmeters and other equipment. Motorola.

The Golden Dart is the world's finest outdoor UHF antenna. It uses the Periodic design principle to deliver peak performance on all channels. For the finest indoor UHF antenna, use the Blonder-Tongue Golden Arrow. Blonder-Tongue, Newark, N.J. 07102



Nearly everybody uses the Blonder-Tongue UHF Golden Dart

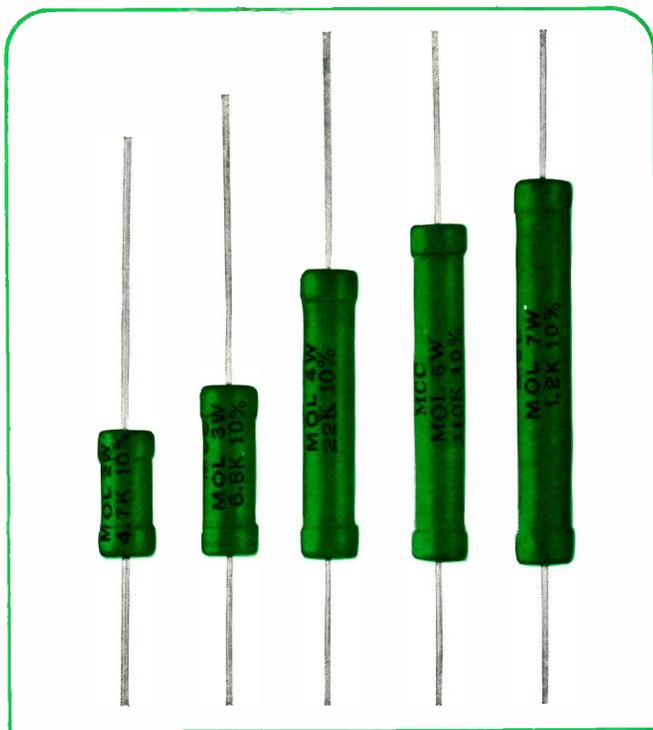
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Tips for Technicians

Mallory Distributor Products Company
P.O. Box 1558, Indianapolis, Ind. 46206
a division of P. R. Mallory & Co. Inc.

What you should know about film resistors



If you've been looking inside some of the recent model television sets, chances are that you've noticed some unusual-looking resistors. Especially in the sizes readily identifiable as under 10 watts. You'll probably find them in spots where you're used to seeing small wirewounds.

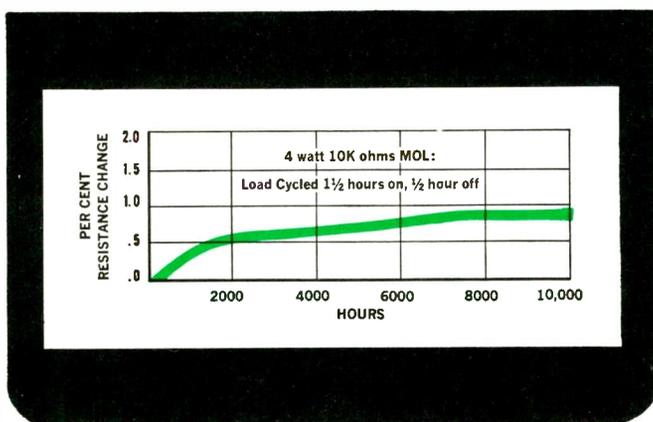
There's a good reason. These are metal oxide film resistors. And the reason they're making such a hit is that they have as good stability and life as wirewounds—but they cost only about half as much in most values.

What's different about them?

First, they're made differently. A thin layer of tin oxide is evaporated onto a high quality ceramic rod, at high temperatures. A spiral groove is then cut, by a highly precise automatic machine, to produce a resistance path with the desired ohmic value. Then the end connections are applied and the whole works gets a coating of silicone finish. You can get a lot higher resistance values, size for size, than with wirewounds, because you're not limited by the problems of winding hair-thin wires. Top resistance for the 4, 5 and 7 watt sizes is 120,000 ohms; for 2 and 3 watts, 56,000 ohms. Standard tolerance is 10%.

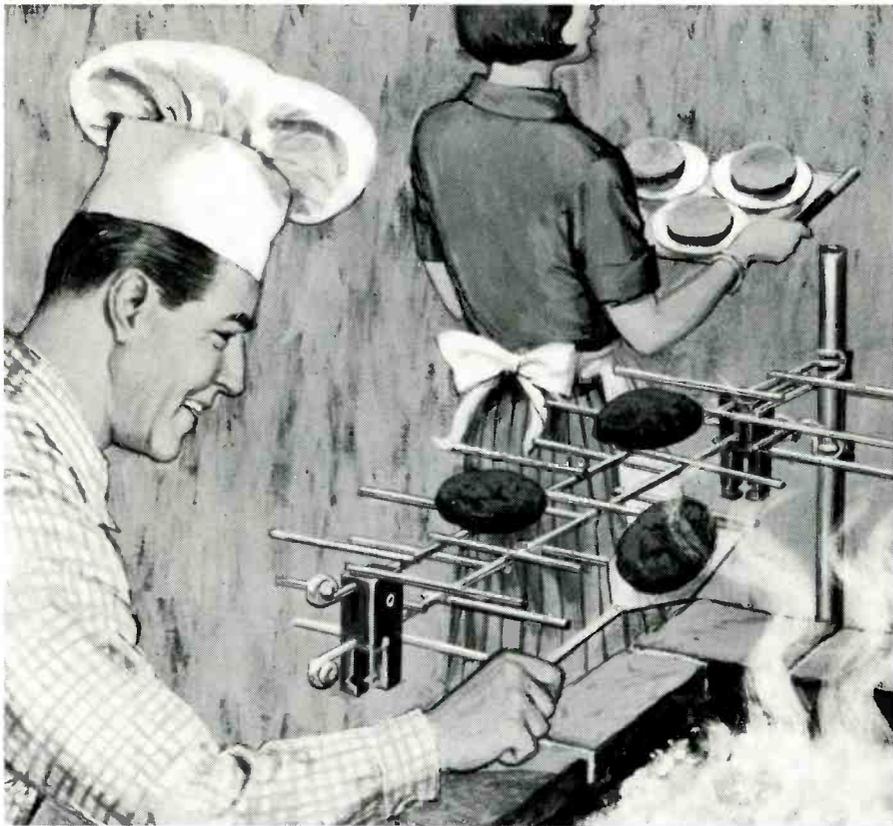
Second, they behave differently. Their stability is really terrific. We've run them with on-off load cycling for 10,000 hours and measured changes of less than 1%. They'll take heavy brief overloads without damage, aren't bothered by humidity or vibration. And they're noninductive up to 250 mc. The name to ask your Mallory Distributor for is the MOL film resistor. He has them in 2, 3, 4, 5, and 7 watt ratings, in popular resistance values. And when you need a higher wattage (up to 200 watts) ask him for Mallory vitreous enamel resistors—you can't beat them for cool operation and stable life.

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Typical stability test data: 10,000-hour load cycling test. Average resistance change is less than 1%!

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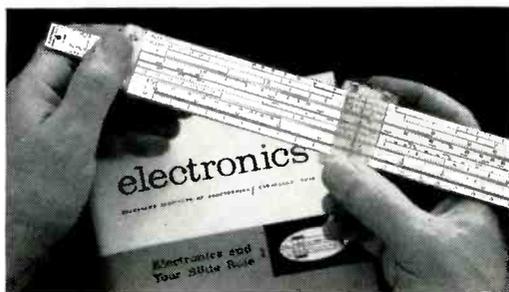


nearly everybody uses the Blonder-Tongue UHF Golden Dart

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. . . NOISE FIGURE

Continued from page 67

UHF TV tuner service). These represent good economical choices, and are therefore the most common in daily usage. As the 10,000 micromho level is passed, prices rapidly increase as do equipment complications.

In general, a clean, straightforward approach will give the most stable, lowest noise amplifier. With special tubes which require large amounts of heater power, draw relatively large plate currents, and require special cooling considerations, circuits become expensive to fabricate and touchy to service. This is the price one has to pay, presently, for very low noise performance.

Any of the high gm tubes will run quite hot compared to a similar sized tube of low gm. This effect is associated with the large amount of electron emission necessary to achieve high gm. Since these tubes do run hot, their gm will deteriorate rapidly if they are not cooled by forced air and/or special sockets and heat-dissipating shields. In the case of one commercial converter at 108 Mc it was found that the W.E. 417A (5842) lost gm rather badly in only a week, operating in a field van environment. Replacing the tube shield with a I.E.-R.C. T6-1001 shield base and an I.E.R.C. T6-1015 shield extended this life to several months.

The great majority of commercial equipment uses a few tubes in a handful of circuits. For reasons probably more associated with tube manufacturer's suggested circuits than anything else, a given tube will generally be used in only one or two ways. There are many tales about how such-and-such a tube will not work in some circuit but suffice it to say that the man who developed the working circuit probably had similar feelings about *his* favorite for a few days too. Typical cases are the Hazeltine neutralized 6BQ7 cascode circuit and the 6CW4 coil-neutralized grounded cathode circuit. These circuits work to nearly their theoretical limits, but this does not mean that these circuits are the only ones that will work with the particular tubes. It *is* likely, however, that you will have a hard time improving on the commonly-used combinations. ■

. . . LESSON IN COLOR

Continued from page 60

purity. If the degausser remains energized, the screen will display a pattern similar to one caused by placing an operating degaussing coil near a set. The symptom will be an impure screen which in most cases will be more noticeable on a pure red screen than regular B/W or color programs.

A symptom that will be found most frequently in the thermal cut-out system will be an impure screen even though the thermal switch opens. The probable cause will be a bad thermal cutout which allows the switch to open too soon leaving the CRT magnetized.

The repair in both of the above cases is obvious. Other symptoms will also appear but the nature of the circuitry makes the trouble particularly easy to find. For example, impurity can be caused by one of two things: Either the degaussing network is not removing the magnetic field or the coil itself is causing the impurity. If the coil is causing the impurity, it can happen in one of two ways: Either the coil is remaining on too long or it is being turned off too soon (or too suddenly), leaving a magnetic field on the tube.

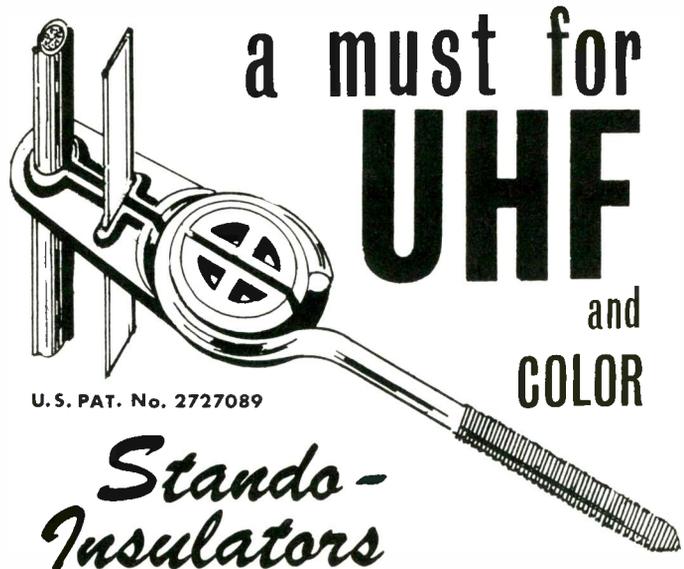
What is actually happening can be determined with the aid of a portable degaussing coil. First, with the set turned on, try to remove the impurity with the degaussing coil. If the impurity cannot be removed, it can be assumed that the degaussing coil is not being turned off and is remagnetizing the tube. As mentioned earlier, the effect of this is much like trying to operate the set with a regular degaussing coil near it.

If this trouble is suspected, the coil can be unplugged from the power supply and results noted. On the other hand, if the impurity is removed by using the external degaussing coil, it can be assumed that the coil is either not working or a magnetic charge is being left on the tube when the coil is turned off.

Troubleshooting

The current graph shown (Page 59) can aid in clarifying explanations.

Continued on page 98



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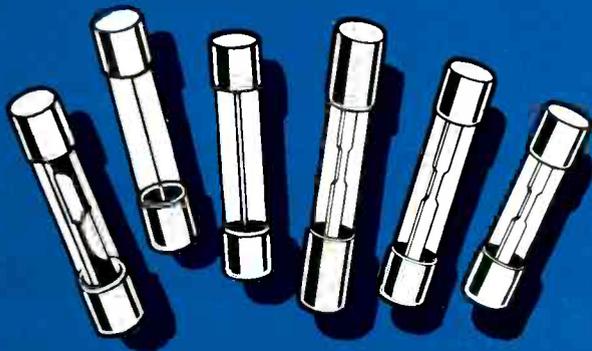


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the signals received by the antennas and feed them to antenna cables running the length of the tunnel ceiling. Leon R. Johnson, Chief Engineer for the bridge-tunnel, said that the new AM antenna will eliminate the annoyance motorists feel when they drive into a tunnel and their radios go dead.

New Antenna Plant

Antennacraft announces completion of a new manufacturing plant on their four acre site near Burlington, Iowa. The installation houses office facilities along with machines and equipment for plastics molding and aluminum tube rolling and one additional production line.

Johnson Overseas Deal

E. F. Johnson Company of Waseca, Minnesota, announced completion of export distributing arrangements with Roburn Agencies, Inc. of New York. As exclusive export distributors, Roburn will handle distribution of Johnson's communications, amateur radio, and selective paging equipment as well as its component line.

Blonder-Tongue Plant

Blonder-Tongue Labs recently began manufacturing operations in its fourth Newark plant, it is announced by Harry A. Gilbert, vice president and

BUSS : the complete line of fuses .

NEWS OF THE INDUSTRY

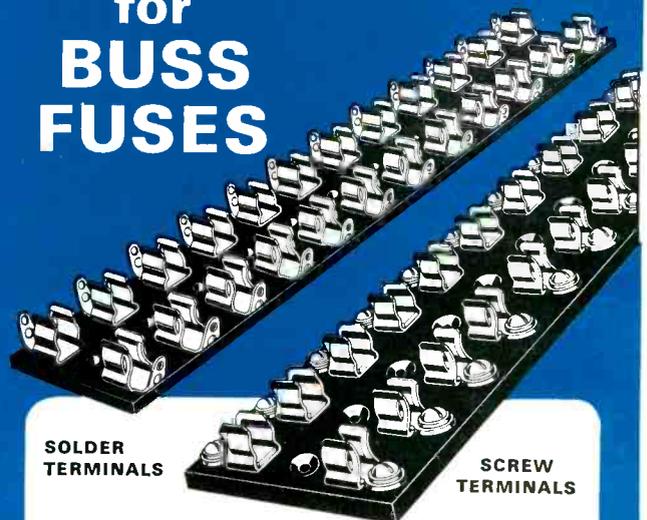
Admiral Fourth Quarter Sales

Fourth quarter sales in excess of \$70 million by Admiral Corporation surpassed 1963's \$62.3 million by a substantial margin and also topped the previous sales record of \$68.5 million established in the comparable quarter of 1952, Vincent Barreca, president, announced. Consolidated sales for the 1964 fiscal year exceeded \$236 million compared with slightly more than \$26 million reported in 1963. Heavy distributors' orders covering the first three months of 1965 indicate that first quarter sales will be sharply higher than in the same 1964 period, Mr. Barreca said.

Tunnel Radio Listening

The Chesapeake Bay Bridge-Tunnel became the first travel facility where motorists can listen to their car radio while driving through tunnels. Broadcast-band radio reception was added to the existing two-way shortwave system in the two mile-long tunnels. The 17.5 mile long bridge-tunnel, longest in the world, opened for traffic last April. The radio system consists of AM antennas mounted at each end of the tunnels and connected with amplifiers. The amplifiers boost

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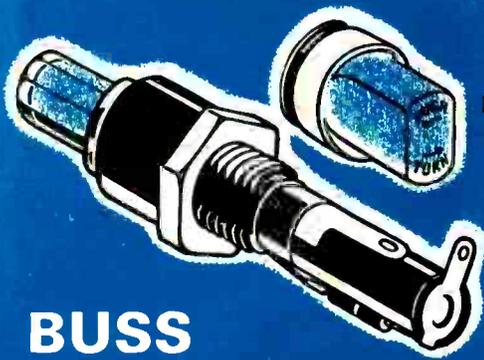
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television receivers, phonographs and their components, EIA Executive Vice President James D. Secrest disclosed. EIA said television, radios and phonographs are no longer considered luxuries, but "as essentials to our daily life." Radios or phonographs are in 52 million homes (94 percent) and TV is in 93 percent of all homes and reaches huge audiences. Radio and TV have become instruments of public enlightenment, education and news dissemination and an excise tax on them is as unwise as a tax on newspapers would be, Secrest said. They also provide an unprecedented communications system for the population in the event of a national emergency, it was noted. EIA cited annual sales figures for 1963 to indicate that manufacturers of radios, TV sets and phonographs pay an unfair share of the excise tax. Other figures were submitted indicating that the burden of the excise tax falls heaviest on the lower income purchaser.

REACT National Emergency Channel Nine

The headquarters of Radio Emergency Associated Citizens Teams (REACT) has established CB Channel 9 as a National REACT Emergency Channel for local emergency communications. All REACT teams are expected to establish primary monitor facilities on this channel. Local teams may, at their discretion, also utilize a secondary emergency channel of their choice to suit local conditions, but, channel 9 must be maintained as primary contact 24 hrs a day, seven days a week.

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general manager. The plant, which occupies an entire building on Liberty Street, provides an additional 20,000 sq ft of production facilities.

G-E Portable TV

General Electric has added a second battery-powered transistorized 9 in. portable television set to its TV line. The model TR803, which also operates off house current, has a private earphone jack and automobile battery cable. A UHF loop and VHF monopole antenna are supplied as standard equipment.

College Credit Swap

Electronics Training Center, Pennsauken, N.J., has reached an agreement with Indiana Northern University, Upland, Indiana, whereby students who have received 18 months of training at Electronic Center can transfer with full college credit to the university. Under the provisions of the plan worked out by the two institutions, the student can proceed to complete his second two years of college training and earn his Bachelor of Science degree.

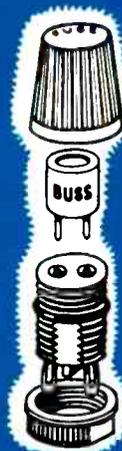
EIA Asks Excise Tax Repeal

The Electronics Industry Association has formally asked the Treasury Department to urge legislative repeal of the manufacturers' excise tax on radio and

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. . . LESSON IN COLOR

Continued from page 95

They can also be used for troubleshooting, if a scope with a current probe is available to measure the current. Actually, since the current probe is no more than a resistor parallel with the scope input, the voltage waveform across the resistor will be proportional to the current. The actual value of the current will have to be calculated by Ohm's law. The waveform would also have to be traced in steps be-

cause of the time required for a cycle. Also, only a dc scope would give accurate results.

A current meter may be used to advantage in troubleshooting. One caution, however: Do not connect the meter in series with the coil and then turn the set on. The surge through the meter, while the filter capacitors charge, could damage the meter. Even if the meter were not damaged, the results might not be significant. If it is desired to use a meter, however, it should be shunted for the first two seconds

of operation to bypass the surge. The actual reading you will get will depend on the damping of the meter used and the type of movement. Best results would be obtained by checking a known good set first and comparing results. The current reading will be an RMS reading which, of course, will be lower than the graph shows.

A still more meaningful method of troubleshooting the units is with the aid of an extra power supply. The best way to do this is by building one similar to that shown or by using another chassis which employs a similar power supply.

The degausser on the suspected set can then be plugged into the extra power supply and with the set to be checked operating, the power supply is turned on. When the degaussing coil is operating normally a pattern is presented which looks like that shown in Fig. 6. If you want to re-examine the results, discharge the capacitors in the test power supply and wait for the thermistor to cool a little.

Shorted turns in the coils will also cause impurities even though preliminary tests look OK. Watching the raster while the test power supply is turned on will also show this one up. Instead of a straight symmetrical pattern, a misshapen one will appear. It will also be possible to detect shorted turns in most cases by measuring and comparing the resistances of the coils.

While the information here should help you through the first few sets that employ automatic degaussing, you can be sure of one thing: More failure data can be gathered in the future when new designs come on the market. ■

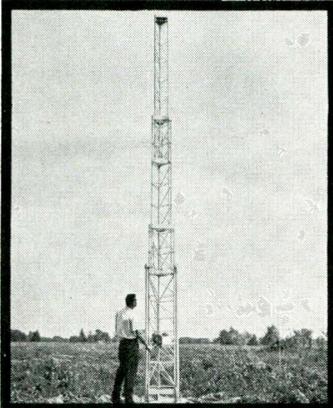
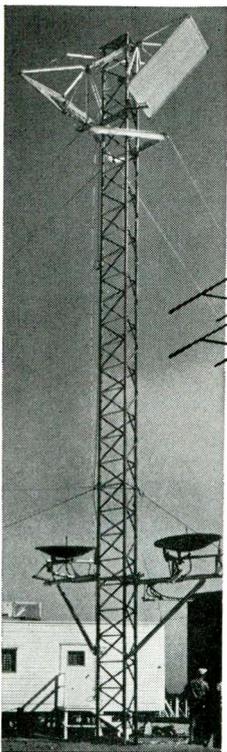
COMING EVENTS

March 22-26: IEEE International Convention, Hilton Hotel and Coliseum, New York.

March 23-26: Spring Convention and Technical Sessions, Audio Engineering Society, Hollywood Roosevelt Hotel, Los Angeles.

March 29-April 4: National Electronics Week "Sound Theatre" exhibit, Americana Hotel, "Electronic Showcase" exhibit Hilton Hotel, New York.

May 6, 7, and 8: National Symposium on Human Factors in Electronics, Boston-Sheraton Hotel, Boston.



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... VISUAL SYMPTOMS

Continued from page 63

ringing coil which is semi-permanent and is *not* adjusted in the usual manner. In these receivers, this adjustment is done with a low-scale VTVM. When the coil is properly tuned a zero voltage appears across the grid. The padder should be adjusted so the hold control is optimum at center range.

Philco is another receiver with a semi-permanent ringing coil. These sets have a "centering" control in series with the hold control. Here, also, the centering control is adjusted so that horizontal hold is maintained at center range. The ringing coil should be adjusted *only* in severe cases.

The Hartley Oscillator

Not all horizontal oscillators are what they appear at first glance. How Zenith, for instance, uses the Hartley oscillator is shown in Fig. 4. The cathode is tied to an off-center tap of the ringing coil. The coil may be capacitively tuned with a "bridged T" circuit, or have a capacitor each side of the tap. This same circuit is used in Zenith color receivers. Its stability is without question.

A good clue here: if there is a steady squeal in Zenith B/W receivers in or near the high voltage cage, change the horizontal oscillator tube. The "control" section of the tube is either open or shorted and the oscillator is free-running at slow rate. There'll be no raster, of course.

No Ringing Coil

Some receivers, such as Satchell-Carlson, do not use a ringing coil. Here the TC is maintained by a capacitor across the cathode resistor.

Depending on the model, this resistor may range from a high of 56K to a mere 4.7K. The TC "shunt" capacitor here will vary from .05 μ f to .03 μ f, according to the cathode resistor value. The replacement should be no more than five percent tolerance for reliable stability.

Any horizontal oscillator depends on the effectiveness of the phase detector. If a germanium or selenium diode is used, it's good insurance to replace it if it's over two years old. Thermal deterioration runs high in these units. ■

... SERVICING TOPSIDE

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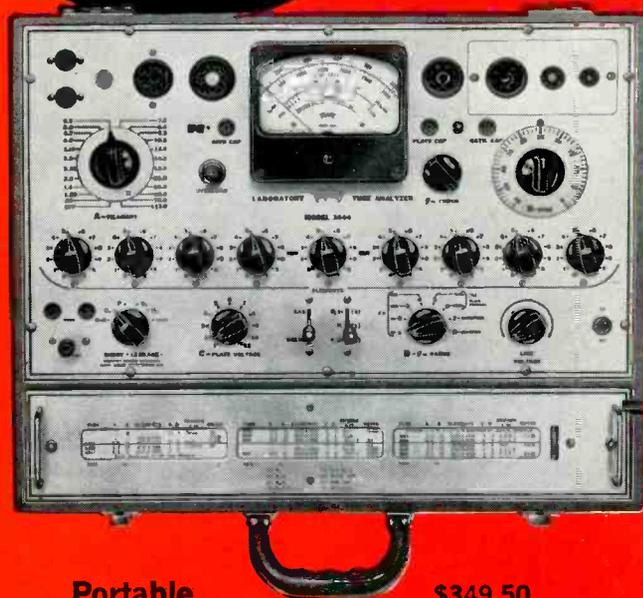
If TV antenna outlets are installed in the wall, check both the jack and plug. A lot of snow can be created by an open lead on a plug. It is very easy for the housewife to yank on the TV lead-in wire to unplug it from the wall when moving furniture around. Also check and see if the owner has added a hookup of his own that may set up standing waves on the TV lead-in.

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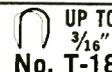
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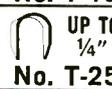
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**the oldest, most
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| | LIST |
| 2 oz. bottle with dropper | \$1.49 |
| 4 oz. bottle | 2.54 |
| 4 oz. bottle (brush-n-cap) | 2.64 |
| 8 oz. bottle | 5.07 |
| 6 oz. spray can — with extender | 2.79 |
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Quietrole is your guarantee of the most effective, quick silencer of noisy radio and TV controls — the quality product that is a top value.

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ELECTRONIC TECHNICIAN



How to replace top quality tubes with identical top quality tubes

Most of the quality TV sets you are presently servicing were designed around special Frame Grid tubes originated by Amperex. More and more tube types originated by Amperex are going into the sets you'll be handling in the future.

Amperex Frame Grid tubes provide 55% higher gain-bandwidth, simplify TV circuitry and speed up your servicing because their extraordinary uniformity virtually eliminates need for realignment when you replace tubes.

Amperex Frame Grid Tubes currently used by the major TV set makers include:

2ER5	2GK5	2HA5	3EH7	3GK5	3HA5	4EH7	4EJ7	4ES8	4GK5	4HA5	5GJ7
6EH7	6EJ7	6ER5	6ES8	6FY5	6GJ7	6GK5	6HA5	6HG8	7HG8	8GJ7	

If your distributor does not yet have all the Amperex types you need, please be patient—in some areas the demand keeps gaining on the supply.

Amperex Electronic Corporation, Hicksville, Long Island, New York 11802.



Color-TV servicing is profitable

GET THE MOST OUT OF IT WITH COLOR-TV TEST INSTRUMENTS FROM RCA
PIONEER OF COLOR TV



Making last-minute convergence adjustments on a color-TV receiver with an RCA WR-64A Color-Bar/Dot/Crosshatch Generator.

(A) RCA WR-64A COLOR-BAR/DOT/CROSSHATCH GENERATOR

Low-cost, lightweight, portable instrument that provides all essential Color-TV test patterns:

- *Color-bar pattern*: ten bars of color for checking phase and matrixing, and for automatic frequency and phase alignment.
- *Crosshatch pattern*: thin sharp lines for adjusting vertical and horizontal linearity, static and dynamic convergence, raster size, and overscan.
- *Dot pattern*: small dots to facilitate accurate color convergence.

\$189.50* with output cables

(B) RCA WR-70A RF/VF/IF MARKER ADDER

For use with a marker generator and a sweep generator. Used for RF, IF, and VF sweep alignment in color and B&W TV receivers.

- Choice of four different marker shapes
- Provides very high-Q markers of high amplitude and narrow bandwidth

\$74.50* complete with cables

(C) RCA WO-91A 5-INCH OSCILLOSCOPE

A wideband scope for checking colorburst signals and general troubleshooting.

- Dual bandwidth: 4.5 Mc at 0.053 volt rms/in. sensitivity; 1.5 Mc at 0.018 volt rms/in. sensitivity.
- Continuously adjustable sweep frequency range; 10 cps to 100 Kc

\$249.50* including direct/low capacitance probe and cable, ground cable, and insulated clip.

(D) RCA WR-69A TELEVISION FM SWEEP GENERATOR

For visual alignment and troubleshooting of color and B&W TV receivers, and FM receivers.

- IF/Video output frequency continuously tunable from 50 Kc to 50 Mc.
- Sweep-frequency bandwidth continuously adjustable from 50 Kc to 20 Mc on IF/Video and FM; 12 Mc on TV channels

\$295.00* including all necessary cables

(E) RCA WR-99A CRYSTAL-CALIBRATED MARKER GENERATOR

Supplies a fundamental frequency RF carrier of crystal accuracy for aligning and troubleshooting color and B&W TV receivers, FM receivers.

- Most-used IF and RF frequencies indicated on the dial scale
- Sound and picture carrier markers available simultaneously

\$256.50* complete with output cable and phone tip.

(F) RCA WT-115A COLOR PICTURE TUBE TESTER

Designed specifically to test color-TV picture tubes, either in or out of the set. Tests each gun for emission quality, inter-electrode leakage and shorts.

- Large sensitive meter with separate 3-color scales
- Provision for accurate adjustment of cut-off point for each gun

\$89.50* with cable, carrying case and socket assembly



FREE! You have a chance to win a new 1965 Chevy-Van...and over 100 additional prizes...in the RCA 1965 Regional Sweepstakes. For details, see pages 22-23

See them all at your Authorized RCA Test Equipment Distributor.

*Optional Distributor Resale Price
All prices are subject to change without notice. Prices may be higher in Alaska, Hawaii and the West.



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