

ELECTRONIC TECHNICIAN

Including
SERVICE
Magazine



60¢

December • 1961

NEW CALLBACK-PROTECTION WELDED INTO EVERY SILVER SCREEN 85 TV PICTURE TUBE

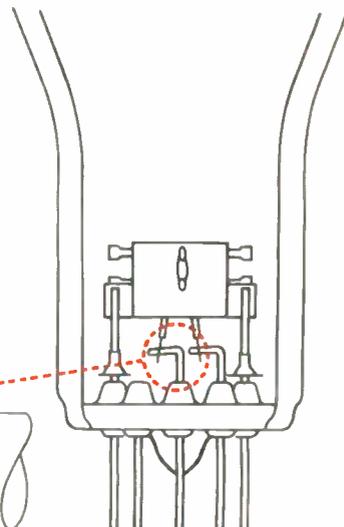
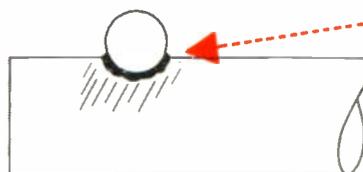
Sylvania technique
eliminates tube failures
caused by open heater or
cathode lead welds.
Protects your profits.

Sylvania . . . the leader in picture tube improvements . . . now gives you another built-in plus — "Controlled Atmospheric Welding"! Engineering investigations revealed that in the welding of picture tube gun parts something more than automatic controls, skilled operators and careful inspection was needed. The uncontrolled factor was the degree of oxidation occurring at the time of welding. The answer — control the atmosphere surrounding the weld at the instant it is made!

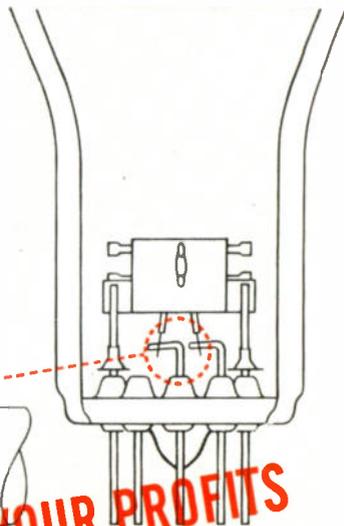
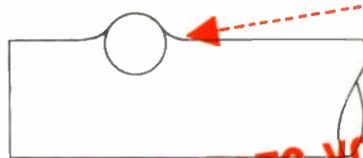
Now . . . through "Controlled Atmospheric Welding" Sylvania Silver Screen 85 TV picture tubes give you maximum assurance against callbacks. Common field problems of intermittent, poor, or open connections due to oxidized welds have been eliminated. Every year hundreds of thousands of TV picture tubes are replaced with Silver Screen 85. No wonder. It's more profitable in the long run.

Electronic Tubes Division, Sylvania Electric Products Inc., 1740 Broadway, New York 19, New York.

Early welding techniques oxidized or "burned" the metal surfaces. As shown in the enlarged cross-section view of the heater to stem lead weld, this prevented clean metal to metal joints — caused high-resistance electrical contact.



NEW SYLVANIA welding techniques keep metal surfaces clean during welding, which is essential for low-resistance contacts and strong mechanical bonds.



PROTECTS YOUR PROFITS

SYLVANIA

SUBSIDIARY OF

GENERAL TELEPHONE & ELECTRONICS



Servicemen everywhere are saying:



brings in sharp

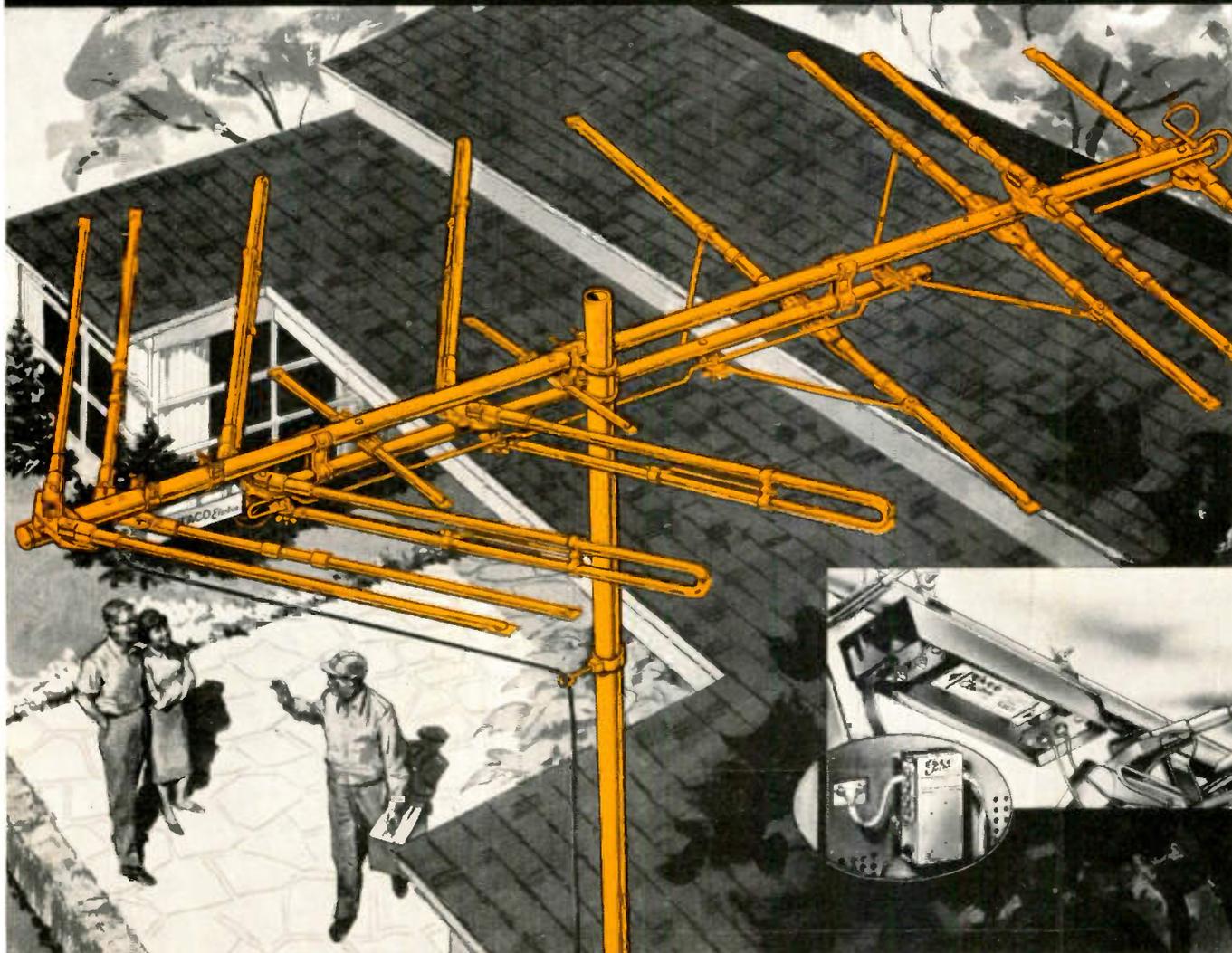
pictures where other electronic antennas fail

It stands to reason that TACO would produce, in the T-BIRD ELECTRA, the world's best electronic antenna. Only TACO gives you the combination of the most rugged, highest-performance antennas plus the finest in antenna-mounted transistorized preamplifiers (designed by Jerrold).

So, with the T-BIRD ELECTRA you assure customer satisfaction, even in severest "problem" areas. Rigid chrome-alloy aluminum elements and

contacts eliminate the antenna "friction noise" and "signal flutter" inherent in some so-called "high-gain" antennas. There's a T-BIRD ELECTRA for every TV/FM home need, priced from \$79.75. And it's completely pre-assembled for your convenience.

Only TACO offers custom area-engineering on electronic antennas to help you solve any type of signal problem. For these special services, see your TACO distributor.



TACO

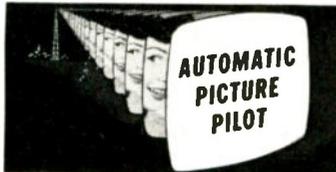
TECHNICAL APPLIANCE CORPORATION

Distributor Sales Division • Dept. JTD-5, Sherburne, New York
A Subsidiary of Jerrold Electronics Corporation

For more details, circle 48 on page 52

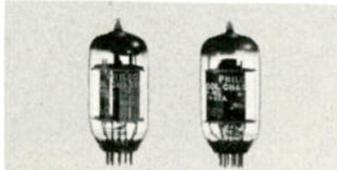
Another reason why you're hearing so much about Philco...

PHILCO COOL CHASSIS TV THE ULTIMATE IN ELECTRONIC RELIABILITY



Automatic Picture Pilot

Perfects the picture 15,750 times a second, maintains constant contrast even with varying signal strength.



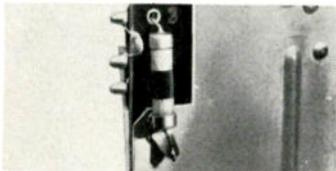
New Cool Chassis Tubes

New Picture Sweep Control tube up to 6 times more reliable. Also new, ultra-reliable vertical Deflection Tube.



New Vertical Output Transformer

New, expanded, more costly design makes possible lower operating temperature and greater reliability.



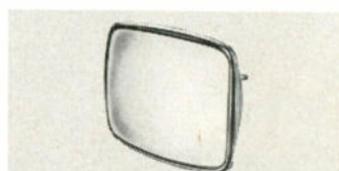
New Voltage Regulator Varistor

Compensating controls maintain constant picture voltage. Picture stays distortion-free, does not dim or lose detail.



Air-Flo Power Transformer . . . NO HEAT FINS

Special design eliminates old fashioned heat fins. Combined with Silicon Rectifiers, it's now the most advanced TV power supply.



Bonded Filter on Picture Tube

Seals out dust and dirt. No-glare filter avoids annoying reflections from lamps, windows or interiors.



Exclusive SAFE-GUARD System

Shields all parts and tubes from high voltage breakdown, overload and power surge. Only Philco has it.



Easiest to Service

All Cool Chassis parts and test points are on top; circuit traced from the top; designed to save serviceman's time.



"Drop-In" Remote Control

With Exclusive Philco "Remotable" TV you can install Drop-In Wireless Remote Controls in just 10 minutes.

TOTAL GUARANTEE

Philco's exclusive nationwide 90-day total service guarantee covering parts, tubes and service labor backs up the unmatched reliability of Philco Cool Chassis TV.

The sum of all these features plus Philco's exclusive, patented Cool Chassis construction (*beats the heat—major cause of TV breakdowns*) adds up to the last word in electronic reliability.

PHILCO'S ON THE MOVE!

GO WITH

PHILCO

Famous for Quality the World Over

For more details, circle 33 on page 52

ELECTRONIC TECHNICIAN

ELECTRONIC TECHNICIAN

Including
SERVICE
Magazine

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION

HOWARD A. REED Publisher
ALBERT J. FORMAN Editor
ARTHUR P. SALSBERG Managing Editor
JACK HOBBS Technical Editor
B. V. SPINETTA Assistant Editor
HERB HOENE Circulation Manager
EARL HINTZ Production Manager

December • 1961

Vol. 74 • No. 6

FRONT COVER Season's greetings — electronic style — from the ELECTRONIC TECHNICIAN staff to all readers. Our very best wishes for health and success in the New Year.



OJIBWAY PRESS, Inc.
1 East First Street,
Duluth 2, Minn.
Telephone: RA 7-8511

Sales Offices:

NEW YORK: Ron Kipp, National Sales Manager, 480 Lexington Ave., New York 17, N. Y. TN 7-0011

CHICAGO: William Klusack, 221 N. LaSalle St., Chicago 1, Ill. CE 6-1600

CLEVELAND: Bernie Edstrom, 15605 Madison Ave., Cleveland 7, Ohio LA 1-7900

LOS ANGELES: Boyd B. Garrigan, 1145 W. Sixth St, Los Angeles 17, Cal. HU 2-2838



ELECTRONIC TECHNICIAN and Circuit Digests, published monthly at 1 East First Street, Duluth 2, Minnesota, by Ojibway Press, Inc., Marshall Reinig, president; Robert Edgell, executive vice president; Lawrence Rosenthal, vice president; H. B. Fryberger, Jr., secretary; E. A. Kuefner, treasurer. Single copies, 60c. Subscription rates: United States and Canada \$5 for one year; \$8 for two years; \$10 for three years. Pan American and Foreign countries, \$9 for one year; \$14 for two years; \$18 for three years. Second class postage paid at Duluth, Minn. and at additional mailing offices. Copyright 1961 by Ojibway Press, Inc., Duluth, Minn. Reproduction and reprinting prohibited except by written authorization of publisher. POSTMASTER: SEND NOTIFICATION (Form 3579) REGARDING UNDELIVERABLE MAGAZINES TO OJIBWAY PRESS, INC., 1 EAST FIRST STREET, DULUTH 2, MINNESOTA.

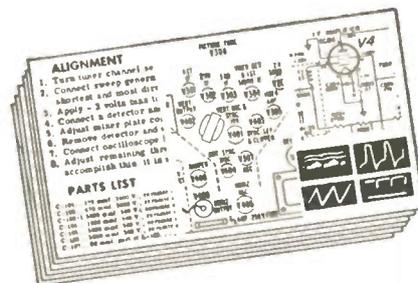
FEATURES and ARTICLES

TV Manufacturers Technical Digest	18
"Tuning in the Picture"	28
Shop Hints by Harry Parker, H. L. Davidson, George E. Lytle and Dee Bramlette, Jr.	34
Just How Critical Is Transistor Operation? by Herb Bowden and Jim Neuman	38
How to Diagnose TV Picture Hum Symptoms	by Jack Hobbs 40
Examining Audio Power Output Stages	by Mannie Horowitz 42
Distributors Dress Up for Dealers	45
Do You Choose the Right Test Probe for Your Scope and VTVM? by David R. Anderson	46
"Tough Dog" Corner	by Howard Keilholtz and Eugene Fleming 50

DEPARTMENTS

Editor's Memo	8	Free Literature	52
Letters to the Editor	14	Catalogs and Bulletins	66
New Products	17	Association News	68
Calendar of Coming Events	29	Reps and Distributors	69
Audio News Letter	32	New Books	71
ET Viewpoint	37	News of the Industry	72
Cumulative Article Index		73	

CIRCUIT DIGESTS

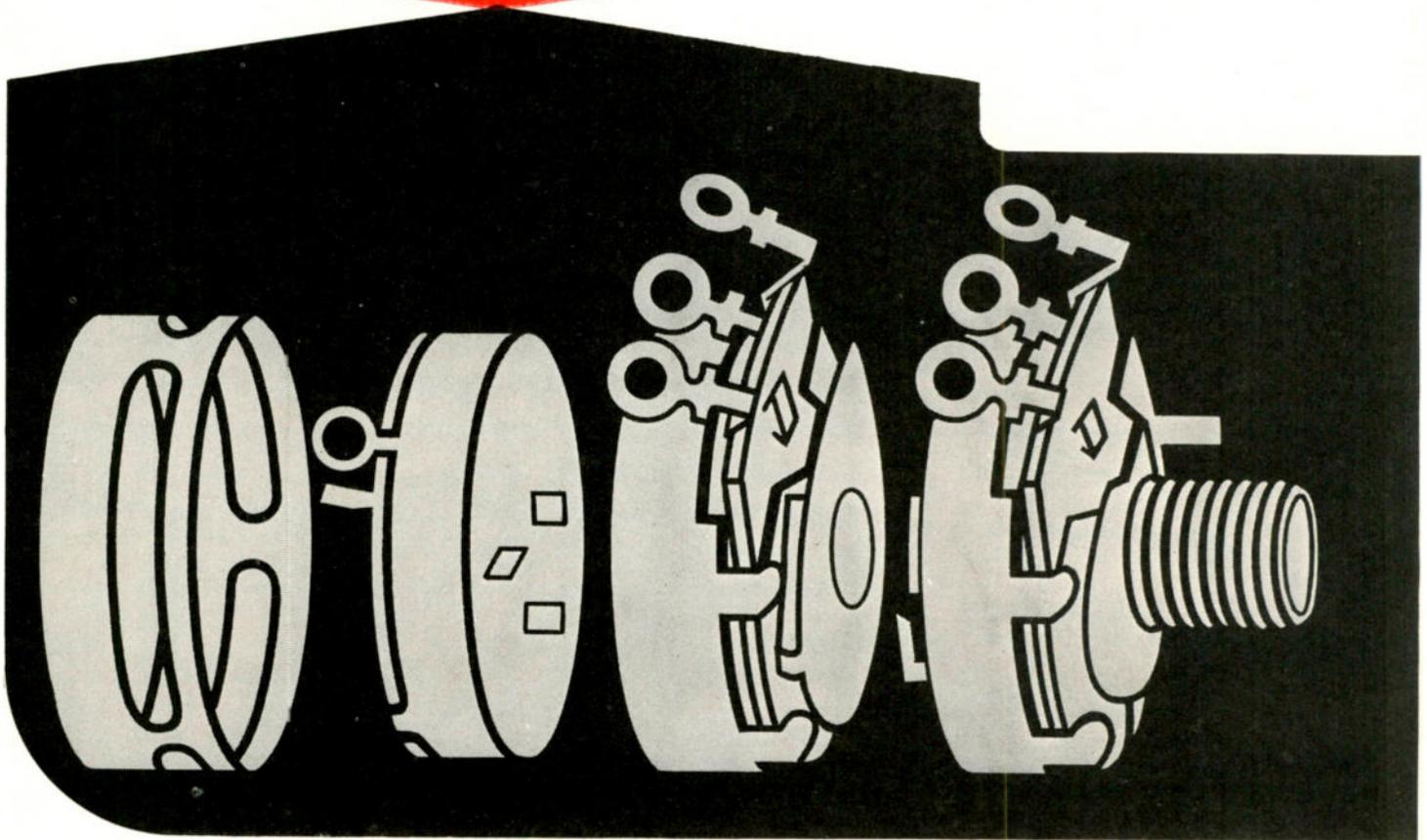
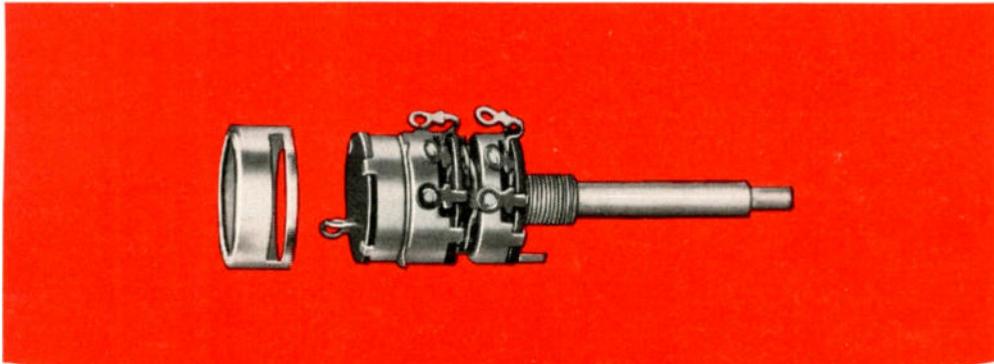


... PRECEDING BACK COVER

IN THIS ISSUE

(16 pages latest schematics and data)
PACKARD BELL: TV Chassis 98D14 and 98D14C
PHILCO: TV Chassis 12J27
SYLVANIA: TV Chassis 551, -2, -3, -5, -6, -7
WEBCOR: Tape Recorder Model 2207
WESTINGHOUSE: Transistor Portable Radio Chassis V-2393-4 Models H-790P6 and H-791P6

STA-LOC[®] CONTROLS



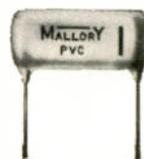
ELECTROLYTIC CAPACITORS

Famous FP-WP metal can types, reliable TC tubulars, and tiny TT tubulars.



VIBRATORS

Sure-start Gold Label[®] and every other type for auto or mobile communications.



PVC CAPACITORS

Top quality Mylar** Capacitors in zip-lip package.
**Du Pont Reg. Trademark



SILICON RECTIFIERS

Top performance, moisture-proof. 50 to 600 volt ratings. 5-packs, in re-usable jewel boxes.

...always the best...always available

You can get the exact replacement control you need when you ask for STA-LOC. Your Mallory Distributor can fix you up in a hurry . . . singles, duals, tandems, clutch, printed circuit . . . with or without a switch (there's a push-pull switch, too). You name it, he has it.

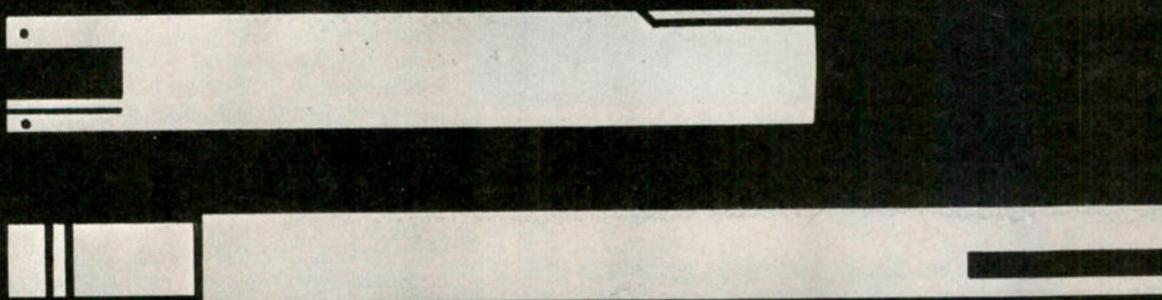
You'll get the best service-engineered control ever made when you ask for STA-LOC. Snaps together

(without tools) and stays together.

But be sure to get the real thing. STA-LOC is patented*, but like any hot item there are lots of imitations.

You should ask your Mallory Distributor about the STA-LOC Dealer Kit . . . it's inexpensive and can save you lots of phone calls and extra trips.

*U.S. Patent 2,958,838



DISCAPS®

Standard of quality in ceramic capacitors.

®Trademark Radio Materials Co., a Mallory Division



MALLORY BATTERIES

Mercury and Manganese Batteries outlast all others. Advertised in LIFE.

Distributor Division, Indianapolis 6, Indiana

P. R. MALLORY & CO. Inc.
MALLORY

In Canada: A. C. Simmonds & Sons, Ltd., Toronto 7, Ontario

For more details, circle 31 on page 52

*lowest cost
master antenna system
ever developed*



**NEW
BLONDER-TONGUE
TRANSISTOR 4-SET
BOOSTER—MODEL IT-3**

All the gain you need from one antenna for 4 TV or FM sets!

This new transistor-operated 4-set booster provides higher gain and lower noise than any comparable vacuum tube unit. There are no tubes to replace, lower power drain and negligible heat — all contributing to lower cost, longer maintenance-free operation than any unit on the market. List price of model IT-3, \$32.50.

SUPERB 1, 2, 3 or 4 SET PERFORMANCE

- **1 SET**—B-T 'straight thru' circuit provides full gain without isolation losses (Gain: 9 to 14 db, TV; 8 to 12 db, FM).
- **2, 3 OR 4 SETS**—splitting circuit provides gain and inter-set isolation necessary to provide top performance on 2, 3 or 4 sets. Gain two sets—each set 4 to 8 db; Gain three sets—each set 3 to 4 db; Gain four sets—each set 2 to 3 db.

*Sold through distributors. For details write: Dept. ET-12
engineered and manufactured by*

BLONDER-TONGUE
9 Alling St., Newark, N. J.

Canadian Div.: Benco Television Assoc. Ltd., Toronto, Ont. • Export: Morhan Export Corp., N. Y. 13
home TV accessories • UHF converters • master TV systems • industrial TV systems • FM/AM radios

For more details, circle 16 on page 52

**EDITOR'S
MEMO**



Buying on credit has become a way of life with almost all of us. That great credit rating organization, Dun & Bradstreet, displays the slogan, "Credit—Man's Confidence in Man."

A. M. Sullivan defines credit as "a form of money, minted of faith. It is as old as man's willingness to honor the word of his fellow man. Credit is not a right, but a privilege earned by candor and restraint. It flourishes with prudent use, it fades with neglect and abuse."

Even in the writings of Omar Khayyam, some 850 years ago, it was said, "Take the cash, and let the credit go."

Some time ago, I printed a couple of cartoons which, readers claimed, really hit the spot. One showed a TV tech in the home. He is telling the set owner, "Yes, we have terms—cash or certified check." In the other cartoon, this same tech is asking the lady of the house, "Would you like to charge it, or would you prefer I leave the set here?"

Could be a small counter-revolution is in the making against credit. One company has already come out in competition with credit cards. This enterprising firm offers a cash card. The card holder shows it to a participating store or restaurant (after the bill has been added up), and he gets a 5 percent cash discount. This is still less than the 7 percent the store might normally pay to the credit card company.

Just as service dealers appreciate prompt paying and cash-on-the-line customers, electronic distributors think more highly of those dealer customers who do not have to be dunned for collection. Suppliers will usually make an effort to cater to good customers.

To encourage prompt payment, carrots sometimes work better than sticks. One tempting attraction is the 2 percent discount when paid in ten days.

Credit is something one must deserve. Not like the panhandler who asked for a \$5 loan to get a cup of coffee. When asked why he needed so much for coffee, he explained that he preferred a fine restaurant to the local cafeteria.

"Isn't that extravagant?" he was asked.

"Listen, mister," he replied, "I'm no cheap skate!"

Al Foman

ELECTRONIC TECHNICIAN

1401* exact replacement electrolytics

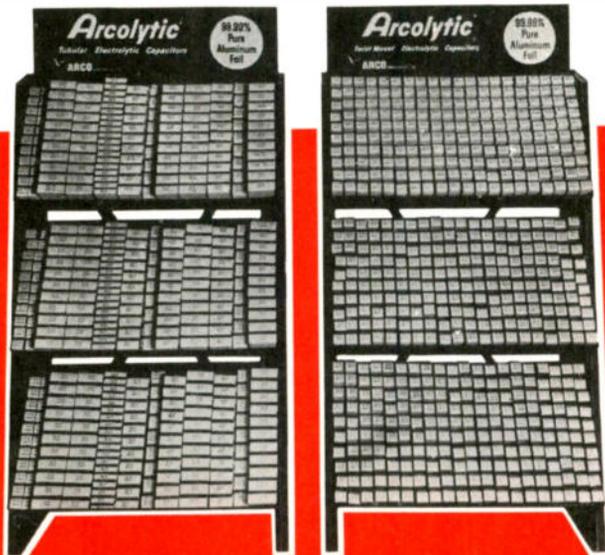


99.99% HIGH PURITY FOIL
ELECTROLYTICS
AT NO EXTRA COST!



Arcolytic

*The largest selection
of exact replacement
Twist-Mount & Tubular Electrolytics
... 1401 values!



SELF SERVICE DISPLAY RACKS
LOOK FOR THE ARCOLYTICS ON DISPLAY AT
ALL AUTHORIZED ARCO DISTRIBUTORS

- Choose from stock any single, dual, triple or quadruple capacitance — voltage combination for replacement in television, radio, and other electronic equipment.
- Made to withstand high ripple and high surge voltages.
- Designed for 85 °C high temperature operation.
- Greater shelf and operating life because only premium grade ingredients are used.
- Built and tested to meet EIA Specification RS-154.
- Individually packaged with mounting plates for your convenience.
- Unconditionally Guaranteed.

Manufactured by

ARCO

electronics inc.

ELECTROLYTIC
DIVISION

Community Drive, Great Neck, N. Y. • Branches: Dallas 7, Los Angeles 35

The Creator of Slender Seventeener and Briefcase TV does it again!

PHILCO

Announces the World's Finest
High Performance Portable TV



Town and

establishes a new standard of TV excellence...the ultimate
in performance—really new features, true styling elegance!

New Features:

- Top-End Tuning
- Soft-Glo Channel Window
- Visual Volume Control
- Hideaway Handle
- Tuck-a-way Cord Holder
- Front Removable Safety Glass filter... easy to clean

New Styling

- Tapered Continental Shape
- Flare Front Picture Frame
- Fashion Molded Back

Now, from PHILCO, comes the Town & Country; a truly great advance in portable television design! No other portable approaches it... for beauty, features, reliability! Here, in this sleekest new portable are advanced High Performance Tubes, Circuits and Components never before offered in a portable! Here is the new Tapered Continental shape... the Black Beauty, garbed in gleaming black trimmed with polished chrome; or the rich, warm Saddle Mate, sheathed in leather-like vinyl in Saddle Tan with Champagne Gold! Here also is portable Television's greatest chassis—with Vivid Vision and Black-Level circuitry—to give you the most brilliant, realistic, dimensional picture ever packed into a portable. You must see it for yourself! You must palm its smooth, elegant patina, pat its fashion-molded, finished back—float a finger down its Flare-Front picture frame, snap its solid-sounding Top-End Tuners. Yes, you must pick it up, set it down, spin it 'round, walk it, watch it!



PHILCO MODEL 3244

... the Elack Beauty (Black Vinyl Clad and Chrome)
 ... the Saddle Mate (Saddle Tan Clad and Champagne Gold accents)
 19" overall diagonal measurement screen; 17½ sq. in. viewable area.

Country

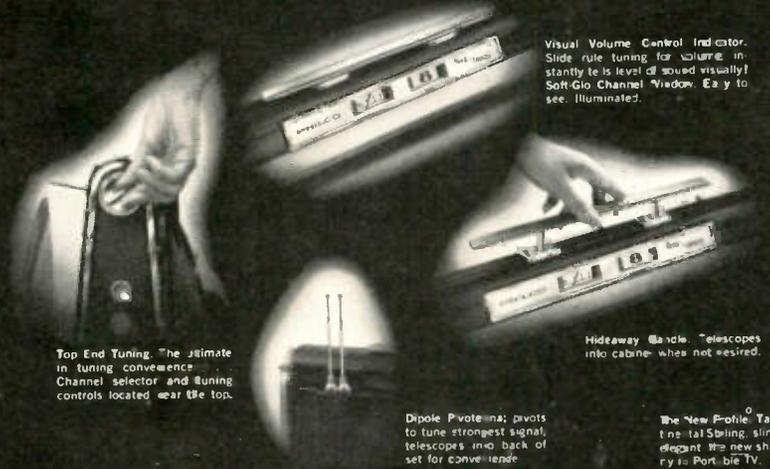
PORTABLE TV

New High Performance

- Exclusive Vivid Vision picture—most brilliant ever!
- Back level circuitry for greatest dimension, contrast
- Beam-Booster circuit with Intens-Tube ... longer life
- Few Electron Gun and Picture Beam Sharpener for finest pictures
- Ladder Grid Tuner for finest fringe-area picture—in town or country
- Safeguard Circuits
- High Performance Tubes throughout
- Automatic Picture Pilot perfects picture 15,750 times a second!
- Telescoping Dipole Pivotenna
- Solid Copper Circuits—less service costs

Big Ad Campaign Starts This Month!

In seven leading mass class magazines reaching over 36,500,000 readers PLUS pages in leading Sunday newspaper magazine sections listing dealers. Displays, ad materials, the works ... to help you put the PROFIT back in Portables. Your Philco distributor has the full story ... it's sensational!



Visual Volume Control Indicator. Slide rule tuning for volume instantly tells level of sound visually! Soft-Glo Channel Window. Easy to see. Illuminated.

Top End Tuning. The ultimate in tuning convenience. Channel selector and tuning controls located near the top.

Hideaway Handle. Telescopes into cabinet when not desired.

Dipole Pivotenna. pivots to tune strongest signal, telescopes into back of set for convenience.

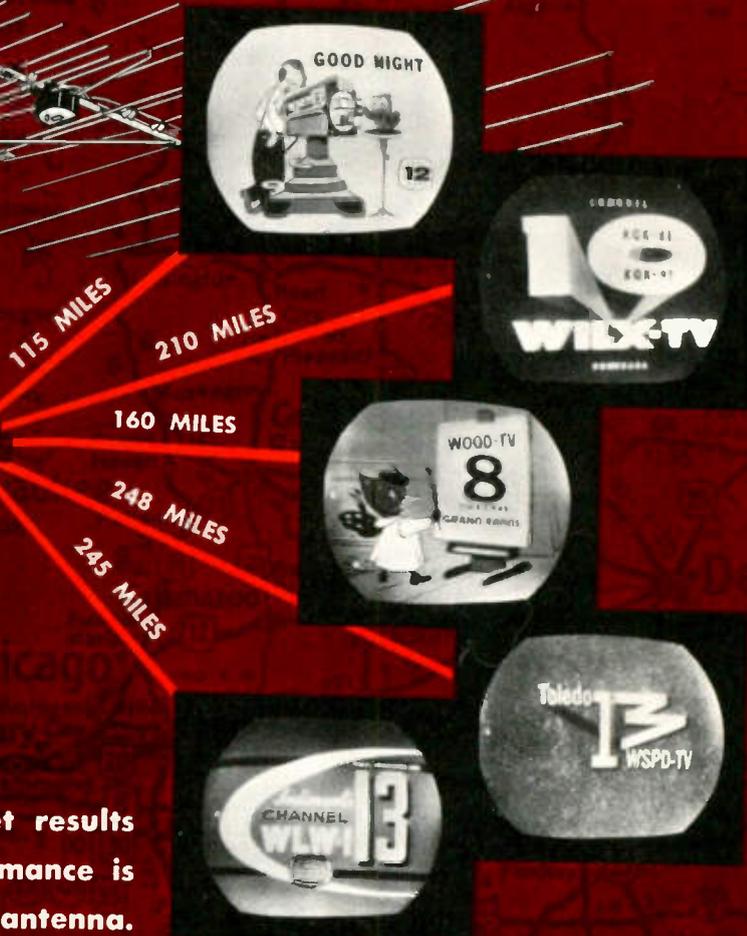
The New Profile Tapered Control Panel. slim, trim, and elegant the new shape of quality in Portable TV.

For more details, circle 34 on page 52

ACTUAL PHOTOS OF TV PICTURES RECEIVED UP TO 248 MILES AWAY

PULLED IN BY A *Winegard* SUPER POWERTRON TV ANTENNA

We can't guarantee that everyone will get results like this but long distance reception performance is not unusual for the world's most powerful TV antenna.



Why the Winegard Super Powertron is the Most Effective Antenna Ever Designed—



IT CAPTURES MORE SIGNAL than any other all-channel antenna ever made. Patented design, electro-lens director system, dual "TAPERED T" driven elements, 30 precision-tuned elements in all.



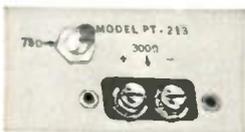
IT'S THE ONLY TRUE ELECTRONIC ANTENNA. Only the Winegard Powertron is built with the amplifier as part of the driven element—not an "add-on" attachment.



IT ELIMINATES ALL SIGNAL LOSS that normally occurs between the driven element and the amplifier due to transmission and coupling mis-match.



IT BOOSTS WEAK SIGNALS UP OUT OF THE SNOW far better than any other antenna or antenna-amplifier combination made.



ONLY POWERTRON HAS BOTH 300 OHM TWIN LEAD AND 75 OHM COAX TERMINALS ON BUILT-IN AMPLIFIER.

ONLY POWERTRON GIVES YOU YOUR CHOICE OF TRANSISTORS OR TUBES (TUBE MODELS 300 OHM ONLY).

ONLY POWERTRON HAS RANGE AND POLARITY CONTROL SWITCH TO PREVENT OVER-DRIVING ON STRONG CHANNELS.

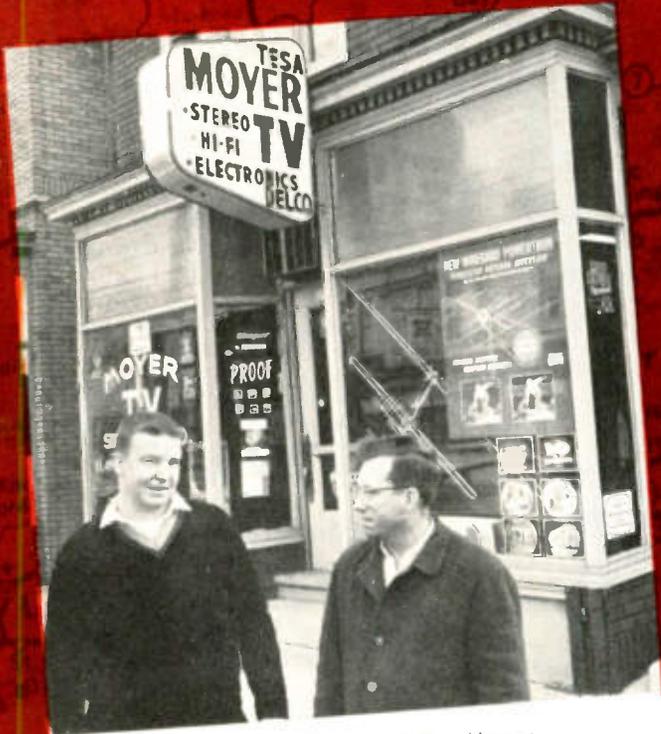
ONLY POWERTRON HAS AC PLUG-IN OUTLET FOR TV SET BUILT INTO THE POWER SUPPLY.



POWERTRON POWER SUPPLY IS ALL AC—SAFE, SHOCKPROOF.

Transistorized Model has rectifier and filter in power supply—not in amplifier, where servicing is difficult. No nuisance batteries. Costs 27c to operate for a full year.

Read what Charles J. Milton of Moyer TV, Milwaukee, has to say about the Winegard Super Powertron...



Charles Milton and Jim Moyer
In front of Moyer TV

Of course, everyone can't get reception results like Charles Milton has experienced. Each area has its own unique reception characteristics and problems. But one thing we can promise, the Powertron will deliver more clean pictures on your TV screen than any antenna you can own.



TESA-MILW.

MOYER TV & RADIO SERVICE

3111 W. NORTH AVE.

MILWAUKEE 8, WIS.

2913 W. NORTH AVE.

Hilltop 4-0740

Winegard Company
3000 Kirkwood
Burlington, Iowa

Gentlemen:

I would like to thank the Winegard Company for building the Super Powertron SP-44X.

With this antenna, reception at the local station level is perfect in both black and white and color. At medium range, the Powertron outperforms all others. Channel nine from Chicago, about 90 air miles, comes in clear and regularly. This is the Cubs baseball station and the one Milwaukeeans are willing to pay big money to get.

When the "Big Winegard", as it is affectionately called around the shop, is on long range it probes the unknown alone. All other antennas have fallen far behind. I have picked up eleven stations over 100 air miles away. The farthest of these is WWJ, Channel Four, Detroit, an unbelievable 251 miles. I have included a few pictures that I took off the TV with a Rolliflex F 3.5 at one second using Verichrome Pan.

We use the pictures in a window display and I use a set of pictures to explain the advantages of a Winegard to prospective customers. Believe me the pictures work -- and so does the "Big Winegard."

Sincerely,

Charles J. Milton

**POWERTRON IS 100%
CORROSION-PROOFED**

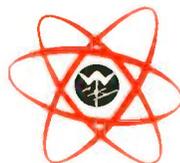
ANTENNA IS GOLD ANODIZED,
ALL HARDWARE IRRIDIZED,
AMPLIFIER HOUSING OF HIGH
IMPACT POLYSTYRENE.

PHOTOGRAPH YOUR OWN TV STATION PICTURES AND SEND THEM IN!

If you own a Powertron, chances are you too are experiencing unusual results. Why not photograph the stations you receive and send them in to us. We are always interested in hearing from Winegard antenna dealers and owners. We will be glad to enlarge your camera shots so that you can make your own window or store display like Moyer TV has done. The photos make

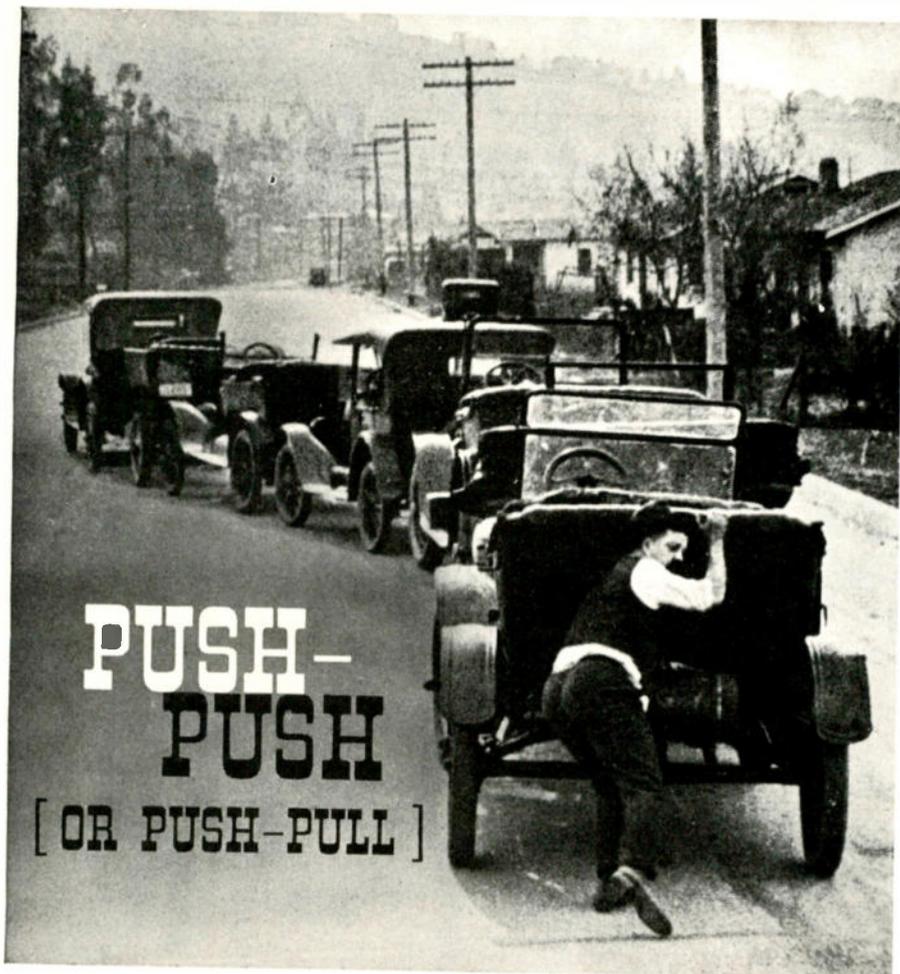
great sales persuaders to prospects and can be used in many ways to sell more Powertrons.

If you have never tried a Winegard Electronic Powertron, give it a test and be agreeably surprised. Don't take our word for it—let your eyes and ears and field strength meter tell the story. For full details and spec sheets, ask your distributor or write.



Winegard
ANTENNA SYSTEMS

Winegard Co., 3019-12A Kirkwood St., Burlington, Iowa



controls from **Centralab**®

... won't make car-pushing easier but they will make your job much simpler.

This is because CENTRALAB has the most complete line of push-push and push-pull controls on the market. They are available in four different types—Adashaft, Universal Shaft, Fastatch for dual concentrics and Twin types for stereo. These push-push and push-pull controls are now used in over 78% of the television, radio and hi-fi sets coming out of the factories. In addition, you can make your customers happier by installing these convenient-to-use controls when replacing the standard volume controls.

You will find the CENTRALAB replacement you need at your distributor. Contact him now for your copy of the latest CENTRALAB catalog listing hundreds of other CENTRALAB replacement components... or write us directly for your free copy.



ACTUAL SIZE

Centralab

THE ELECTRONICS DIVISION OF GLOBE-UNION INC.
902M EAST KEEFE AVENUE • MILWAUKEE 1, WISCONSIN
CENTRALAB CANADA LIMITED—AJAX, ONTARIO

**ELECTRONIC SWITCHES • VARIABLE RESISTORS • CERAMIC CAPACITORS
PACKAGED ELECTRONIC CIRCUITS • ENGINEERED CERAMICS**

For more details, circle 19 on page 52

LETTERS TO THE EDITOR

Sewer TV

Editor, ELECTRONIC TECHNICIAN:

I came across the following ad in the Miami Herald. "SEWER FOREMAN, TV INSPECTION and repair of sewers. Handle equipment and men." I laughed when I read it. Has something new been added to TV service?

GEORGE F. GEORGES

Venice, Fla.

• *It's no laughing matter. An increasing number of municipalities are learning that by pulling a TV camera through the sewer pipes they can inspect the lines more efficiently and safely than having a man crawl through on hands and knees.—Ed.*

No Mistaken Identity

Editor, ELECTRONIC TECHNICIAN:

On page 68 of your May 1961 issue you published a warning to the effect that a Ray Barnes was not authorized to collect subscription payments, and that any effort to do so was an attempt to defraud.

When this was brought to my attention I took it as a joke. Then it occurred to me that I've been in the electronics industry for some 13 years and have met several people occasionally, but not often enough for them to become fully acquainted with my background and character.

The lack of any description of the Ray Barnes you refer to in your warning could result in confusion or misinterpretation on the part of some people. Such misinterpretation would do neither the company I work for nor myself any good.

Could you publish a further description of the person to whom your warning applies and at least give the area in which he operates?

RAYMOND B. BARNES,
DIVISION QUALITY
CONTROL ENGINEER

Semiconductor Div.
Sylvania Electric Products
Woburn, Mass.

• *Let one and all know that Raymond B. Barnes of Sylvania is a reputable member of the industry, and is not to be confused with Ray Barnes of Raybar Publishers Service against whom fraud charges have been lodged. The latter Barnes moves from place to place in gypsy fashion, mostly in the Eastern U. S.—Ed.*

New York Licensing

Editor, ELECTRONIC TECHNICIAN:

The New York State TV license bill came very close to being passed during

ELECTRONIC TECHNICIAN

the last legislative session. Without doubt the license bill will be passed this session and become law. Therefore, I would like to take this opportunity to explain how it will function.

The law is administered by a licensing board. The men appointed are suggested by the state trade association (ESFETA). The Department of Education does not determine the scope of the license examination that will be used (after the grandfathers get in). The contents of these examinations are determined solely by the license board. Many associations in ESFETA do not require all their members to be qualified bench technicians. Also, ESFETA has abandoned their one time requirement that all officers be qualified technicians. We are finding a lowering of the average technical standards by those who will be in a position to set the standards of our industry under

the license law. Therefore, unless the qualifications for the position of license board member be more strongly specified in the present bill, we have no guarantee of a good license law.

MELVIN COHEN

Suburban Television Service
Hudson Falls, N. Y.

Rejected Shop Hint Reappears

Editor, ELECTRONIC TECHNICIAN:

In your September "Shop Hints" on page 44, I was surprised to find the item on Zenith tuners and the method of matching gears when reassembling. The surprise in question was due to the fact that an identical item was submitted to you in February of 1958 when many of these sets were coming into the shop for overhaul after being in use for several years. However, you rejected the item for publication. I have been submitting items for over

25 years to ELECTRONIC TECHNICIAN and its predecessors, but this is the first time this has happened as far as I can recall.

M. G. Goldberg

Beacon Radio & TV Service
St. Paul 3, Minn.

• *Our apologies to Reader Goldberg, who is one of the most consistent and prolific creators of Shop Hints in the industry. It's obvious that our Shop Hint editor in 1958 was in an ornery mood the day he passed up this Hint.*
—Ed.

Correspondence from readers is always welcome. Name and address, which must accompany letters selected by the editor for publication, will be withheld on request. Anonymous letters go right into the wastepaper basket.

NEXT BEST THING TO THE WINEGARD ELECTRONIC POWERTRON TV ANTENNA

NEW TRANSISTOR TV-FM WINEGARD TENNA-BOOST

MOUNTS ON ANY ANTENNA

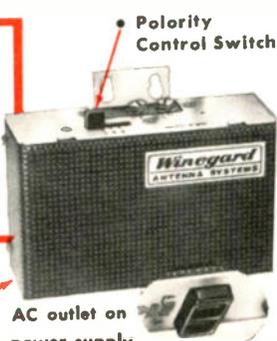


MOUNTS ON ANTENNA



Model MA-300
\$34⁹⁵ LIST
only

INSTALL IT... FORGET IT!
ALL ELECTRIC, ALL-AC POWER SUPPLY costs less than 27c a year to operate. Many exclusive features.
No costly, nuisance batteries!



Built-in two set coupler.

19 DB GAIN! CUTS SNOW...BOOSTS SIGNAL!

Now you can make any TV or FM antenna work better by magnifying signals with the new Winegard transistor Tenna-Boost.

Tenna-Boost has up to 19 DB gain, no peaks and valleys. Ultra low noise. Linear frequency response. VSWR input better than 1.5:1 across all frequencies. Output VSWR 1.8:1 or better. This fine frequency response plus the very low VSWR make Tenna-Boost excellent for color.

Winegard's exclusive input band-pass filter eliminates interference from citizen's band, Hams, garage door openers, etc. Only TV and FM signals are amplified.

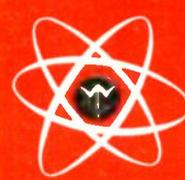
All metal parts are anodized, irridized or stainless steel. Completely weather-proof, trouble-free. Install it... forget it.

There's a big difference in antenna amplifiers! Ask your distributor or write for technical bulletin.



FOR THE ULTIMATE IN TV RECEPTION

Winegard Transistorized Electronic Powertron TV Antennas. 3 Models to Choose From.



Winegard

ANTENNA SYSTEMS
3019-12B Kirkwood • Burlington, Iowa
For more details, circle 56 on page 52

EXTRA VALUE AT NO EXTRA COST RCA ELECTRONIC INSTRUMENTS

The V-O-M with the EXTRAS!

Compare this superlative RCA VOM with the instrument you may have been thinking of buying. See if the RCA WV-38A doesn't offer you more "plus" features.



**RCA WV-38A
VOLT-OHM-MILLIAMMETER**

- AC volt and 0.25 volt DC ranges!
- Big easy-to-read 5 1/4" meter!
- Non-breakable plastic case; no glass to crack or shatter!
- Frequency response of low AC ranges is flat within 1 db to 800,000 cycles!
- Red test lead has probe and slip-on alligator clip for added versatility!
- Orderly location of jacks below switches keeps leads out of the way!
- Spring clips on handle to hold test leads!
- DB scales clearly marked; no squinting!
- Rugged, scuff-proof, stain-resistant laminated vinyl carrying case. Optional equipment. Only \$4.95*.

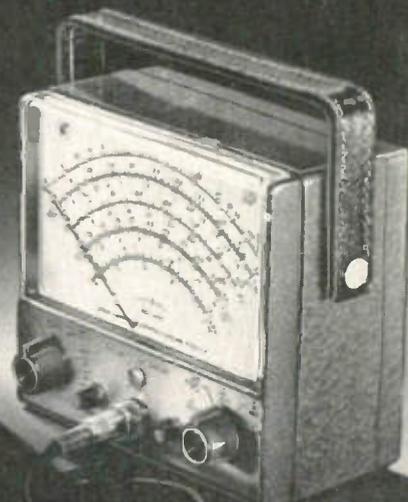
Factory wired and calibrated **\$43.95***
KIT ONLY \$29.55*



**RCA WV-77E
VOLTOHM-MILLIAMMETER**

Measures AC and DC voltages to 1500 volts; resistance from 0.2 ohm to 1,000 megohms. Separate scales, 1 1/2 volts rms and 4 volts peak-to-peak for accurate low AC measurements, color coded scales for easier readings.

Factory wired and calibrated **\$43.95***
KIT ONLY \$29.95*



**RCA WV-98B
SENIOR VOLTOHM-MILLIAMMETER**

Measures AC and DC voltages (3% accuracy full-scale) resistance from 0.2 ohm to 1,000 megohms. Measures peak-to-peak values of complex waveforms. Rugged cast aluminum case, field tested and certified. Big 6 1/2" meter.

Factory wired and calibrated **\$79.50***
KIT ONLY \$62.50*

RCA SCOPES



WO-9A 5-INCH OSCILLOSCOPE

High-performance, wide-band oscilloscope especially suited for color-TV, black-and-white TV, and other electronic applications. Dual bandwidth (4.5 Mc with 0.053 volt rms/in. sensitivity and 1.5 Mc with 0.018 volts rms/in. sensitivity). Internal calibrating voltage and calibrated graph screen. Includes special direct/low-cap shielded probe and cable.

Factory wired and calibrated **\$239.50***



WO-33A SUPER-PORTABLE OSCILLOSCOPE

A low-cost all-purpose scope you can carry anywhere—only 14 pounds—designed for in-the-home servicing of black-and-white and color-TV audio and ultrasonic equipment. High gain and wide bandwidth to handle the toughest jobs! Rugged and compact—3 1/2" graph scale screen.

Factory wired and calibrated **\$129.95***
complete with low-cap direct input probe and cable.
KIT ONLY \$79.95*

RCA GENERATORS



**WF-64A COLOR-BAR
DOT/CROSSHATCH
GENERATOR**

Gives you all essential Color-TV test patterns; Color-bar signals for checking, adjusting and troubleshooting Color-TV circuits; dot and crosshatch pattern signals for adjusting convergence in color receivers and or adjusting linearity and overscan in both color and black-and-white receivers. Designed for in-the-home or shop servicing.

Factory wired and calibrated **\$189.50***



**WA-4C
AUDIO GENERATOR**

Generates sine and square wave signals for testing audio systems. Frequency range: 20 cps to 200 Kc. Used for the measurement of intermodulation distortion, frequency response, input and output impedances, speaker resonance, speed of recording and playback mechanisms, transient response, phase shift, etc.

Factory wired and calibrated **\$98.50***



**WR-49B SIGNAL
GENERATOR**

For alignment and signal tracing of AM, FM and AM-FM receivers, low-frequency signal tracing and alignment of TV v/f or i/f amplifiers. Six ranges—85 Kc to 30 Mc. Internal 400 cps modulation. Low rf signal leakage!

Factory wired and calibrated **\$79.50***



**WR-69A
TELEVISION/FM
SWEEP GENERATOR**

For visual alignment and troubleshooting of TV i/f or v/f circuits and other electronic equipment IF/video frequency ranges 50 Kc to 50 Mc, TV channels 2 to 13, plus FM range—85-108 Mc. Sweep width continuously adjustable to 12 Mc.

Factory wired and calibrated **\$295.00***



**WR-99A CRYSTAL-
CALIBRATED
MARKER GENERATOR**

Supplies a fundamental frequency reference of crystal accuracy for aligning and troubleshooting color-TV, black-and-white TV, FM receivers and other electronic equipment operating in 19 Mc to 250 Mc range.

Factory wired and calibrated **\$242.50***

Every RCA test instrument brings you extra value at no extra cost, and there's one to help you with every job. See your Authorized RCA Test Equipment Distributor for full information on any instrument.



The Most Trusted Name in Electronics

User Price (Optional)

NEW PRODUCTS

Precision TUBE TESTERS

Model 650 grid circuit type tube tester tests all standard radio and TV tubes plus ten-pin miniatures, twelve-pin compactrons, five-pin nuvistors, seven-pin nuvistors, novar tubes and a wide variety of voltage regulator types, foreign and industrial tubes.

Gas content, grid leakage and grid emission are measured and read as μ a of grid current. The built-in balanced VTVM measures gas current as low as one μ a, and leakage sensitivity is over 100 megohms. When used with the accessory picture tube cable adaptor, model PTA, a specially engineered circuit provides a picture producing beam current test for all TV picture tubes. Model 650, \$69.95. Model PTA adaptor, \$9.95. Precision Apparatus Co., Inc., Pacotronics Inc., 70-31 84th St., Glendale 27, L. I., N. Y.



... for more details, circle 400 on page 52

Beaver COMPOUNDS

GTC-59 glass treatment compound is reported to work five ways to cut glass and plastic maintenance costs. It cleans and degreases in one operation; leaves a clear, lustrous, water-repellent and protective surface; cancels static fields which attract dust and dirt; keeps surface free from dirt build-up and has excellent anti-fogging properties.

It may also be used on plastic, enamel, chrome, stainless steel and most other smooth surfaces. Available in 6-ounce bottles, 16-ounce, 32-ounce, and one gallon cans. Beaver Laboratories Inc., 469 Jericho Turnpike, Mineola, N. Y.

... for more details, circle 401 on page 52

G-E NOISE BLANKERS

Announced is a low cost-automatic switching ignition noise blander for two-way radio systems. It works like a thermostat, turning on a suppressor when ignition noise is present and turning it off when noise disappears. Eliminated is the need for a motorist to click a special switch on and off when ignition noise from passing vehicles or other sources causes static interference. Communication Products Dept., General Electric Co., Lynchburg, Va.

... for more details, circle 402 on page 52

Continued on page 54

New transistor
Home TV and
FM System!

Winegard BOOSTER-PACK & 'SIX-SET' COUPLER



BOTH
for the price
of the amplifier
\$34.95*
A \$42.90 value



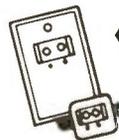
DRIVE UP TO 6 TV AND FM SETS

Cut snow . . . improve contrast . . . deliver sharper, clearer pictures to each set. New low noise, high gain transistor combined with advanced circuitry gives Winegard AT-6 "Booster-Pack" a flat gain of 16 db on low and FM bands . . . a flat 14 db gain on high band.

Shock-proof, full AC chassis with AC isolation transformer (NOT AC-DC). Draws 1.2 watts. Gain control switch prevents overdriving sets on local stations. No heat. Can be mounted remote from coupler. Also ideal as single set booster.

New, Winegard 300-ohm "Six-Set" coupler has low insertion loss, positive isolation between sets. No need to terminate unused outputs.

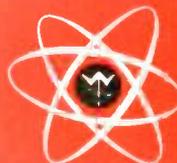
You get both AT-6 "Booster-Pack" and LTS-63 "Six-Set" for the price of "Booster-Pack" alone: a \$42.90 value for only \$34.95 list. Ask your distributor.



For real convenience, add Winegard flush or surface mount 300-ohm plug-in outlets. Even folks with only one TV set appreciate being able to move it from room-to-room.

For finest all-channel reception, use a Winegard "Telatron" antenna with your "Booster-Pack".

*Limited Time Offer



Winegard

ANTENNA SYSTEMS

Winegard Co., 3019-12C Kirkwood St., Burlington, Iowa
For more details, circle 57 on page 52

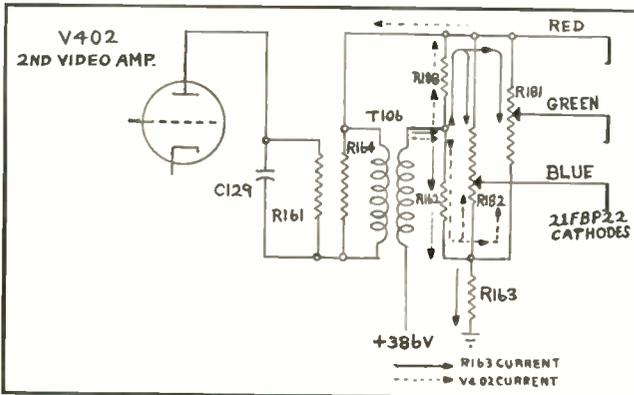
TV MANUFACTURERS TECHNICAL DIGEST

GENERAL ELECTRIC

Color TV Chassis CW — Color-Balance Stabilizer

GE's color TV chassis contains a color balance circuit that automatically maintains correct color values even though picture brightness and contrast may vary.

Correct color hues are maintained by applying



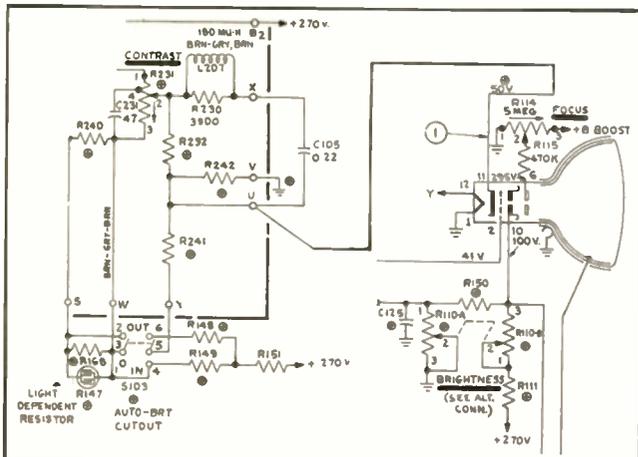
Schematic of G-E's color balance stabilizer which maintains a regulated d-c bias and a constant ratio between the a-c and d-c components of the video signal on each CRT cathode.

regulated d-c signal component levels at each CRT cathode. In this way constant ratio exists between the a-c and d-c components of the video signal with brightness and/or contrast changes.

RCA

TV Chassis KCS 136 Series — Automatic Brightness Control

A resistive network added to the video output tube's plate circuit of some KCS 135 TV receivers serves as an automatic brightness control. A light-sensitive resistor (R-147, RCA type 4419) is used to react automatically to a change in room lighting. This network automatically changes CRT brightness.



A light dependent resistor in RCA's KCS 136 series TV chassis functions as an automatic brightness control.

In a brightly lighted room the resistor becomes a very low ohmmage, while in a dimly lighted area the resistor increases in value. The change in ohmmage varies the voltage applied to the CRT cathode.

A double-pole double-throw switch in the set permits the "resistor" to be manually switched in or out of the cathode circuit. The CRT's cathode circuit has a constant potential applied when the light-sensitive resistor is out of the circuit.

PHILCO

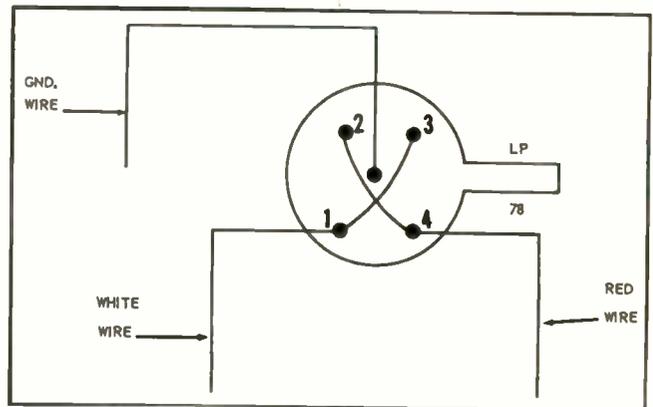
Model H2010 Transistorized TV — Preventing Damper Diode Short

This TV set should not be operated with the high voltage cage open. The damper diode is located near the cage door and may be shorted by the open door. A shorted damper diode will cause excessive current flow in the horizontal output circuit, with possible damage to the transistor or transformer.

WEBCOR

Cartridge Substitution

Webcor phono cartridge No. 21P721 is no longer available as a replacement part. When a replacement



Wiring diagram of Webcor's new No. 21P829-1 replacement cartridge which supersedes no-longer-available cartridge No. 21P721.

is needed, cartridge and bracket No. 21X728 should be obtained.

Replacement cartridges for the new type bracket may be ordered by part No. 21P729-1. The new cartridge must be wired as illustrated.

MAGNAVOX

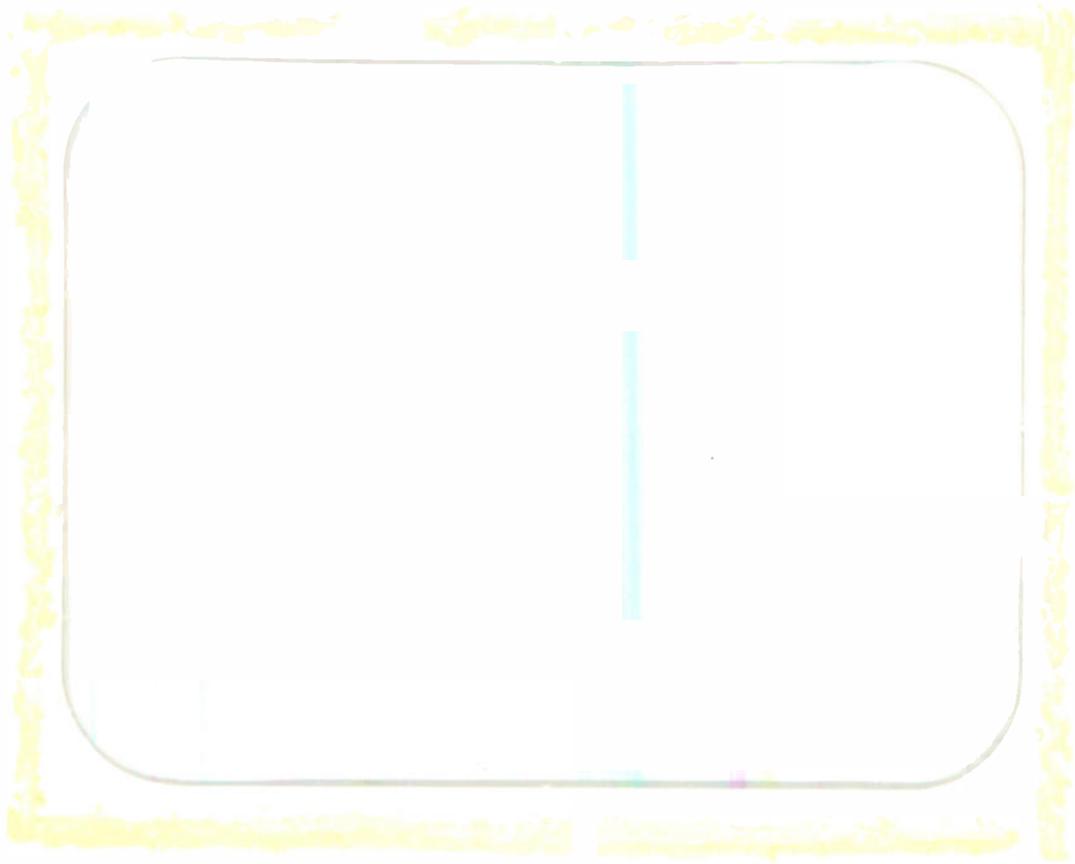
Chassis 35 Series — Damaged 1G3 Tube Socket

The 1G3 tube socket on these chassis may be damaged because filament leads are dressed too near the chassis. If a breakdown occurs in a socket, it must be replaced since repair is not practical. A new

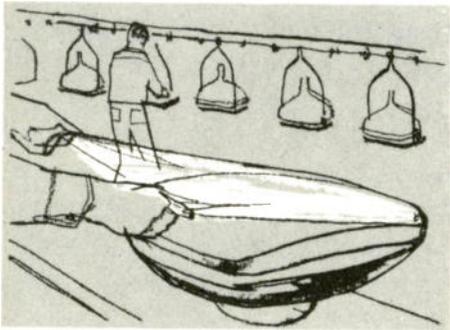
Continued on page 23

THE DIFFERENCE IS CLEAR!

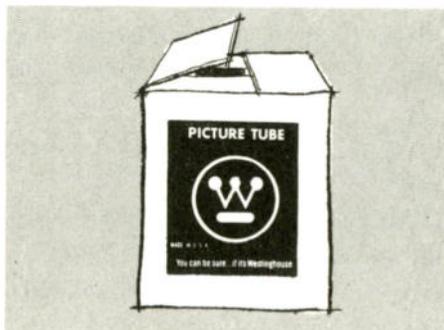
**ONLY WESTINGHOUSE HAS
NEW GLAS-GARD FILM...
TOTAL SCRATCH-PROTECTION FOR
EVERY GOLD-STAR PICTURE TUBE!**



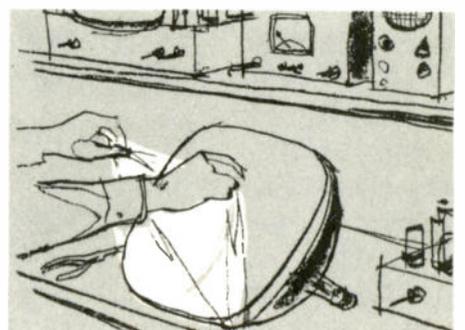
THERE'S NEW POWER IN



1. Glas-Gard polyethylene film is applied to every Gold Star Picture Tube at the factory.



2. Protects tube in shipping from scratching, and chemical action of packing materials.



3. Film is easily removed just before tube is installed in set.



WESTINGHOUSE TUBES!

Now GLAS-GARD film protects tube face... gives you exclusive selling "extras"

An industry first . . . from Westinghouse! Every Westinghouse Gold Star Picture Tube now comes wrapped in Glas-Gard polyethylene film. Glas-Gard protects the tube face against scratching . . . eliminates corrosion of glass sometimes caused by conventional cardboard packaging. Glas-Gard positively identifies the picture tube as new and fresh from the factory. Glas-Gard gives you a powerful, exclusive selling story. Make the most of it! Point out its benefits to your customers.

Glas-Gard packaging is one of many features in

the Westinghouse NEW POWER program for marketing electronic tubes. Others include: ■ HIGHER PROFIT MARGINS—Realistic and constant—result of outstanding product quality and competitive product-cost ratios. ■ THE ULTIMATE IN FINANCING PLANS—offers distributors a flexible line of credit ■ MARKETING AND FINANCIAL COUNSEL—to help distributors solve financial, advertising, promotion problems ■ FAST TIE-LINE SERVICE—Distributor orders processed in one hour of receipt ■ INDUSTRY INNOVATIONS—New packaging, merchandising builds more business.

You can be sure . . . if it's **Westinghouse**





There's NEW POWER in Westinghouse Tubes. Turn to get the full story on new Glas-Gard film—exclusive scratch-protection for all Westinghouse Gold Star Picture Tubes.

Distributors and servicemen-dealers who wish to sell Westinghouse Gold Star Picture Tubes with exclusive Glas-Gard protection are invited to call or write any of these Westinghouse sales offices:

ATLANTA 2, GA.
1299 Northside Drive, N. W.
TRinity 4-1641

BLOOMFIELD, NEW JERSEY
MacArthur Avenue
HUmiboldt 4-3000

BOSTON, MASS.
10 High St.
Llberty 2-0600

CHARLOTTE 8, N. C.
P.O. Box 1399, 2001 W. Morehead St.
FRanklin 7-3471

CHICAGO, ILL.
2211 West Pershing Road
WHitehall 4-3860

CINCINNATI 2, OHIO
6th & Main Streets
GARfield 1-2250

DENVER 10, COLORADO
710 E. Louisiana Ave.
PEarl 3-5528

DES MOINES, IOWA
2515 Dean Ave.
AMherst 2-3181

DETROIT, MICHIGAN
P.O. Box 502, 5757 Trumbull Ave.
TRinity 2-7010

ELMIRA, NEW YORK
P.O. Box 284
REgent 9-3611

KANSAS CITY 6, MO.
101 West 11th St.
HArrison 1-7122

KAILUA, HAWAII
Box 188

LOS ANGELES, CALIF.
600 St. Paul Ave.
MAdison 6-3881

MELROSE 76, MASS.
Box 131, 53 Youle St.
NOrmandy 5-0879

PHILADELPHIA 4, PA.
3001 Walnut St.
EVergreen 2-1200

PITTSBURGH, PA.
306 Fourth Avenue
EXpress 1-2800

SAN LORENZO, CALIFORNIA
2222 Grant Avenue
BRowning 6-1800

TAMPA, FLORIDA
4304 Corona St.
62-4071

SEATTLE, WASHINGTON
1209 Poplar Place

INDIANAPOLIS 7, INDIANA
1560 Stadium Drive
GARfield 1-6911

**Westinghouse Electric Corporation,
Electronic Tube Division, Elmira, N. Y.**

You can be sure . . . if it's

Westinghouse



TV MANUFACTURERS TECHNICAL DIGEST

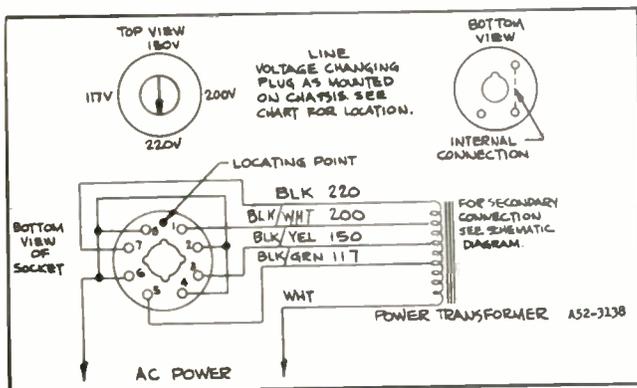
Continued from page 18

tube socket which has a filament lead channel to prevent incorrect lead dressing, is available for replacement. This socket also provides more chassis clearance and a greater margin of safety. The socket (part number 180695-1) can be obtained from the nearest Magnavox parts distributor. Damaged sockets may be returned for exchange.

ANDREA

Chassis VT-123 — Multiple-Voltage Power Transformer

These chassis are equipped with a variable a-c input and may be operated on 117, 150, 200 and 220 volts. The chassis are shipped with the transformer



Andrea's VT-123 chassis will operate on various a-c line voltages ranging from 117 to 220v, 50 to 60 cps. Proper voltage for the power transformer's multi-voltage primary can be selected by removing and re-inserting the line voltage-changing plug on the chassis.

connected for set operation at the voltage stamped on the chassis rear.

To use this set on any voltage not specified on the chassis, remove the line voltage changing plug from its socket in the chassis and re-insert it with the plug's arrow pointing toward the voltage needed.

For combination models make sure that the TV chassis plug and the plug on the amplifier are set at the same voltage.

RCA

Ion Magnets for Modern CRT's

The magnetic flux density of original ion magnets used in many older receivers ranged from 46 to 55 gauss. Because of a change in gun structure, all new and rebuilt CRT's require ion traps rated from 31 to 33 gauss. If the old type traps are used on a new or rebuilt replacement tube, the magnet may have to be adjusted too far back on the tube's neck and maximum brightness may not be obtained. The proper ion magnet should be used when replacing a CRT.

Continued on page 30

TIME-TESTED HEATHKITS NOW WITH NEW FEATURES



World's largest selling VTVM

No finer VTVM value at this price anywhere! A favorite for years because of its high accuracy and dependability at low cost. Now, with improved styling, extended low frequency response, and single test probe convenience, an even greater value! Precision components and high quality throughout for years of dependable, trouble-free performance. Check the specifications below and you'll see why Heathkit offers more.

Kit IM-11 . . . 5 lbs. . . no money down, \$5 mo. **\$29.95**
Assembled IMW-11 . . . no money down, \$5 mo. **\$46.75**

SPECIFICATIONS—Meter scales: DC & AC (RMS): 0-1.5, 5, 15, 50, 150, 500, 1500 volts full scale. AC peak-to-peak: 0-4, 14, 40, 140, 400, 1400, 4000. Resistance: 10 ohm center scale x1, x10, x100, x1000, x10K, x100K, x1 meg. Measures .1 ohm to 1000 megohms with internal battery. Meter: 4 1/2" 200 ua movement. Multipliers: 1% precision type. Input resistance DC: 11 megohms (1 megohm in probe) on all ranges. Circuit: Balanced bridge (push-pull) using twin triode. Accuracy: DC ± 3%, AC ± 5% of full scale. Frequency response: ± 1 db, 25 cps to 1 mc (600 ohm source). Battery: 1.5 volt, size "C" flashlight cell. Dimensions: 7 3/4" H x 4 1/16" W x 4 1/4" D.

Lab quality—low price AC-VTVM

New features . . . new styling . . . new performance in this brand new Heathkit AC VTVM! An excellent meter for use where high accuracy AC measurements are a must! 10 ranges, 0.01 to 300 volts RMS.

Kit IM-21 . . . 4 lbs. . . no money down, \$5 mo. **\$33.95**
Assembled IMW-21 . . . no money down, \$7 mo. **\$60.25**

SPECIFICATIONS—Frequency response: ± 1 db 10 cps to 500 kc, ± 2db 10 cps to 1 mc, all ranges. Ranges: VOLTS—Ten ranges from 0.01 to 300 volts RMS full scale. Decibels: Total range -52 to +52 db, meter scale -12 to +12 db (0 db = 1 mw in 600 ohms), ten switch selected ranges from -40 to +50 db in 10 db steps. Input impedance: 10 megohms shunted by 12 uuf on ranges 10 to 300 volts, 10 megohms shunted by 22 uuf on ranges .03 to 3 volts. Accuracy: Within 5% of full scale. Dimensions: 7 3/4" H x 4 1/16" W x 4 1/4" D.



Remember! Heathkit offers more kits,
better quality, guaranteed satisfaction



HEATH COMPANY

Benton Harbor 24, Michigan

Yes, Send free 1962 Heathkit Catalog
 Enclosed is \$_____; send _____

Name _____

Address _____

City _____

Zone _____

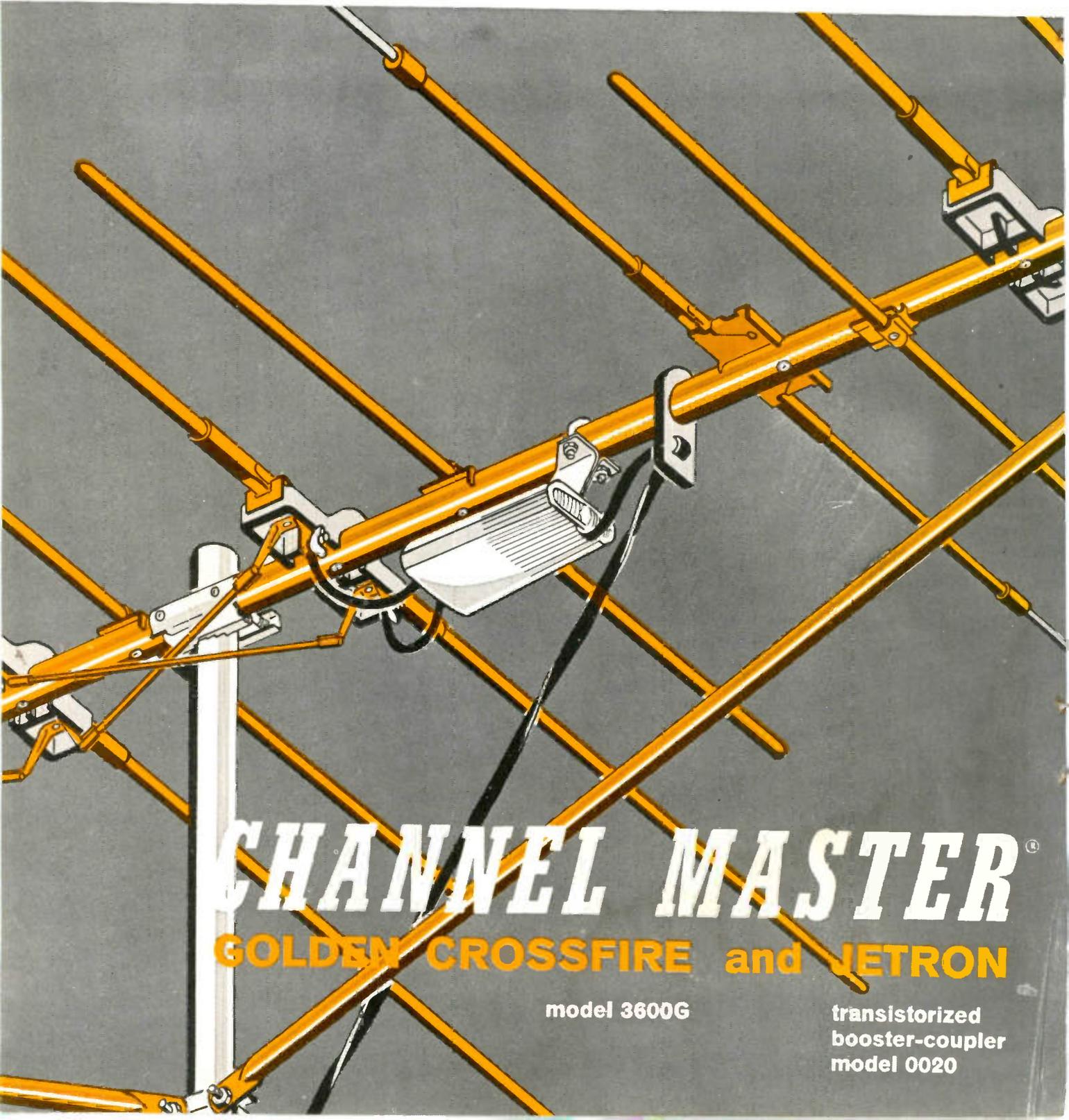
State _____

ORDERING INSTRUCTIONS: Fill out the order blank, include charges for parcel post according to weights shown. Express orders shipped delivery charges collect. All prices F.O.B. Benton Harbor, Mich. A 20% deposit is required on all C.O.D. orders. Prices subject to change without notice. Dealer and export prices slightly higher.

For more details, circle 30 on page 52

The most powerful pair you can put on a TV mast!

BEST...for black & white TV...color TV...and FM, too!



CHANNEL MASTER[®]

GOLDEN CROSSFIRE and JETRON

model 3600G

transistorized
booster-coupler
model 0020

There are no lazy elements in the Golden Crossfire!

In less than three months, the Channel Master Golden Crossfire has become the most wanted antenna of all time! Dealers and customers alike have been quick to recognize the outstanding superiority of the Crossfire over every other antenna.

The remarkable performance of the Crossfire is made possible by the use of a revolutionary engineering principle... Proportional Energy Absorption. In other antennas, a great many of the elements are "lazy" on any given channel... they are not actively working. But in the Crossfire, Proportional Energy Absorption puts more picture-pulling elements to work on every channel. The result: the highest gain and front-to-back ratios ever built into a broad band antenna!

The Crossfire's performance is coupled with "take anything" construction that provides exceptional resistance to high winds and ice loading.

Antenna-mounted booster... install it, then forget it!

The Jetron is built to last! Not only does it have fewer components than any other booster, but the Jetron amplifier pod on the antenna contains no transformer, no rectifier, no filter capacitor. These components are all in the power supply, right by the set, where servicing is quick and easy. This power supply also serves as a 4-set coupler.

The Jetron can be used with any make or type of antenna to add electronic power boost. You are not limited to a particular antenna. That's why the Jetron provides a convenient, trouble-free means of enhancing the performance of already existing installations.

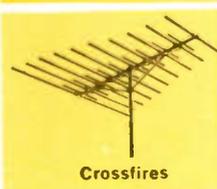
Here's why no other booster measures up to the Jetron!

FEATURE	Jetron	Booster A	Booster B	Booster C
No. of sets that can be coupled	4	1	2	4
Newest low-noise transistor	Yes	No	No	Yes
Low-cost AC operation	Yes	Yes	Yes	No
Antenna-mounted components subject to failure (electrolytic condenser, selenium rectifier)	No	Yes	Yes	No
No. of antenna mounted components	14	26	31	22
Highest gain on:	high band	low band	low band	low band
Consumer-appeal styling	Yes	Yes	No	No

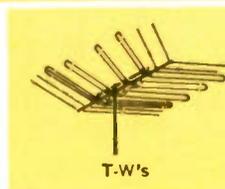
PICK THE RIGHT ANTENNA FOR THE JOB! CHANNEL MASTER MAKES IT IN **GOLD...** AT NO INCREASE IN PRICE!

There's no need to sacrifice performance in order to meet a customer's desire for a gold antenna. Channel Master has the widest selection of gold antennas. Seventy-seven individual models are now available with Channel Master's exclusive E•P•C "golden overcoat".

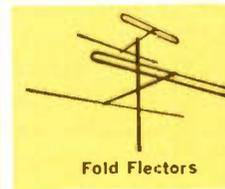
- ENHANCES** appearance for extra consumer appeal.
- PROTECTS** antenna performance against salt air, industrial atmosphere, chimney smoke, and other corrosive agents.
- CONDUCTS** electrical energy and assures metal-to-metal contact. Does not have to be scraped off like anodizing. E•P•C protects the entire antenna... and really lasts!



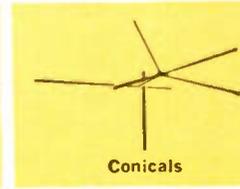
Crossfires



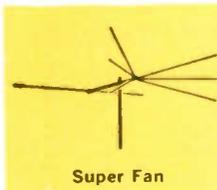
T-W's



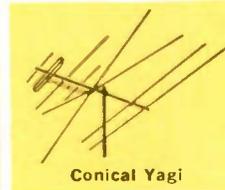
Fold Flectors



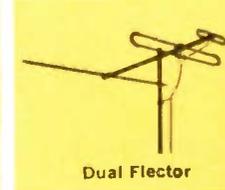
Conicals



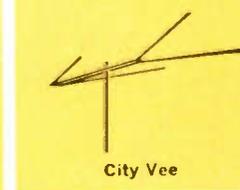
Super Fan



Conical Yagi



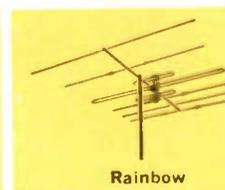
Dual Flector



City Vee



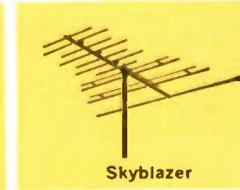
Champion



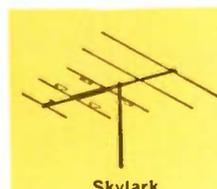
Rainbow



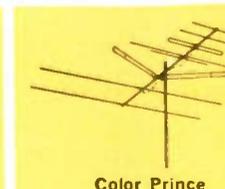
Super Rainbow



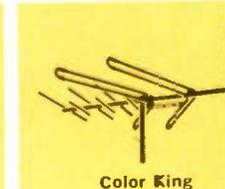
Skyblazer



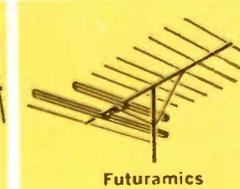
Skylark



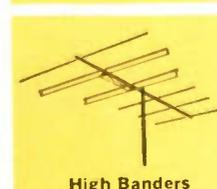
Color Prince



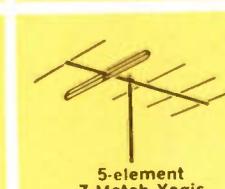
Color King



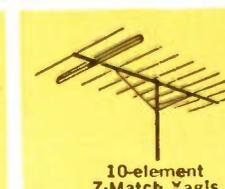
Futuramics



High Banders



5-element Z-Match Yagis



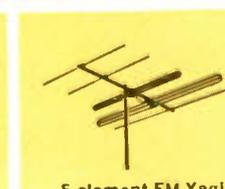
10-element Z-Match Yagis



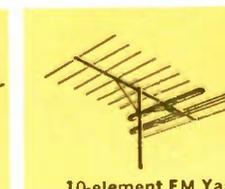
UHF Para-Scope



3-element FM Yagi



5-element FM Yagi



10-element FM Yagi



FM Turnstile

For the best antenna of its type, select a Channel Master Gold Medal antenna.



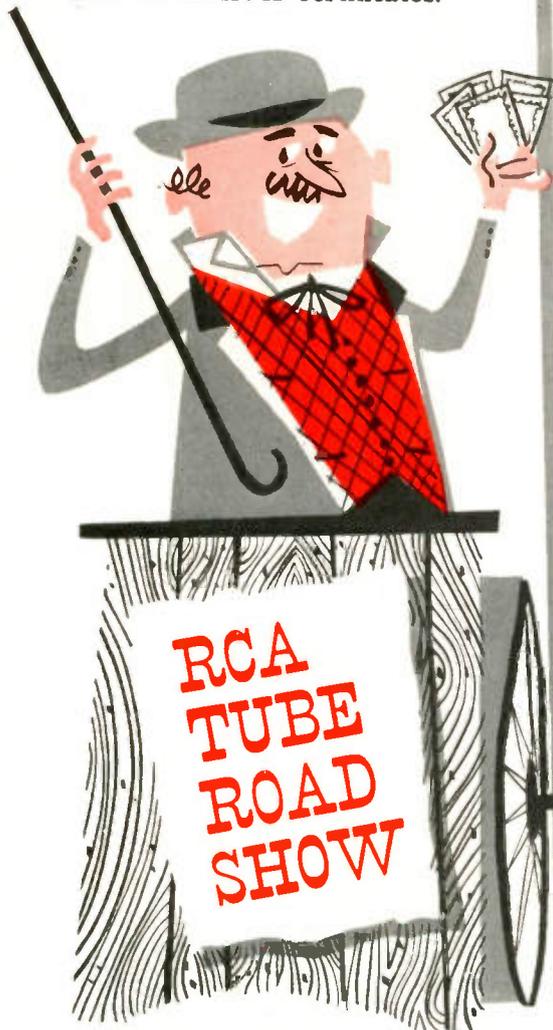
For more details, circle 20 on page 52

RCA TUBE ROADSHOW

"Step right up, folks—
hurry, hurry, hurry..."

"All right, friends, tell you what this show's about. For a limited time now, you're going to earn yourself valuable certificates when you buy famous RCA Electron Tubes. You can redeem your certificates any time through July, 1962, at any Firestone store or dealer for a wide selection of auto accessories and valuable gifts.

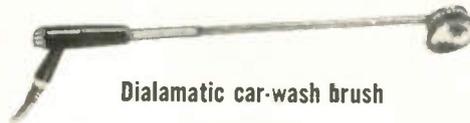
"Just cast your eyes upon a few of the items you can get with your RCA ROADSHOW Certificates."



Car and truck tires, standard or snow-tread



Firestone or Delco batteries, 6- or 12-volt



Dialomatic car-wash brush



Sno-Chaser brush



AC or Autolite spark plugs



Auto rugs and floor mats



COMES TO TOWN

FEATURING Firestone

"And here's the best part of all, friends. This year you can do your Christmas shopping at Firestone stores with ROADSHOW Certificates. Look what you can get for your family, just for buying RCA tubes..."



Bicycles, tricycles



Pedal-driven fire engines



Golf cart



Scooters



Croquet set



Wagons



Badminton set

"Now how about that, friends? A brighter, happier Christmas for your entire family. So go down and talk to your Authorized RCA Distributor today. Ask him about the wonderful things you can get with RCA ROADSHOW certificates."

RCA ELECTRON TUBE DIVISION



The Most Trusted Name in Electronics

TUNING IN

NAB TELLS FCC it trespasses on American freedom if it seeks to dictate what Americans should hear and see on radio and TV. The National Association of Broadcasters dissects the broad revisions proposed by the Federal Communications Commission and takes a position between the extreme views that a broadcaster may broadcast whatever he desires so long as his programs are not obscene, indecent or profane; and that the people own the airwaves and the FCC, acting for them, can dictate what is broadcast. The Association says broadcasters approve efforts by the FCC "in encouraging an ever-increasing elevation in the quality and scope of broadcast programming," but adds: "If and when the government moves from the area of encouragement and stimulation of programming in general to the area of advocating with favor or disfavor specific programming, or with special emphasis in specific categories of programming, then it has stepped across the line that divides its responsibility from that of the licensee. . . ."

DENTAL PAIN KILLER



A "Stereo Dental Package," by Koss, Inc., for use by dentists in audio analgesic systems provides relaxation and materially raises the pain threshold. Effect is even more pronounced with patient-controlled "white sound," a noise applied to the hearing mechanism to produce a masking effect and reduce the apparent intensity of other stimuli. The package includes a white noise generator.

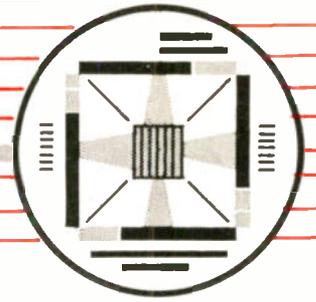
FIRST LP RECORD now in the Smithsonian Institution. Dr. Peter C. Goldmark, president and director of research, CBS Laboratories, has presented the Institution with the first 33-1/3 rpm record on which he and his associates first succeeded in recording 16 minutes of sound. Institution secretary, Dr. Leonard Carmichael, said the record made in 1945 is a significant addition to the national collections, which span the 83 years since Thomas A. Edison patented the phonograph in February 1878.

CRT WITHOUT LINES, mounted in a special German-made TV set, was displayed at the recent Berlin, Fair in Germany. The new-type Westinghouse picture tube eliminates the usual scanning lines by subjecting the electron beam to a small-amplitude, high-frequency deflection, thus enlarging it vertically to fill in the conspicuous black areas between the information lines. The output of an oscillator is used to deflect the scanning spot so that it moves up and down in a sinusoidal path instead of tracing straight across the tube. Difficulties inherent in previous methods for eliminating horizontal lines were overcome with a split-focus grid device, developed by the Westinghouse electronic tube division.

ON THE RISE are United Kingdom exports of electronic products to the United States. First quarter in 1961 total over \$4.5 million, up 6 percent over the same period in 1960, reports the Electronics Division of the Business and Defense Services Administration, U. S. Department of Commerce. Record-playing mechanisms accounted for over 50 percent of the total value, an increase of 26 percent, but exports of record players, radios and phonographs dropped sharply. Substantial increase in exports of electron tubes was offset by a decline in exports of communications, navigation and radar equipment.

A SINISTER THREAT in increasing government ownership of patents. At the recent National Electronics Conference, Robert W. Galvin, president of Motorola, Inc., expressed grave concern that increasing government ownership of patents has become a vital and fundamental threat to the root strengths of the electronic industry. He said, in part: "There may have been a unique justification for the government owning inventions associated with atomic research because of the lethal nature of the weapon that resulted. The justification should have ended there. . . ."

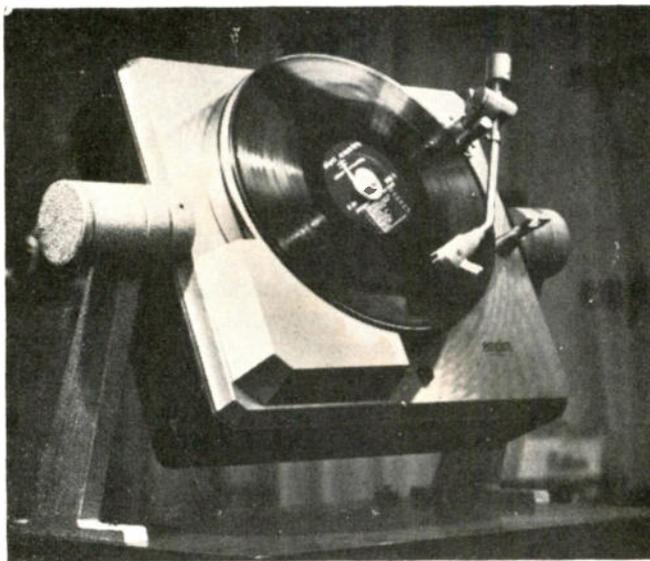
THE PICTURE



PRODUCTION totals for both radio and TV receivers hit the second highest peak of the year in August, according to the Electronic Industries Association. TV output in August totaled 514,674 sets, second only to the June high total of 615,118. Cumulative output for 1961 exceeded the total for the same period in 1960 by 5,000 sets. Radio output in August, 1,385,101, was also the highest since June, for a total of 1,626,263. Year-to-date output of radio sets remained below the cumulative total for the same period in 1960. One interesting segment of the compilation shows: TV sets with UHF Tuner in August, 33,946; year-to-date, 1961, 205,011; year-to-date, 1960, 286,297 sets.

WOMAN'S HAT SHOP has an FM radio station behind it which is the hobby of two Mount Kisco (N. Y.) business men and six other Westchester residents. Their daily jobs range from radio station engineering, restaurant proprietorship, writing and selling to other remunerative activities. But before and after work, they operate station WRNW, on 107.1 mc, where they are announcers, programmers, disc jockeys, repairmen. The mail? Their wives answer it. First

I'VE GOT A SECRET!



It performs perfectly upsidedown as well as right side up! The Empire Troubador's "secret" is a dynamically-balanced tone arm. Dynamic tone arms utilize a counter weight to maintain horizontal balance in any position. An adjustable spring applies vertical stylus tracking pressure.

CALENDAR OF COMING EVENTS

- Feb. 3-6:** 2nd bi-annual Palms Springs Conference. Southern California Chapter, Electronic Representatives Assn., (ERA). Riviera Hotel, Palm Springs, Calif.
- Feb. 6-7:** 25th regional seminar, National Electronic Distributors Assn., (NEDA). Shrine Exposition Hall, Los Angeles, Calif.
- Feb. 9-11:** 2nd Pacific Electronic Trade Show, (PET). Shrine Exposition Hall, Los Angeles, Calif.
- Mar. 20-25:** 1962 Los Angeles High Fidelity Music Show, Institute of High Fidelity Manufacturers, Inc., (IHFM). Ambassador Hotel, Los Angeles, Calif.
- Mar. 26-29:** IRE International Convention, Coliseum and Waldorf-Astoria Hotel, New York, N. Y.
- Mar. 28-31:** 11th biennial Electrical Industry Show and Conference. Electrical Maintenance Engineers Association of Calif. Shrine Exposition Hall, Los Angeles, Calif.
- April 11-13:** S. W. IRE Conference and Electronics Show, (SWIRECO) Rice Hotel, Houston, Texas.

broadcast, April 8, 1960. Original investment, \$10,000. Increased to \$30,000 for additional equipment and expanded music library. Broadcasting hours extend from six a.m. to midnight.

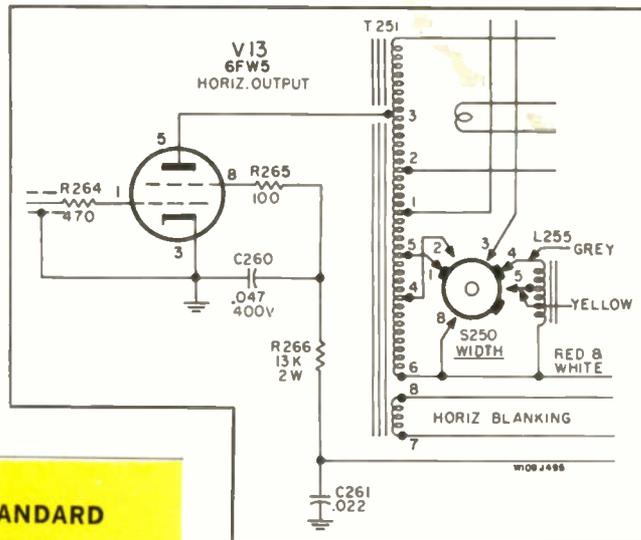
PAY TV, in the form of community antenna TV systems, began more than ten years ago and shows no signs of abating. Since World War II, more than 1,000 communities across the country have installed the systems, which serve more than 3,700,000 households. These systems consist of an antenna installed conveniently near a TV signal and electronic equipment to send the signal at increased strength through a coaxial distribution cable or over microwave transmission lines.

FOR WANT OF A MAGNET . . . if these little units lost their magnetism the complex communications system would come to a halt. More than 200,000,000 were produced last year for more than 40,000 uses. Alnico magnets find their greatest single market in the electronic communications and entertainment fields. In their development, the first breakthrough was the discovery, during the past twenty years, that magnetic properties could be built into alloys of aluminum, nickel, cobalt and iron. The second breakthrough, achieved during the past ten years, was the discovery of ferrites which hold the key to the future growth of companies in the magnetic field. Ferrites are mixtures of the oxides of iron and such metals as manganese, cobalt, nickel, copper and zinc.

TV MANUFACTURERS TECHNICAL DIGEST

Continued from page 23

Also, the blue glow sometimes seen in the neck of a picture tube does not indicate that the tube is gassy. This is a normal condition and is simply a fluorescent effect similar to that seen in some receiving tubes. Generally, the blue glow will vary as the ion magnet is adjusted and is usually at a minimum when the magnet is positioned properly.



Horizontal output circuit of G-E's M6 chassis, Code 112M6 and all later code numbers, which has a 6FW5 horizontal output tube installed in place of the original 6DQ6.

GENERAL ELECTRIC Chassis M6 — Production Changes

(See ET Circuit Digest No. 580, 8/60)

Code 024M6 and above: Capacitor C405 (in the low voltage rectifier circuit) is connected between pin 4 and 6 instead of from pin 4 to ground.

Code 028M6 and above: De-emphasis network RC303 (between the volume control and the ratio detector transformer's secondary) has been changed. The 10,000 pf capacitor, C303C, within the network has been replaced with a 5,000 pf unit.

Code 037M6 and above: Resistor R251 (across one section of the horizontal diode) is changed from 560K to 390K ohms.

Code 106M6 and above: Capacitor C264 (connected between pins 3 and 5 of the damper tube) is changed from 315 pf to 280 pf.

Code 109M6 and above: Integrator network RC 201 (between the sync amplifier's plate and the input to the vertical oscillator tube) is changed. Capacitor C201C has been changed from 150 pf to 100 pf.

Code 112M6 and above: The horizontal output circuit is changed to use a 6FW5 in place of a 6DQ6.

Since the plate of the new tube is connected at the tube's base, the original plate cap and lead assembly are likewise no longer used. In addition, the width coil (L255) is located on a terminal board.

**SAVE
CUSTOMERS
MAKE
MONEY**

THE INDUSTRY'S STANDARD

Most Widely Used Today
by Professional Servicemen



FAMOUS
DELUXE

B&K

CRT 440



For Black & White and Color

"Most valuable and useful" . . . "Wouldn't be without it" . . . "Pays for itself over and over again" . . . servicemen say. Quickly checks and corrects television picture tube troubles in a few minutes right in the home without removing tube from set. Gives new life to weak or inoperative tubes. Checks for leakage, shorts, open circuits and emission. Removes inter-element shorts and leakage. Repairs open circuits and low emission. Restores emission and brightness. Life Test checks gas content and predicts remaining useful life of picture tube. Makes new tube sales easier. Completely self-contained. Rich leatherette-covered carry-case. Net, \$74.95

TESTS AND REJUVENATES

all picture tubes at correct filament voltage from 1 to 12 volts

TESTS AND REJUVENATES

110° tubes and the new 19" and 23" tubes

TESTS AND REJUVENATES

color picture tubes. Checks each gun of color tube separately

UP-DATE YOUR B&K CRT WITH THESE ACCESSORIES

Model C40 Adapter. For use with previous Models 400 and 350 CRT's—to test and rejuvenate TV color picture tubes and 6.3 volt 110° picture tubes. Net, \$9.95

Model CR48 Adapter. For use with previous Models 400 and 350 CRT's—to test and rejuvenate 110° picture tubes with 2.34, 2.68, and 8.4 volt filaments. Net, \$4.95

Subscribe to
New
Picture Tube
Information
Service

See Your B&K
Distributor,
or Write for
Catalog AP18-T

B&K MANUFACTURING CO.
1801 W. BELLE PLAINE AVE • CHICAGO 13, ILL.
Canada: Atlas Radio Corp., 50 Wingold, Toronto 19, Ont.
Export: Empire Exporters, 277 Broadway, New York 7, U.S.A.

B&K

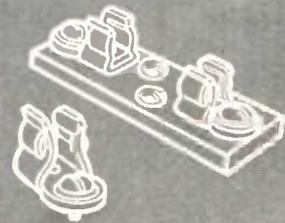
For more details, circle 13 on page 52



BUSS and **FUSETRON** **FUSES**

A Complete
Line of Fuses
in sizes
from 1/500
Amps. up

Plus
a companion
Line
of Clips,
Blocks
and Holders



Probably your best insurance against call-backs and loss of customer satisfaction is to install components of the highest quality.

To assure trouble-free service that helps protect your good name, each BUSS and FUSETRON fuse is tested in a sensitive electronic device that automatically rejects any fuse not correctly calibrated, prop-

erly constructed and right in all physical dimensions.

Thus, you help protect yourself against possible service troubles when you say to your jobber, "I want only genuine BUSS and FUSETRON fuses."

For more information, write for the BUSS bulletin on small dimension fuses and fuseholders. Form SFB.

1261

BUSSMANN MFG. DIVISION, McGraw-Edison Co., UNIVERSITY AT JEFFERSON, ST. LOUIS 7, MO.

Talk Two-Way

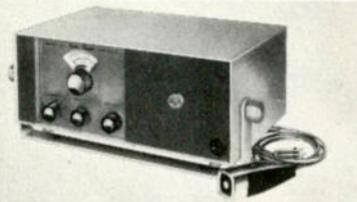
- on your job
- in your car
- in your office



PERSONAL-COM 300 Hand-Held 2-Way Radio

Rugged, dependable, fully transistorized 27-megacycle portable 2-way radio, designed specifically for business and industrial uses. Small and light, weighs less than one pound. Has 11-volt mercury battery for 50 hours' operation. Factory-installed plug-in module available to increase transmit power.

MARK VII "Top-of-the-Line" Citizens' Band 2-Way Radio



Short-range communications facilities for business service and personal needs. Ideally suited for use on materials handling vehicles, or for 2-way conversation between fixed points. Also serves as excellent base station for hand-held radio. 6 or 12 V DC or 115 V AC operation.

LOW-COST INTERCOM



A complete line of quality Intercoms—wired, or wireless—designed for office, factory or home use, at lowest prices. Suitable for many applications, from simple wireless 2-way talk-listen systems to flexible, multi-unit systems with a variety of talk-listen-monitor options.

Additional sales outlets are now being opened. Full particulars on request. Write to RCA, Telecommunication Center, Dept. C-417, Meadow Lands, Pa.



The Most Trusted Name in Electronics
RADIO CORPORATION OF AMERICA

RADIO CORPORATION OF AMERICA
Special Products Department, Dept. C-417, Meadow Lands, Pa.

Please send me complete information on the following:

RCA PERSONAL-COM 300 RCA Mark VII RCA Intercom

NAME _____
TITLE _____
FIRM OR ORG. _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____

AUDIO NEWS LETTER

SHURE BROS. names Gerald H. Reese as coordinator of sales promotion, advertising and public relations — a new post.

HARMAN-KARDON's eight-page question-and-answer brochure explains the features, installation, construction and philosophy of Citation hi-fi kits.

GENERAL ELECTRIC reports that Roy Dally, a G-E phono cartridge engineer, received the Emile Berliner Award for 1961 at the Annual Awards Banquet of the Audio Engineering Society.

ACOUSTIC RESEARCH expects to market a turntable-arm combination before the end of the year, their first product outside of the loudspeaker field. Unit to be single speed (33-1/3 rpm).

AM STEREO broadcasting petitions by RCA, Philco and others turned down by FCC. Agency said that, unlike FM stereo, there's no evidence of public need or industry desire for AM stereo.

PICKERING reports that approximately 200 hi-fi dealers will receive "Live Wire Dealers Promoting Pickering Products" awards . . . a plaque identifying them as Pickering key dealers.

ROBINS announces a new low cost bulk tape eraser. Erases recordings from reels of recording tape up to 7 inches in diameter and 1/4 of an inch wide. Especially suited for 3 and 4 inch reels. Model ME-77, \$22.

JENSEN INDUSTRIES' new snap-in cartridge kits cover replacements for every phono cartridge design and model. Eight cartridges and two each of 13 different brackets allows replacement of 432 cartridge types.

AMERICAN CONCERTONE adds model S505 to its line of tape recorders. Available in a large assortment of configurations, from a two-track recorder to the "Reverse-O-Matic," which reverses automatically to play the other stereo track.

FERRODYNAMICS announces improved "Brand Five" magnetic recording tape, at same price level as the old "Brand Five." Employs newly developed dry synthetic lubricant to eliminate squeal and gumming, as one of the improvements.

PENTRON introduces the Transtape, two-speed portable tape recorder. Originally introduced by Steelman Radio Corp., now re-engineered by Fairbanks-Morse, this transistorized, battery-operated recorder will be marketed exclusively by Pentron. \$149.95.

SPRAGUE CERAMIC CAPACITORS

THE Complete LINE THAT OFFERS MORE THAN MERE "CAPACITY"

"Rated" capacitance is not enough . . . actual capacitance during operation is equally important. Excessively high or low values as well as capacitance change with temperature can foul up a TV or radio set. Therefore, characteristics such as Capacitance Stability, Capacitance Tolerance, and Temperature Coefficient of Capacitance must be considered in replacement applications.

That's why the Sprague Ceramic Line is varied and broad—it includes capacitors with electrical and mechanical characteristics to meet practically every replacement requirement.

See complete listings in the new Sprague Catalog C-614. Get your copy from any Sprague Distributor, or write to Sprague Products Co., 65 Marshall St., North Adams, Massachusetts.

CERA-MITE® CAPACITORS



Tiny, tough, dependable. Silvered flat-plate construction for high by-pass efficiency, high self-resonant frequency. Available in the following types to meet specific requirements:

- *General Application*, for by-pass and coupling
- *High-K*, for applications requiring guaranteed minimum capacitance values
- *Temperature-Stable*, for minimum capacitance change with temperature
- *Temperature-Compensating*, for applications requiring negative temperature coefficient
- *NPO*, for use where capacitance change with temperature is undesirable
- *AC*, rated at 125 VAC
- *Buffer*, rated at 2000 WVDC
- *Low-voltage*, for by-pass and coupling in transistorized circuitry
- *TV Yoke*, rated at 3000 and 5000 WVDC

HYPERCON® CAPACITORS

Ultra-miniature discs for use in transistorized circuitry. Designed for by-pass and coupling applications in low voltage circuits where high capacitance and low power factor are important considerations. Superior in size and performance to comparably-rated aluminum electrolytic capacitors.

"UNIVERSAL" CAPACITORS



Have multiple leads. Quick-fix capacitors for on-the-spot repairs. By using certain leads for terminals, connecting certain leads together, and removing certain leads, various ratings may be obtained. Available in General Application as well as High-K types.

DOORKNOB CAPACITORS



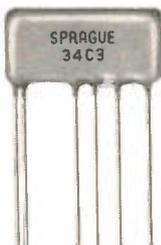
Available in 20 and 30 K V ratings. Molded guard rings lengthen surface creepage path. Complete with variety of screw-in terminals to meet all replacement requirements.

BUTTONHEAD CAPACITORS



Screw-mounting units with flat disc capacitor elements seated in hexagon head. This series includes feed-thru capacitors for filtering leads through chassis, as well as standoff capacitors for by-pass applications.

BULPLATE® CAPACITORS



Rugged multiple-section units which combine in one compact assembly all the capacitors used in one or more stages of a radio circuit. These space-saving capacitors are ideal for miniature sets.

SPRAGUE®
THE MARK OF RELIABILITY

WORLD'S LARGEST CAPACITOR MANUFACTURER

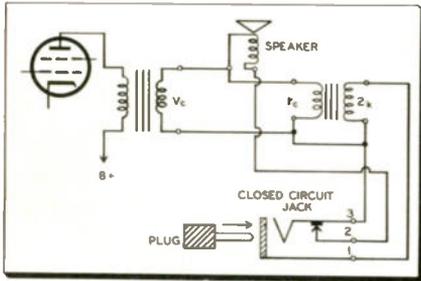
SHOP HINTS

TIPS FOR HOME AND BENCH SERVICE

Earphones on Series-String TV's

Earphone installation on series-string TV sets is one job that should not be taken lightly.

Connecting the phones through a blocking capacitor to the first



Earphone jack should be insulated from series string chassis. When low impedance phones are not available, an additional output transformer is used for matching.

or second audio tube's plate and chassis is positively out of the question, especially if the customer's home has cement or terrazzo floors.

To eliminate shock hazard, a closed circuit jack should be inserted in the set's audio output transformer secondary, as shown in the schematic. If four-ohm phones are not available, I mount a second audio output transformer inside the TV and wire it in backwards; that is voice coil-to-voice coil. The set's speaker disconnects automatically when the phone plug is inserted in the jack.

Impedance of the second transformer is selected to match the phones used. The jack is insulated from the cabinet with bushing-type fiber washers.—*Harry Parker, West Palm Beach, Fla.*

Misadjusted Horizontal Hold Triggers Remote

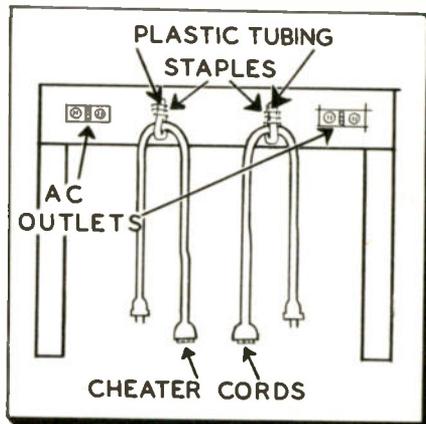
We have had several "self-triggering" complaints of remote controls in RCA color TV sets. (The channel selector continually moves from one channel to another and can be stopped only when the set is switched to manual operation.)

Customers will often turn the horizontal hold control trying to

adjust their picture, and in the confusion the control is turned too far. This setting of the horizontal control will usually start the remote control channel selector operating. Usual cure for this trouble will be readjustment of the horizontal hold control until the picture shows one frame. The remote unit will then stop triggering. This symptom may not occur on all color sets, but we have seen it on a few.—*H. L. Davidson, Fort Dodge, Iowa.*

Bench Fastened Cheater Cords

Frequently the last set repaired for the day by my bench technicians was delivered to the customer



Cheater cords are fastened to back of work bench with flexible plastic tubing to keep handy and to prevent loss.

with a shop a-c cord still attached. In fact, we were continually running out of cheater cords.

To prevent this from continuing, I furnished each test position with a fastened a-c cord. A technician could easily shift his a-c connection within his immediate area, but the set could not be transferred to the out-going rack with the cord attached. After moving five feet, the technician would become immediately aware he was still connected.

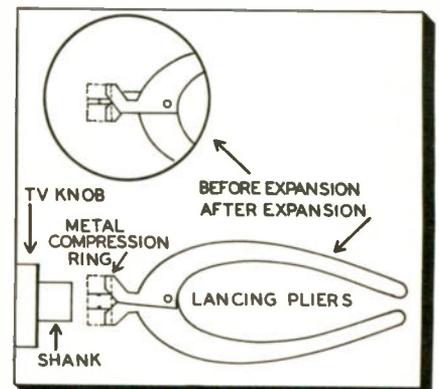
I use a length of 1/4-inch flexible plastic tubing at each a-c outlet to act as the cord holder. The tubing is wrapped one full turn around the cheater cord and the two ends

of the plastic tubing are stapled to the bench.

Each work area has a set-up of this type, and the technician is immediately alerted when the a-c cord is left connected.—*George E. Lytle, Marion, Ohio.*

Installing Knob Compression Rings

Installing small metal compression rings on TV and radio knobs can be a troublesome job. But it



Knob compression rings can be easily installed on knob shank with lancing plier.

can be made easy and simple by using an XA12X70 GE or equivalent type lancing plier. The plier is normally used to install grommets in certain types of steam irons. TV technicians who service small appliances may already have this tool.

Rings are easily placed on knob's shank by inserting the plier tips in the ring and applying pressure on the handles. This expands the ring and it can then be slipped on the shank while in an expanded condition.—*Dee Bramlette, Jr., Greenbrier, Tenn.*

SHOP HINTS WANTED!

\$5 to \$10 for acceptable items. Use drawings to illustrate whenever necessary. A rough sketch will do. Photos are desirable. Unacceptable items will be returned if accompanied by a stamped envelope. Send your entries to Shop Hints Editor, ELECTRONIC TECHNICIAN, 480 Lexington Ave., New York 17, N. Y.



©1961 VOLKSWAGEN OF AMERICA, INC. *SUGGESTED RETAIL PRICE, EAST & EAST P. O. E., \$1,995 WEST COAST

“Near as I can tell, somebody tried to put anti-freeze in it.”

Please don't try to force alcohol on our little truck.

It can't hold it.

There's nothing in the Volkswagen cooling system that can freeze, anyhow. Just air.

You may not have given much thought to air-cooling an engine. It has its advantages.

No radiator to leak. Or flush out. Or rust.

No hose to rot. No pump to poop out.

No water to freeze up or boil over.

No anti-freeze to buy.

You'll never hear of a Volkswagen with a cracked block from the cold.

Or of one that blew its top in a summer traffic jam.

For more details, circle 53 on page 52

It may seem funny that the truck that can't freeze up or boil over only costs \$1,895*, while trucks that cost several hundred more can still be seen by the side of the road.

On the other hand, you may not think it's funny at all.

It all depends on which one you have.

NOW! ONE SOURCE TO BUY FROM... ONE NAME

TO SELL — ELECTRO-VOICE!

300

**EXACT
REPLACEMENT
NEEDLES**

Complete line
to fill every need



150

**EXACT
REPLACEMENT
CARTRIDGES**

for every modern type,
every major brand

90 replaceable-needle
cartridges

60 plug-in, permanent-
needle cartridges

**THE
INDUSTRY'S
ONLY COMPLETE
"LOOK-ALIKE" LINE
OF BOTH
NEEDLES AND
CARTRIDGES!**

Here, at last! The industry's first complete line of both needles and cartridges of every type! Not just a few general-purpose models, but exact type-for-type, model-for-model, "look-alike" replacements for every modern type, every major brand!

It's the greatest merchandising break-through since needles and cartridges became "big business." And only Electro-Voice, with over 35 years experience in electro-acoustics exclusively, could accomplish it.

What an opportunity for you to consolidate your inventory! . . . to step-up sales through instant, convenient service! . . . and enjoy complete coverage of your entire cartridge and replacement-needle requirements from one source. Saves time, money . . . simplifies inventory . . . and speeds your ordering. And complete cross-reference catalogs, wall charts and guides make needle or cartridge selection quick and positive!

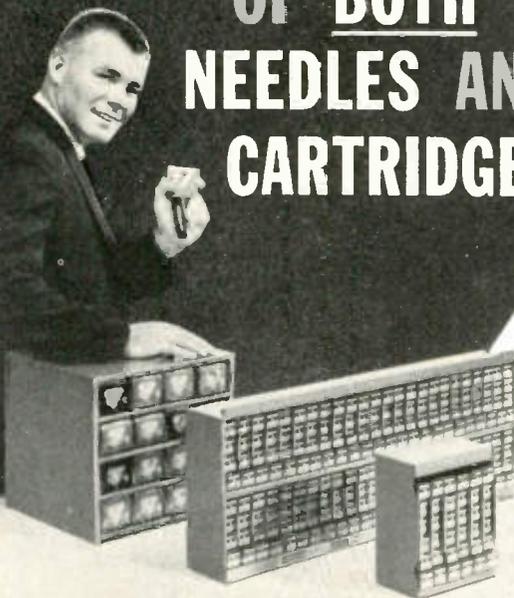


Your E-V distributor is now stocking the complete E-V needle and cartridge line. Ask him for your FREE cross-reference guides or write today for literature.

ELECTRO-VOICE, INC.,
Needles & Cartridge Div., Dept. 1217T
Buchanan, Michigan

For more details, circle 24 on page 52

Electro-Voice®



ET VIEWPOINT

FCC's Crucial UHF-TV Test

As we go to press, the Federal Communications Commission is about to put a TV station on the air. How well this station performs may drastically affect the entire future of TV broadcasting.

The station is WUHF, Channel 31, atop the Empire State Building in New York City. It is part of a \$2,000,000 project to determine how well UHF can perform in a major metropolitan area. The results of these tests could be the basis for FCC proposing to move all television to UHF, Channels 14 through 82.

Antennas on the four corners of the Empire State Building will broadcast to 100 monitoring sets placed at 5,000 different locations within a radius of 25 miles from the transmitting antenna. Greater distances will also be checked by mobile receivers. How UHF compares with VHF, particularly where there are shading problems of big buildings, will be the nub of the findings.

FCC is grimly seeking an answer to the dismal UHF picture. One recent report states that though there are 1,319 commercial UHF spots available, only 79 stations are on the air. And half of these are in trouble. Ninety-nine UHF stations have already failed. In comparison, there are 456 VHF stations broadcasting, out of a possible 556.

The basic reason for this unhappy state of affairs is that the FCC made an abysmal error when it set up its allocations originally. It never should have mixed VHF and UHF in the same market areas, because UHF has not been able to compete.

Among FCC plans to alleviate the situation, is to take VHF out of eight medium sized cities such as Madison, Wis.; Rockford and Champaign, Ill.; Hartford, Conn.; Erie, Pa.; Binghamton, N. Y.; Columbia, S. C.; and Montgomery, Ala.; areas where UHF has been established.

Next, FCC may try to get Congress to require by legislation that all TV sets have all-channel tuning. As we expressed in our May 1961 editorial, we are opposed to such "design by legislation," unless legislation also provides the economic basis. In other words,

the public will be forced to spend \$155,000,000 extra on its TV set purchases because of the UHF feature, unless Congress attracts (rather than forces) manufacturers to all-channel sets by eliminating the excise tax on such sets.

Next, FCC wants to add eight VHF stations to get a third major channel in most of the major markets. This might include such cities as Baton Rouge, La.; Birmingham, Ala.; Charlotte, N. C.; Dayton, Ohio; Jacksonville, Fla.; Johnstown, Pa.; Knoxville, Tenn.; and Oklahoma City, Okla.

At the same time, other communications services are casting covetous glances at the vast expanse of the TV spectrum that is so under-utilized.

What happens in New York with station WUHF will have great impact on the entire TV industry. The TV service dealer will have to play a vital role in any major change, since consumers will require converters, new antennas and related items. The current growth of color TV could also be affected adversely or favorably.

We wish the FCC good luck in this needed undertaking, but we caution them that they must listen carefully to the advice of industry — the same kind of advice from industry which could have prevented this UHF mess in the first place.

Joyeux Noel

As you can see from our cover, we are getting into the holiday spirit. We look upon this time, not only as one of celebration, but also a time of serious reflection of the world's need for good will.

Though each of us individually cannot affect the world's peace, we can each contribute by dealing with one another on a high moral level, with a will to do right, and the strength to protect our way of life and to offer human compassion. These are the characteristics we want for our nation in its international dealings.

On behalf of the staff, we wish you a Merry Christmas, good fortune, peace and happiness for the coming year.

Just How Critical Is Transistor Operation?

Practical experiments show how much voltages can change without seriously affecting performance. Results of substituting different types are shown

by Herb Bowden and Jim Neuman

Mr. Bowden is president and Mr. Neuman, field engineer of Sencore, Inc.

■ MANY OF US have heard lectures and read articles on transistor servicing. Authors and lecturers often express extreme and opposite views. One may claim that all you need to service transistor circuits is a coupling capacitor and a screw driver. Another may propose that accurate beta measurements are absolutely essential. Reports have been published in *ELECTRONIC TECHNICIAN* comparing the accuracy of one transistor tester against another. Those reports purposely did not indicate whether or not the accuracy was essential for practical service work. Nor was it the intent of those reports to examine tolerance extensively.

This article deals with the practical problems concerning transistor circuits and components, particularly transistors. Just how critical are transistors? How critical are bias voltages and battery voltages? How critical are replacement transistors?

To find out how critical, a typical transistor radio was selected at random and circuits upset, transistors substituted, voltages altered and biases changed. The results obtained indicated that transistors and transistor radio repair are not

nearly as critical as you might have been lead to believe. Transistorized circuits can be just as easy to repair as vacuum tube circuits, providing the technician has a working knowledge of the circuits and has practical test equipment to help speed him on his way to a satisfactory conclusion.

Here are the experiments that were performed to help dispel some of the fiction surrounding the repair of these circuits.

B Plus Voltages Varied

In order to find out what effect the battery voltage would have on a transistor radio's operation, a Philco model TS124 transistor radio was picked at random. This radio uses a 3 volt battery supply and a 1.5 volt bias tap. The AM radio was of conventional design using six PNP type transistors.

A variable transistor radio power supply of the type shown in Fig. 1 was used. This supply has a 1.5 volt biasing tap to provide the d-c bias required. All d-c measurements were made with a standard VTVM. Our "yardstick" of operation was to produce clear and adequate sound. The results were as follows:

"BATTERY" VOLTAGE	VOLUME AND TONE
3 volts (normal)	normal sound
2.5 volts	barely noticeable change; slight decrease in volume; tone normal
1.6 volts	volume very low with volume control all the way up; tone clear and distinct
1.5 volts	very slight indistinguishable sound in speaker with volume control all the way up; radio started motor boating

Knowing that the internal resistance of a battery increases as the voltage drops, the same experiment was tried with batteries. By adding resistor in series with the battery, increased battery resistance was simulated. The only change that took place was at the point where the radio became practically inaudible, which was at 1.7 volts.

From these results, it can be clearly seen that a rather large reduction in battery voltage can be present before the radio is appreciably affected. This is chiefly because transistors follow closely the characteristics of pentode tubes which compensate for wide voltage variations.

Altering the Biasing Voltages

Several checks were made to determine, from a practical standpoint, how critical biasing really is in transistor radios. Bias resistor values were changed to simulate actual field troubles. The converter transistor should be a critical stage as far as bias is concerned; so, we started with that. The emitter voltage on the converter transistor was 1.82 and the base was 1.72 volts measured from ground. This results in a 0.1 volt bias voltage. (Keep in mind that transistors are biased by current, but that the voltage bias can be used as an indicator of trouble.) The audio was monitored to note any change that the bias on the converter stage may have had on the receiver operation.

At 0.2 volt bias between the emitter and base, the radio would only track the lower end of the broadcast band. At 0.25 volt difference between the emitter and base, the radio was inoperative. It was interesting to note that, at this point, the emitter voltage and the difference voltage between the emitter and base were exactly the same. The emitter was at 0.25 volt and the base was at zero.

These voltages were measured from ground on a 3 volt scale, although they could have been read on a special VTVM. You will find it easier and more helpful to measure from ground in this manner used above, because, as just mentioned, the one element of the transistor may change considerably, pointing to the trouble in that part of the circuit. In the case just mentioned, the base went to zero, indicating trouble in the circuit connected to the base. Further, when measuring from ground, and subtracting the difference on a 3 volt scale, the results become a comparison, eliminating any error in your voltmeter from a calibration standpoint. Biases were changed on all other transistors in the radio and the results were almost identical to the converter bias change.

From these limited checks, it would appear that biasing voltages are not as critical as you may have

STAGE	ORIGINAL TRANSISTOR	SUBSTITUTE TRANSISTOR	RESULTS
Converter	T1033	2G406	radio worked satisfactorily
-Osc.	T1233	2N525	radio worked satisfactorily
1st I-F	T1233	2N406	radio worked satisfactorily
2nd I-F	T1001	2N406	radio worked satisfactorily
Audio driver	two	UST222	reduced volume, distortion at higher volumes.
Audio output stages (push pull)	T1003		

been taught to believe. However, keep in mind that a 0.25 volt change in bias on transistors may be a fairly large percentage of the total difference voltage. Also, remember that this voltage is not actually bias, but the word bias is

being used here for want of a better term.

Substituting Transistors

Have you ever wanted to "grab" a batch of transistors at random

Continued on page 70

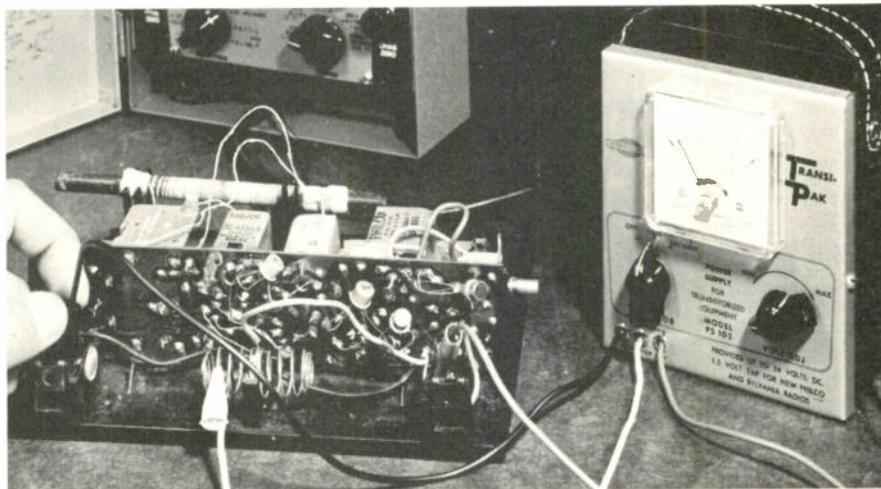


Fig. 1 — By substituting a Sencore PS103 variable power supply for the radio's batteries, voltage was reduced from 3 volts normal. At 2.5 volts, there was only a slight decrease in volume.

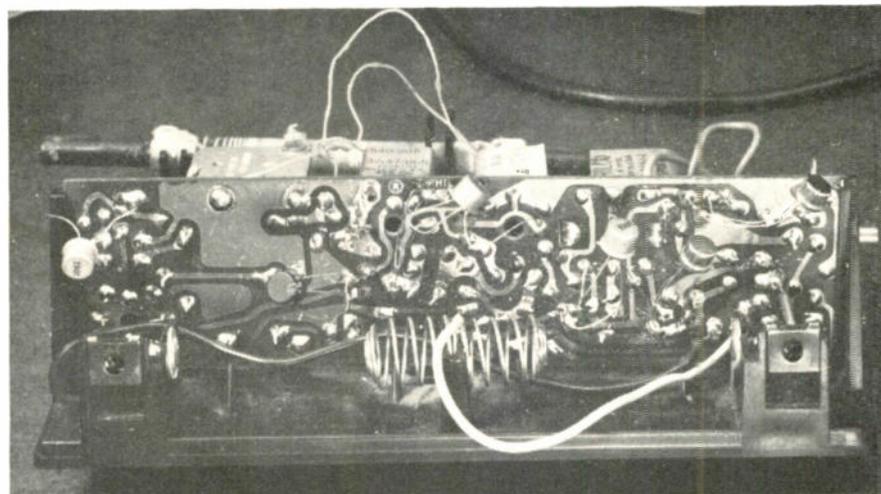


Fig. 2 — Close-up of Philco TS124 radio shows random batch of transistor types substituted for the original transistors. Except for output stage substitution, radio still worked satisfactorily.

"Reading" the CRT screen properly
can indicate the defect's source

How To Diagnose TV Picture

by Jack Hobbs

Technical Editor

■ "HUM" IN TV RECEIVERS can be extremely annoying to a set owner — and equally trying for a technician on many occasions.

Before the various hum symptoms can be diagnosed, the fault located and eliminated, however, the technician must distinguish the difference between "hum" and "buzz."

Hum is generally defined as an interference in the picture, or raster, appearing as black "hum bars" and caused by 60 or 120 cycle a-c ripple. When appearing in the set's sound section, the interference literally "hums" in the speaker at a low 60 or 120 cycle tone. A sample of this ripple on the scope will appear as a sine wave pattern.

Buzz, on the other hand, is a "raspy," rough, 60 cycle tone and its pattern on the scope appears essentially as a pulsed rectangular wave or as a sawtooth wave. It usually originates from a fault in the vertical sweep circuits or because of feedback from this circuit, and it can usually be easily isolated by varying the vertical hold control. If the tone changes in the set's speaker, the interference is obviously originating in the vertical section.

Buzz can be caused by an open decoupling capacitor, defective vertical blocking oscillator transformer, arcing between vertical windings in the deflection yoke, incorrect lead dress and other defects. Another type of buzz interference, or noise, is often called sync buzz. This can be caused by overloading,

misadjusted video i-f transformers, traps, agc faults, etc. The vertical sync signals are getting into the audio section. And the picture is usually over-contrasty and distorted. Buzz can also originate from ghost signals through the antenna. Widely out-of-phase ghost signals, for example, can cause a "ghost" horizontal blanking bar to appear vertically in the picture.

Video Hum

Perhaps the most usual cause of 60 cycle hum in TV sets' composite video section arises from cathode heater leakage in tuner, i-f, detector, video amplifier, agc and noise canceller tubes. Comparable leakage in a CRT is another, but less likely, cause.

The effect of typical cathode-to-heater leakage on a TV screen is shown in Fig. 1A. The defective tube can be quickly found by touching a low-capacitance scope probe to each tube's cathode, as shown in Fig. 2, beginning with the r-f tube in the tuner, and observing the video waveform. The "leaking" tube's cathode will show a distorted composite video pattern, as seen in Fig. 1B. Heater-to-grid leakage can also cause hum in the picture.

If the tube is completely shorted, the black area will be broader and more dense, and little or no video will appear on the raster. Hum may or may not appear in the sound. (In split video-sound sets, it will not appear in the sound unless the heater cathode leakage

is in a tuner tube or in a sound tube.)

Another rapid method used by technicians to locate a leaking tube, in parallel heater circuits, is to remove each tube — one by one — beginning with the r-f tube in the tuner. When the defective tube is removed, the black bar will no longer appear on the raster.

Some highly skilled technicians employ still another approach in sets with parallel heater supplies. Having learned from experience that snap judgments are risky, they take nothing for granted. The TV set's antenna is first removed and the antenna input terminals are shorted. This step definitely places the hum source in either an external or internal category. External interference from a nearby diathermy, or from other specialized electronic equipment, for example, is sometimes mistaken for an internal TV defect. Reversal of the set's line cord plug often gives similar information, too. If internal hum is causing the symptom, the light and dark areas on the screen will change positions.

To establish a consistent optimum per-set troubleshooting time-average, technicians employing the aforementioned procedures invariably remove the last i-f amplifier tube as the second step. This step isolates the fault to the video-detector-amplifier-CRT circuit, or to the area from tuner r-f tube up to and including all but the last i-f amplifier stage. If the fault has not been isolated after the second step, they usually follow the same basic procedure by removing the tuner's r-f amplifier tube. This method is generally considered to be the "fastest" average approach to this

HUM Symptoms

particular problem. Some other technicians, of course, have their own pet methods.

It should not be forgotten that a microphonic tube can also cause hum bars in the picture or raster. Also, an open screen by-pass capacitor can cause an i-f tube to oscillate — resulting in black bars on the screen.

Power Supply Hum

The next most usual cause of 60 cycle a-c hum is defective filters in TV sets having half-wave B+ supply rectifiers. If cathode heater leakage checks fail to isolate the hum problem to defective tubes, the technician would normally direct his attention to an open or leaking filter in the power supply.

Many technicians use a calibrated oscilloscope to measure the ripple content at various voltage divider points on the B+ supply and compare the p-p a-c ripple

content observed against manufacturers' specifications. When in doubt, the suspected capacitor is *removed* from the circuit and a known-to-be-good capacitor is substituted by using flexible clip leads.

A 60 cycle hum bar, as it may appear on the TV screen when a half-wave power supply filter is open, or leaking, is shown in Fig. 3B. Fig. 3A illustrates 120 cycle a-c ripple bars. Naturally, the 120 cycle ripple hum bars can only come from a defective capacitor in a full wave power supply — not from a leaking tube.

It is recalled at this point that hum can upset both vertical and horizontal sync signals even when the dark bars are only slightly visible in the picture or raster. Most sets employ parallel RC filter networks at sync clipper inputs to eliminate hum interference to sync pulses, but a-c hum can pass to the

Continued on page 64

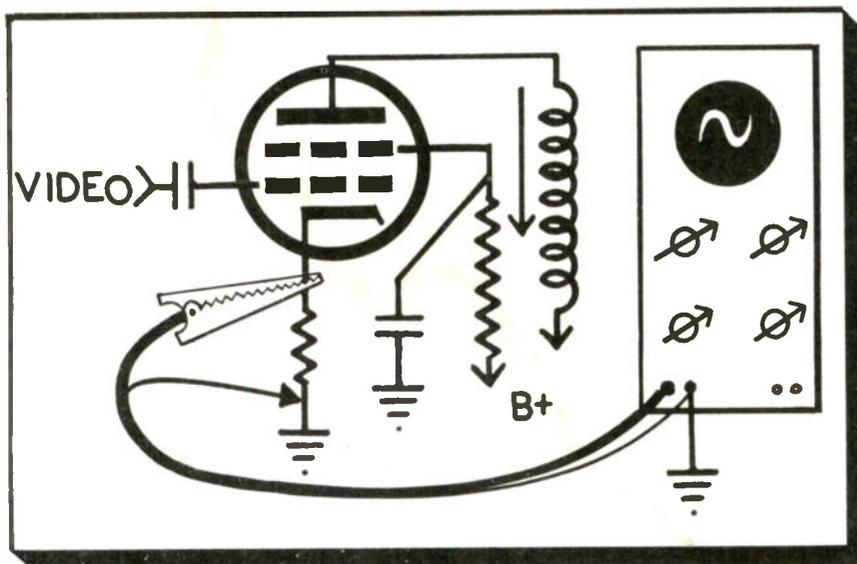


Fig. 2 — Heater-cathode leakage in video tube can be located by observing scope waveform at each tube's cathode. A low capacitance scope probe should be used.

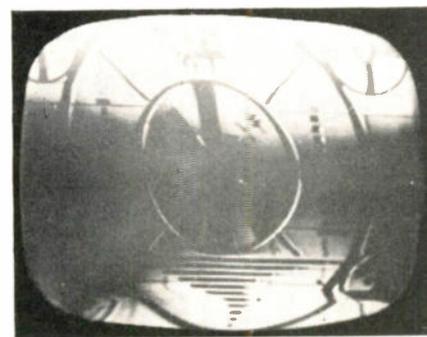


Fig. 1 (A) — 60-cycle hum bar on TV screen caused by heater-cathode leakage in tube. (B) — Composite video waveform from tube's cathode shows heavy a-c modulation.

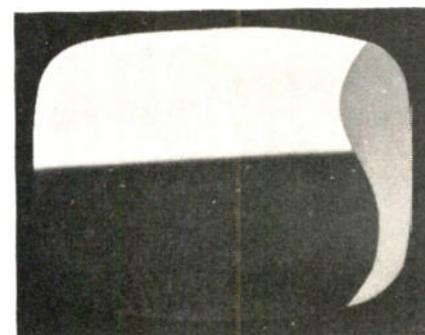
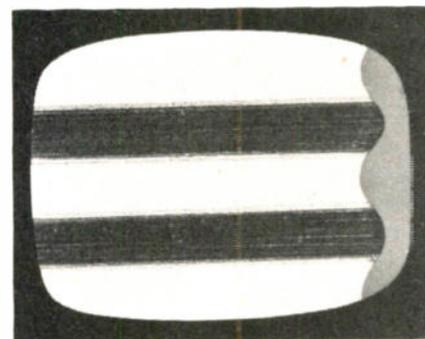


Fig. 3 (A) — 120-cycle hum bars on TV screen caused by open or leaking filter in full wave power supply. (B) — 60-cycle hum bar with similar fault in half wave supply. Faster off center to show curves at edge.

Illustration Credit: John F. Rider Publisher, Inc.

Single-ended and push-pull power output circuit variations are analyzed

Examining Audio Power Output Stages

by *Mannie Horowitz*

Electronic Instrument Company

■ A HI-FI SYSTEM'S audio amplifier may be considered as two distinct sections: preamplifier and power amplifier. Practically all front panel controls and inputs are located in the preamplifier. This includes all circuitry for equalization, low level amplification, signal frequency filtering and compensations as well as switching.

The power amplifier, however, seldom embodies control facilities other than balance, bias and damping factor adjustments, if any at all. There are exceptions, of course. For example, integrated stereo amplifier controls for speaker phasing and channel balance may be located on the front panel. Actually, their functional circuitry is situated in the power amplifier section.

A power amplifier generally consists of three circuit groups: phase inverter, output stage drivers and a power output section. Conventional amplifiers using high transconductance output tubes (6BQ5/EL84, 6CA7/EL34) require no special driver stages.

Output stage driver circuits are frequently omitted if a phase inverter couples its signal directly to the output tube's grid.

You should be familiar with several popular types of audio amplifier output circuitry to speed up troubleshooting time.

Single Ended

The simplest power output stage uses a single pentode output tube, as shown in Fig. 1. Signal applied to the grid of the tube is amplified by the tube, and power is delivered from the plate through the output transformer to the loudspeaker. This basic circuit is used in many radio and TV sets. Distortion and poor low frequency response limits its use as an output stage for a hi-fi audio amplifier.

Troubleshooting a single-ended output stage requires little variation from the techniques you're using in troubleshooting typical radio or TV sets' pentode voltage amplifiers.

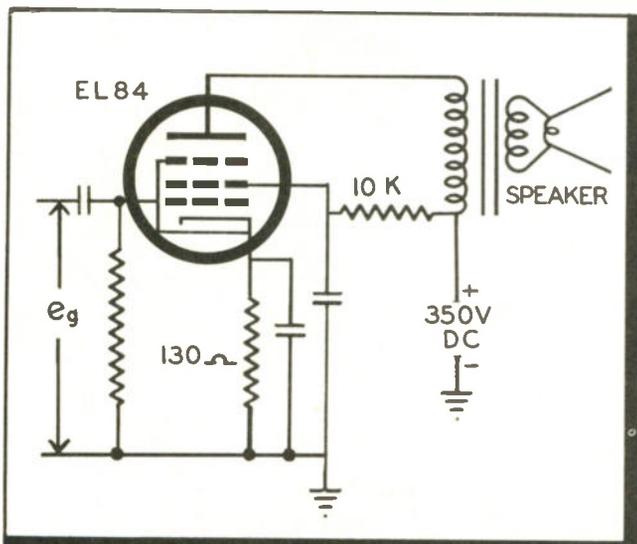


Fig. 1 — Single-ended power amplifier circuit often used in radio, phono, TV sets.

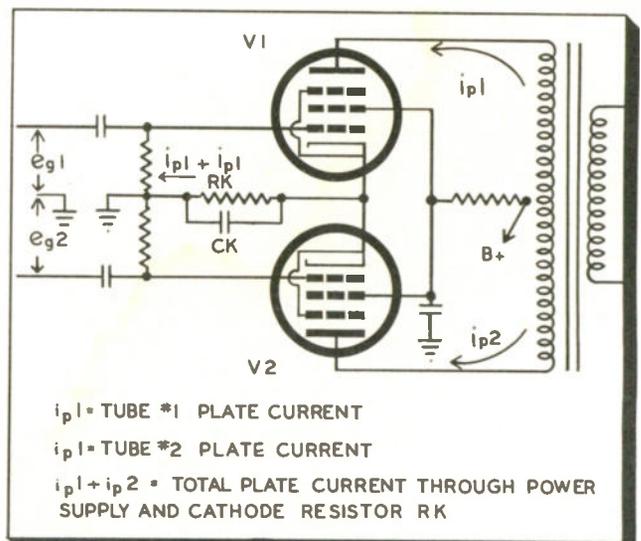


Fig. 2 — Simplified schematic of a conventional push-pull pentode power amplifier.

Push-Pull Circuits

Push-pull output stage operation is frequently utilized to overcome poor low frequency response, low power output and other shortcomings of a single ended arrangement.

A conventional and perhaps the most popular circuit is shown in Fig. 2.

D-c plate current through V1 can be traced by starting at its plate, through the upper half of the output transformer to the B+ supply and ground, back through the cathode resistor Rk to the cathode and back to the plate. The d-c plate current through V2 follows a similar path through the bottom half of the output transformer, B+, ground, Rk and back to the plate of that tube. The common elements are Rk and the power supply (B+ to ground). Each tube's individual reaction to a mutual current is essential troubleshooting information if a defective power stage is encountered.

If either tube or circuit is defective, cathode voltage is affected. This can mar proper operation of the other half of the circuit, frequently causing damage to the good tube. Therefore, it is a worthwhile policy to replace both tubes in a push-pull circuit if either tube or circuit has been found defective.

It should be noted that the plate currents from both tubes flow in opposite directions through their respective halves of the output transformer. Equal but opposite d-c fields are created in the core of the transformer. They are cancelled here, avoiding core saturation. Hence, better low frequency response can be expected from a push-pull type circuit.

At the same time d-c is applied to the output transformer's halves, power supply ripple is also present. If the output tubes are properly balanced (equal plate current under quiescent conditions) the ripple will be cancelled along with the d-c fields in the transformer.

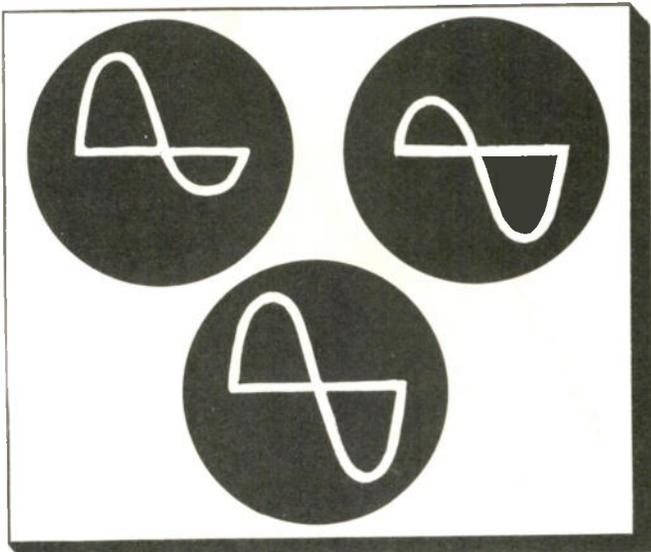


Fig. 3 — Signals appearing between each push-pull plate-to-B+ and plate-to-plate circuit as seen on an oscilloscope.

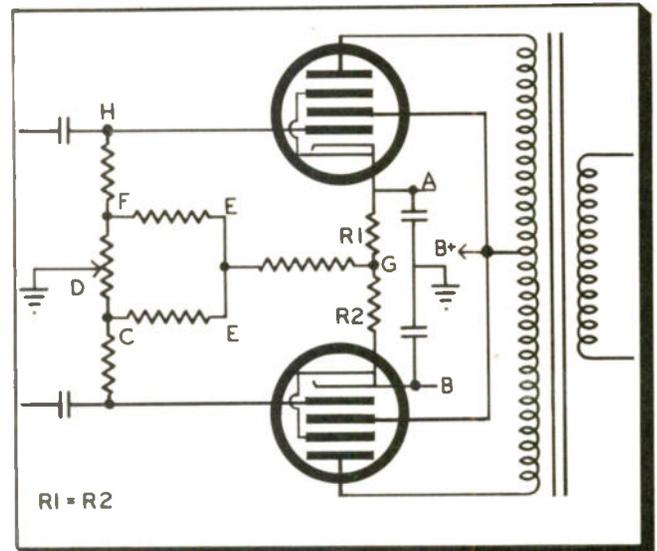


Fig. 6 — Self-biasing circuit with balancing control to permit manual compensation for changing characteristics of tubes.

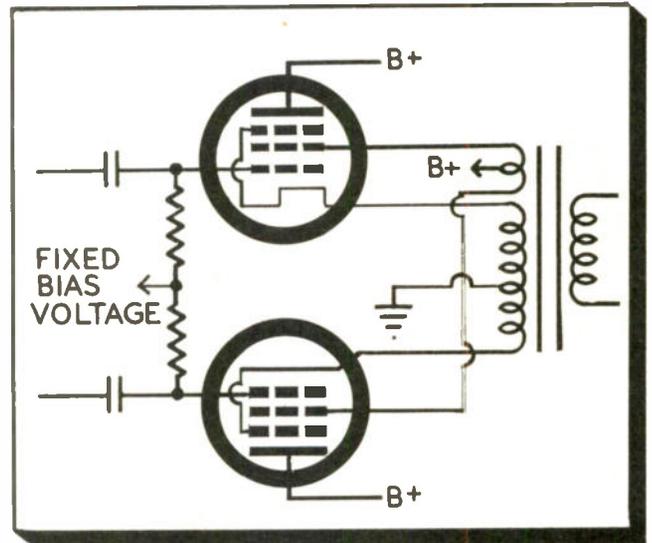


Fig. 5 — Conventional cathode-follower type output stage features both lower distortion and output impedance.

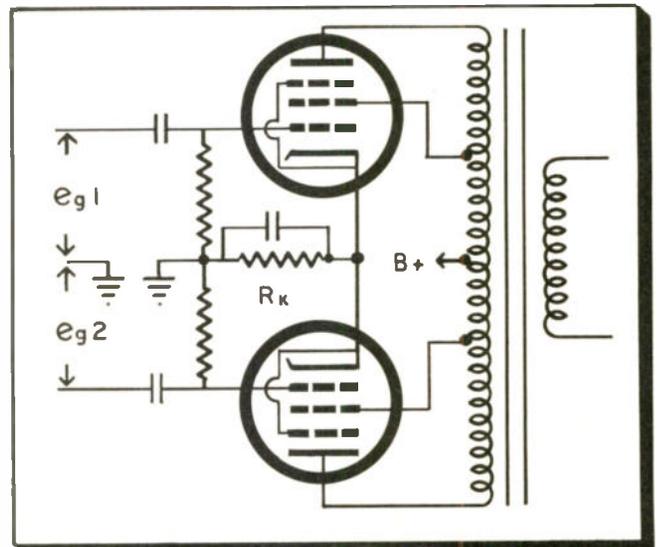


Fig. 4 — Ultra-linear power output stage ties tubes' screen grids to power transformer and primary center-tap to B+.

In operation, signal voltages at the grids of the two output tubes in Fig. 2 must be equal and 180° out of phase. This assumes that in each half cycle, while one grid swings positive the remaining grid swings negative. The relative phase is reversed on the second half of the cycle. Relative amplitude of the applied voltages can be measured on a scope by connecting a probe between ground and each individual grid.

Unequal signal amplitudes at the plates of the two tubes may indicate a defective tube or circuit in one half of the output stage.

To verify the phase relationship, you must first note the sinusoidal signal voltage amplitude between either grid and ground. Next, note the amplitude of the voltage appearing between the two grids. If the voltage in the latter measurement is twice that in the former, the voltages are exactly 180° out of phase.

This amplitude relationship also should be observed between the plate of each tube and the center-tap on the output transformer. Because the tubes do not work on the most linear portion of its individual characteristic, the signal will appear distorted as shown in Fig. 3. However, the sum of the signals appearing between the two plates or across the entire primary winding of the transformer should be undistorted due to the cancellation of even harmonics in push-pull operation.

Ultra-Linear

Among the variations of a conventional push-pull circuit shown in Fig. 2 is the ultra-linear power output circuit of Fig. 4. Note that in this circuit screen grids are connected to output transformer taps rather than to B+. The tap is chosen to provide some of the best characteristics of triode operation with some of the power capabilities of the pentode.

For many years triodes were considered the most distortion-free source of high fidelity power. The low

plate impedance of the triode relative to the pentode added strength to the case for the former. A disadvantage was the low power output.

When screen grids are tied to their respective plates, each tube behaves as a triode with all triode advantages but limited power delivery capabilities. With the screens connected to B+, the tubes behave entirely as pentodes exhibiting maximum power delivery capabilities. Ultra-linear is a compromise between the two.

Troubleshooting this configuration is similar to any conventional push-pull output stage.

The circuit shown in Fig. 5 may be encountered in several commercial amplifiers. Two plates are tied together and connected to B+ while the output transformer is in the cathode circuit of the two power amplifier tubes. The circuits of Fig. 2 and 5 have identical

Continued on page 76

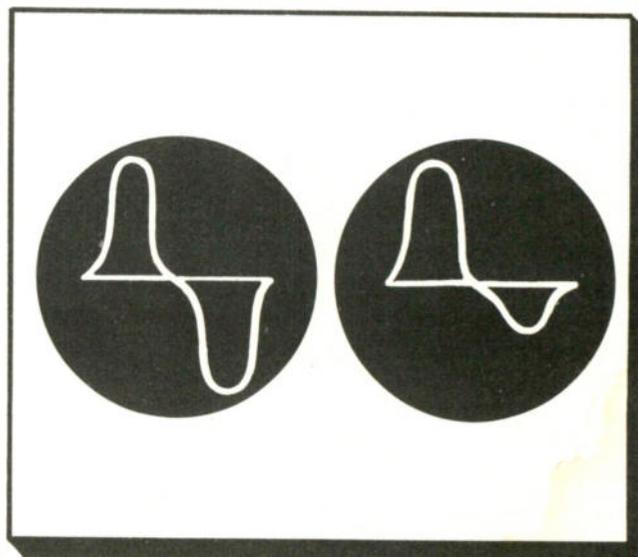


Fig. 9 — Low-loading amplifier waveforms.

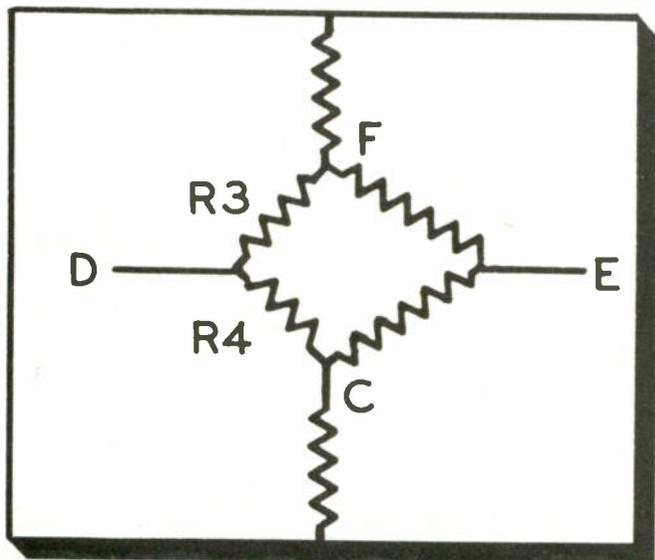


Fig. 7 — Equivalent bridge circuit that is formed by balance control of Fig. 6.

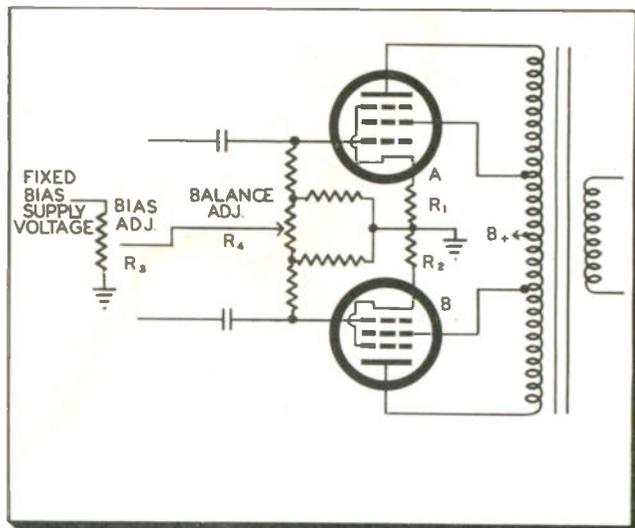


Fig. 8 — Fixed bias ultra-linear output stage using bias and balancing controls.

Distributors Dress Up For Dealers

■ INCREASED SALES for all participating distributors, cash prizes for those doing the best job in each territory, and general all-around satisfaction were the rewards in Philco's recent distributor merchandising and storekeeping contest. Distributors dressed up for you, the dealer.

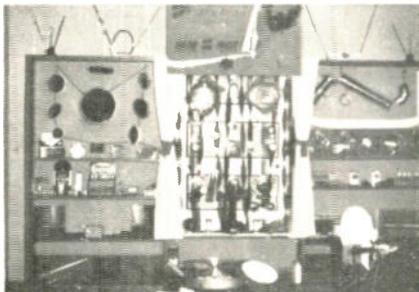
Dealers, too, will profit by dressing up their stores, upgrading merchandising and storekeeping. To be well organized, all merchandise must be neat, clean and properly priced, and sales banners and other aids attractively displayed. All store areas should be well lighted. Current promotions should be highlighted with proper prices and banners. No dealer should be satisfied until his store measures up to the highest standards of good storekeeping and aggressive merchandising.

In today's economy only the most determined and most capable survive.

Those distributors some of whose winning displays are shown here, won through ingenuity, imagination . . . and hard work. ■



Raskin Distributors, Inc., East Hartford, Conn.



California Electric, San Francisco, Calif.



Philca Distributors, San Antonio, Tex.



L & I Distributors,
Tampa, Fla.



Dixie Appliance Co.,
Bluefield, W. Va.



The Frankelite Co., Cleveland, Ohio

An improper probe can cause misleading test indications

DO YOU CHOOSE the Right Test Probe for your Scope

by David R. Anderson

■ A VARIETY of oscilloscope and VTVM probes are important for electronic tests and measurements. They permit accurate measurements to be made in critical circuits or extend the range of a test instrument. Each probe is designed to cover a specific application.

Low Capacity Probe

For example, a scope's low-capacity probe is used to raise the scope's input impedance. A good scope, used for TV service, may have an input capacity from 15 to 30 μmf . This capacity shunts the circuit under test when the scope is connected across it. Beside this, another 30 μmf or more is added by the direct probe cable.

In addition to the scope input capacity, the circuit under test is also being shunted by the scope's input resistance. Although the input capacity and resistance do load the circuit under test, in many cases the loading is negligible and it does not affect performance.

However, the video, sync, sweep and other circuits are affected by the combined shunt capacity of the scope's direct test probe. This added capacity may detune a resonant circuit or distort a critical wave shape. To prevent this, a low capacity probe is used.

A schematic of a typical low capacity probe is shown in Fig. 1. This low capacity probe consists of a variable capacitor and a resistor. The capacitor is small in value and is in series with the scope input

capacity. The scope blocking capacitor, C-3, used with a-c scopes, is large, and it acts as a short at radio frequencies (its reactance is almost zero), merely blocking any d-c in the circuit.

Furthermore, when two or more capacitances are connected in series, the effective capacitance of the group will be less than the smallest capacitance. Thus, the capacity presented to the circuit under test, when using a low-capacitance probe, is less than the small capacity used in the probe. This effectively reduces the scope's input capacity to a value that will not adversely affect the circuit being tested.

The small probe capacitor is made so that the time constant of the probe, determined by the values of R-1 and C-1, may be adjusted to equal the time constant of the scope input. This is necessary to keep the probe's attenuation factor constant at low and high frequencies.

The probe, of course, will attenuate the signal. However, this is not a critical problem since most scopes have more than enough reserve gain to make up for this attenuation. In most cases the attenuation, which is determined by the values of R-1 and C-1, is placed at a ratio of ten or a hundred to one.

Demodulator Probe

A demodulator probe is used when it becomes necessary to view

signals having frequencies beyond the scope's response. Fortunately, most high frequency signals found in TV service work are modulated, and the modulation envelope will give the necessary information without observing each cycle of the carrier frequency.

The demodulator probe removes the modulation envelope from the carrier and passes it on to the input of the scope. There are three basic circuits used in modern demodulator probes. Examples of these are shown in Figs. 2 and 3.

A series demodulator probe schematic appears in Fig. 2. When a modulated signal is applied to this probe it is rectified by a crystal diode. The filter circuit, consisting of capacitor C-2 and resistor R-2, removes the carrier, passing on the modulation envelope to the scope.

The time constant of the filter circuit is important. It must be long enough so that it will not respond to high frequency carrier variations, and it must be short enough to respond to the lower frequency modulation envelope variations.

An example of the various stages through which the signal passes as it is processed by the probe is shown in Fig. 2A. The full signal is passed through capacitor C-1 and rectified by the crystal diode.

As the rectified r-f voltage pulses increase in amplitude, capacitor C-2 begins to charge. Since the time constant of R-2/C-2 is long,

OSCILLOSCOPE PROBE APPLICATIONS

and VTVM?

SCOPE PROBE	TV USE
Direct	<ol style="list-style-type: none"> 1. Low Z, low frequency circuits, such as B+ filters. 2. To use scope's maximum sensitivity.
Isolating	<ol style="list-style-type: none"> 1. Critical circuits such as front ends. 2. Alignment marker.
Low-Capacitance	<ol style="list-style-type: none"> 1. Signal trace sync pulses. 2. Tests in video, sync, sweep circuits, such as grid of vertical oscillator.
Demodulator	<ol style="list-style-type: none"> 1. Signal tracing modulated carriers, such as: r-f, i-f, video amp. 2. Alignment of above stages.

the capacitor cannot discharge between r-f pulses. Hence, it charges to the modulated signal's peak value. Then, as the r-f pulses begin to decrease in amplitude, capacitor C-2 leaks off through R-2.

Therefore, voltage across R-2 is a function of the charge and discharge action of C-2. As a result, the voltage across R-2 follows the outline or envelope of the rectified signal. This voltage is passed on to the input of the scope. Resistor R-1 is added to the probe input to reduce hum voltage.

An example of a shunt type demodulator probe is shown in Fig. 3A. The rectifying action of this probe is similar to the series probe. In this case C-1 and R-1 act as the filter network. R-2 serves to isolate the filter circuit from the effects of probe cable capacity.

The series demodulator probe has a much higher sensitivity than the shunt type, but it is more susceptible to hum voltages. On the other hand, the low input impedance of the shunt type probe can cause distortion of the waveshape when used in high impedance circuits.

The voltage-doubler demodulator probe shown in Fig. 3B is more sensitive than the series and shunt probes. This probe rectifies both halves of the signal and passes the negative and positive peaks to the scope. As a result, this probe feeds the scope a demodulated signal that is equal to the peak-to-peak value of the original signal.

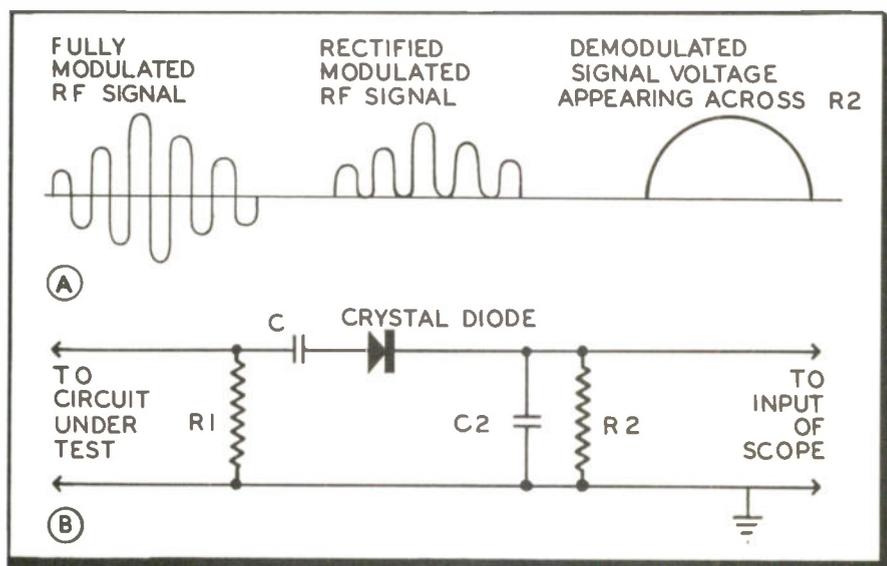


Fig. 2 — An example of a series crystal demodulator probe showing how the r-f signal is affected by the various stages of the probe.

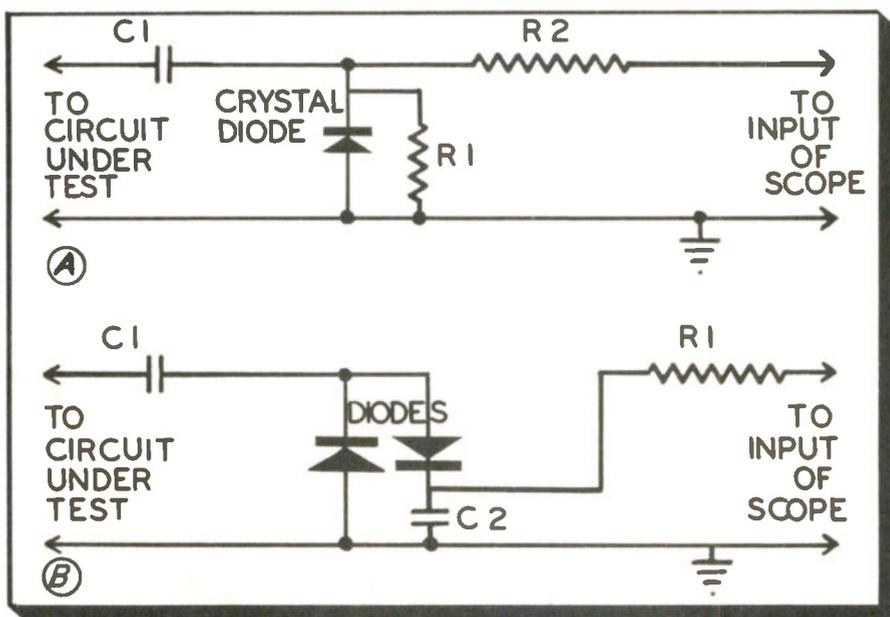


Fig. 3 (A) — Shunt demodulator probe schematic. This type probe is less susceptible to hum voltages than the series type demodulator probe. (B) — The voltage-doubler demodulator probe produces more output than either the series or the shunt demodulator probes.

Although the voltage-doubler demodulator probe offers excellent sensitivity, it can distort high frequency signals because of its low input impedance. As a result of its greater sensitivity, this probe may be used to locate weak signals or signals with uncritical wave-shapes.

Resistor Isolated Probe

A resistor-isolated probe is the third type associated with a scope. This probe consists of a resistor (between 10K and 50K ohms), in series with the hot lead of the probe cable.

The main use for this probe is to sharpen the marker pip when a sweep generator is being used for alignment of a receiver. The isolating resistor in combination with the capacity of the probe cable forms a low pass filter that attenuates the high frequency marker beats. This gives a sharp marker which is readily seen on the response curve.

VTVM Probes

High voltage, r-f and peak-to-peak probes are generally used with VTVM's.

A high voltage probe contains a resistor in series with the input resistance of a VTVM. The probe resistor and the VTVM input resistance form a voltage divider, with most of the voltage under test being dropped across the probe resistor.

As an example, a VTVM has an input resistance of 10 megohms and its highest voltage range is 3,000 volts. Therefore, a high voltage probe is needed that will enable the VTVM to be used up to 30,000 volts. In reality a H. V. probe is a multiplier since it extends the usable range of the VTVM.

In this example, 27,000 volts must be dropped by the probe resistor, in order that the VTVM may measure up to 30,000 volts. Therefore, the probe resistor value must be nine times greater than the VTVM input resistance. In addition to its resistance, the high voltage probe is specially constructed to withstand high voltages. They are usually about 12 to 15 inches

long with the resistors enclosed within high dielectric plastic.

A high voltage VTVM probe schematic is shown in Fig. 4. It is recalled that the VTVM's input resistance remains constant over all ranges. Hence, a probe designed for a specific VTVM will multiply all ranges of the VTVM by a convenient factor such as 10, 100 and so on. Since all VTVM's do not have the same input resistance, however, a particular probe recommended by the meter's manufacturer should be used.

In some cases it is necessary to measure high frequency signal voltage values. Since the a-c portion of a VTVM has a limited frequency response, a rectifying, or r-f, probe should be used. This probe converts high-frequency signals to d-c, making it possible to read the peak value of the signal on the VTVM's d-c ranges.

Operating principles of r-f

probes are similar to oscilloscope demodulator probes, except the time constant of the probes' filter circuits are different.

It is frequently necessary to measure peak-to-peak voltage of an r-f waveform. To do this, a p-to-p probe must be used. The r-f p-to-p probe is essentially the same as the p-to-p demodulator probe shown in Fig 3B. Here, again, the difference lies in the time constant of the filter network.

The p-to-p r-f probe rectifies both halves of the r-f waveform and adds them together. The time constant of the filter network is made long enough so that d-c is produced at its output. This d-c voltage is fed to the VTVM and it is proportional to the peak-to-peak value of the r-f waveform.

A thorough familiarity with all test probe types will enable the technician to enjoy maximum test instrument capability. ■



Unlike direct probe, a low-capacitance probe passes high frequencies without creating a distorted waveform.

Fig. 4 — The high voltage probe acts as a voltage divider in conjunction with the input resistance of a VTVM. Most of the voltage is dropped across the probe.

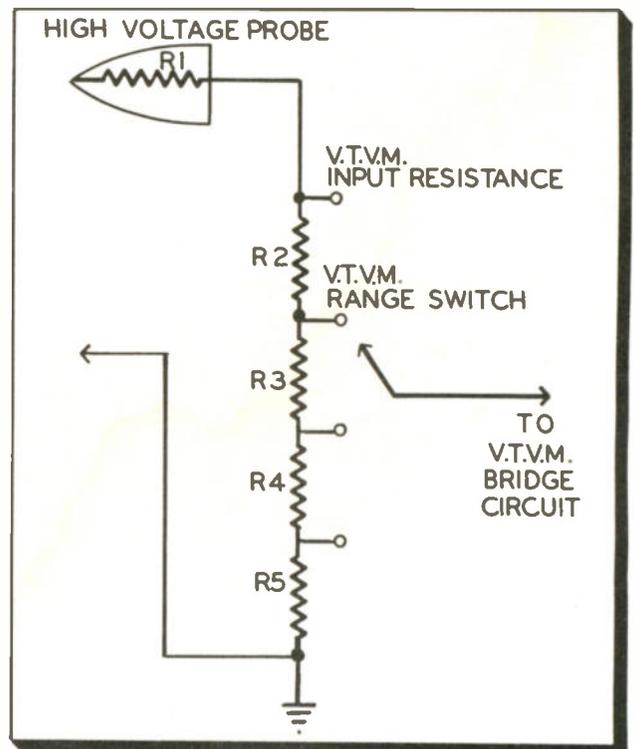
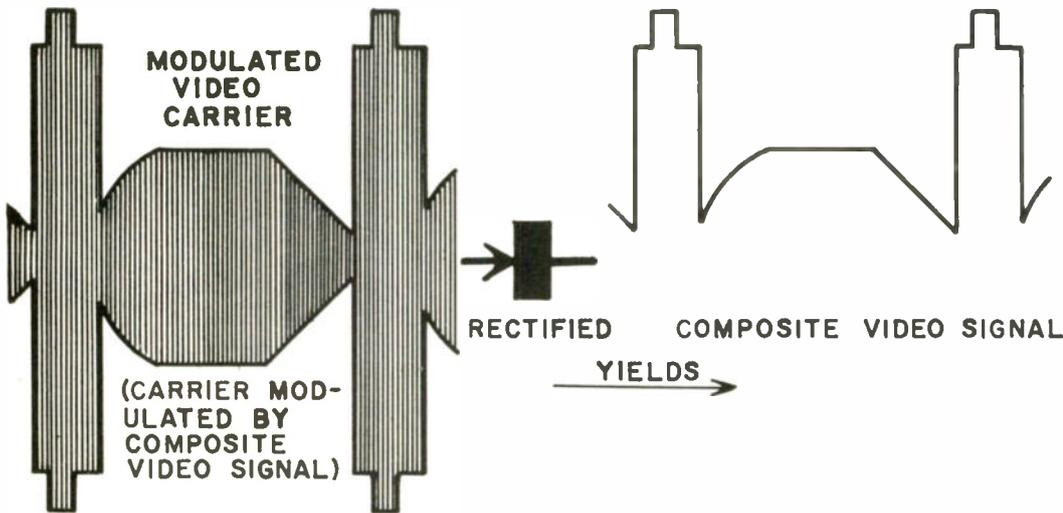
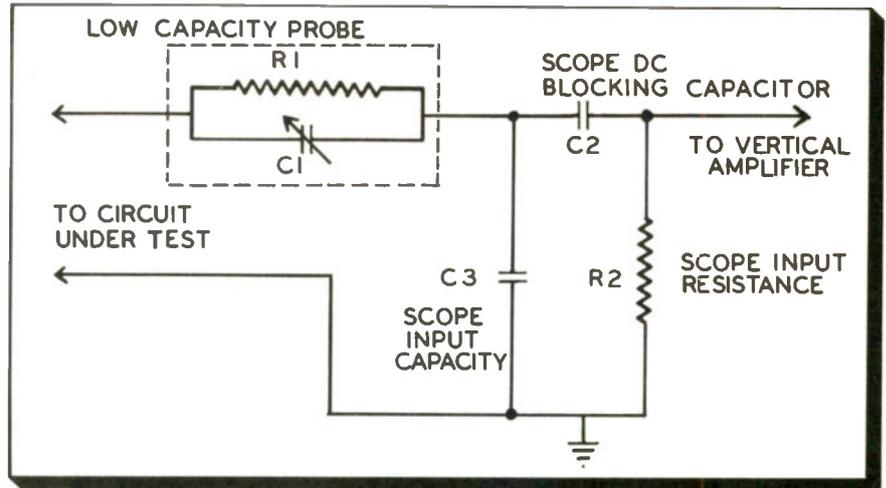


Fig. 1 — A typical low capacity probe circuit. Placing the small value capacitor in series with the input of the scope effectively reduces the scope input capacity. This permits satisfactory use in high impedance circuits.



Effect of demodulator probe on composite video signal from TV i-f amplifier.

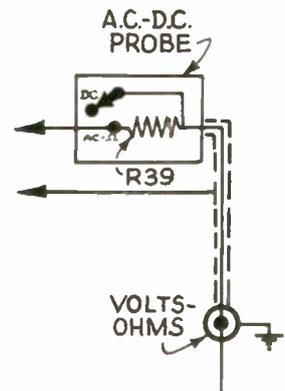


WAVEFORM OBTAINED WITH DIRECT PROBE

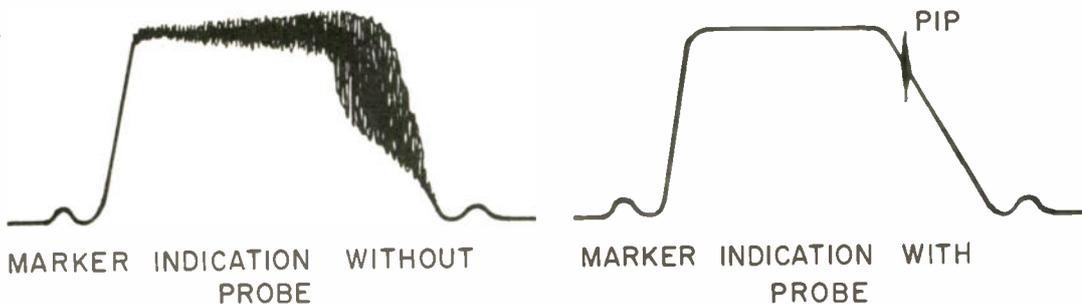


WAVEFORM OBTAINED WITH OPEN TEST LEADS

Direct scope probe with shielded cable eliminates stray field pick-up often encountered when using open test leads.



Schematic of VTVM dual a-c/d-c probe which employs function switch. This eliminates need for two probes used on some VTVM's.



Resistive isolating probe sharpens marker pip in TV response curve pattern.



Difficult Service Jobs Described by Readers

Audio Resistor Affects Sync

An Admiral portable TV chassis 14YP3D was brought to the shop for correction of a horizontal sync problem.

All tubes tested good. I then checked the M-3 dual diode horizontal sync phase splitter with my ohmmeter. One-half was open and I installed a new one. The sync now appeared normal.

The set was then connected to the shop's outdoor antenna and turned on. In about 15 minutes the picture started to bend and pull. Thinking the additional trouble was a bad filter, I used my capacitor checker and tested all filters in the set. All checked good.

Next, I checked voltages throughout the chassis. B+ at the selenium rectifier's output was normal. However, 75 volts appeared at the audio tube's cathode. Specifications called for 130 volts here. Grid voltage on this tube was also slightly lower than specified.

After checking the schematic carefully I decided the resistor in the audio output circuit, located between B+ and the tube's grid, was causing an incorrect bias on the tube's grid. I clipped one end of the 1.3 meg. resistor from the

circuit and it measured over 5 megs!

After installing a new resistor the tube's cathode voltage was restored to 130 volts and the set resumed normal operation.—Howard Keilholtz, Ellicott City, Md.

Double-Trouble With Sockets

A customer brought an Emerson 1291 TV set to our shop, complaining of weak pix and no audio. He said the tubes were all good because he had them checked. He also advised that the sound was reasonably good before the tubes were checked.

When I made voltage measurements in the tuner and i-f strip, I found them normal. I decided to use the scope to check the set's alignment. A compressed response curve pattern on the scope indicated lower-than-normal composite video amplification. For a moment I thought the curve would shape-up normal as I adjusted the second video i-f transformer. Suddenly the pattern collapsed. When I backed the slug off slightly the pattern came back on the scope.

I lowered the scope's gain and could see severe regeneration pre-

**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, 480 Lexington Ave., New York 17, N. Y.

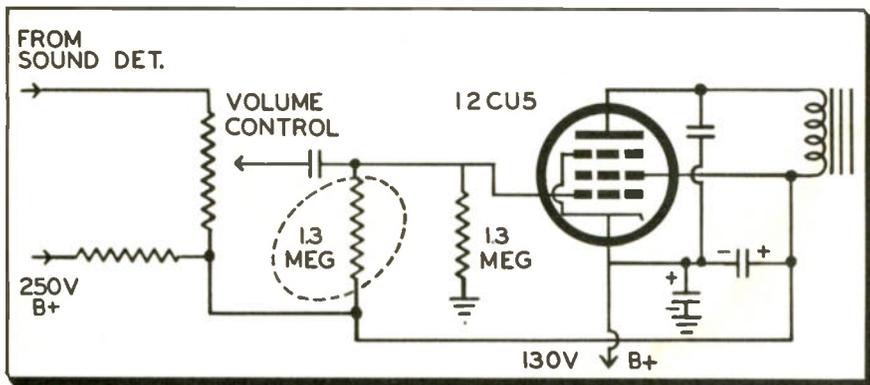
sent. When the slug was advanced the regeneration increased.

I now grounded the first i-f grid, but no change took place. But when I grounded the tube's plate (for a-c that is) through a capacitor, the regeneration stopped. This appeared to indicate that the plate circuit was performing as one section of a feedback loop.

I next injected a signal into the sound section. With the scope's low-capacitance probe at the 5U8 limiter grid, there was no sound in the speaker. However, when the probe was placed at the tube's plate, the audio signal could be heard in the set's speaker. A VT-VM check of voltages around the tube revealed 0 volt at the grid. The set's schematic showed this tube's grid should have been slightly negative.

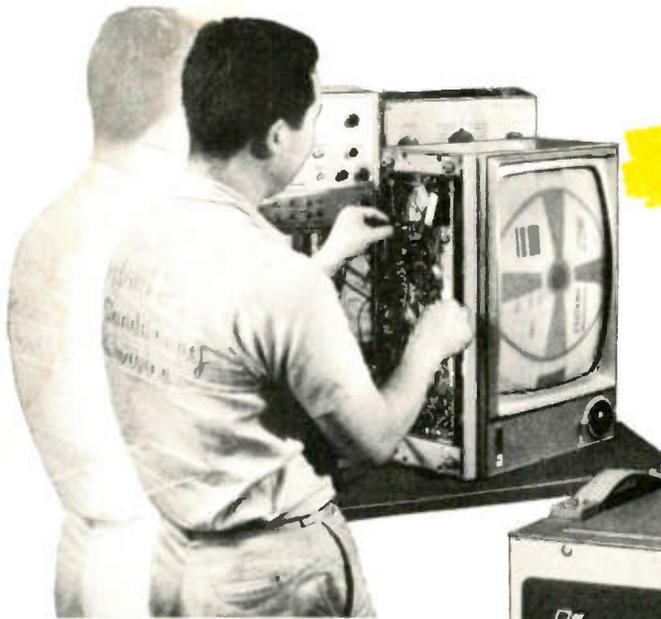
It now appeared that a poor connection existed in the tube socket, since possibility of a defect in the printed circuit RC network at the 5U8's grid input was now eliminated. A close examination of the tube socket indicated the indirect grid pin connection inside the printed board type socket was open. After completing the troublesome job of replacing the socket, the

Continued on page 66



The 1.3 megohm resistor between the 12CU5 grid and 250 v B+ changed value to 5 megs and prevented development of the normal 130 v at the audio output tube's cathode.

DOUBLES YOUR EFFECTIVE MANPOWER



Fix "Tough Dogs" Fast!

Save Half Your Time!

Step Up Your Profit!

B&K NEW
MODEL 1076

TELEVISION ANALYST

for Black & White and Color



Check all circuits—Pinpoint any TV trouble...in minutes

**By Easy Point-to-Point Signal Injection,
You See the Trouble on the TV Screen and
Correct it—Twice as Fast and Easy!**

There's no longer any need to "lose your shirt" (and customers)—and worry about the lost hours you never recover—on "tough dogs" or even intermittents. The remarkable B&K Analyst enables you to inject your own TV signal at any point and watch the resulting test pattern on the picture tube itself. Makes it quick and easy to isolate, pinpoint, and correct TV trouble in any stage throughout the video, audio, r.f., i.f., sync, and sweep sections of black & white and color television sets—including intermittents. Makes external scope or wave-form interpretation unnecessary. Most useful instrument in TV servicing! Its basic technique has been proved by thousands of successful servicemen the world over.

The Analyst enables any serviceman to cut servicing time in half, service more TV sets in less time, really satisfy more customers, and make more money.

Model 1076. Net, \$29995

Available on Budget Terms. As low as \$30.00 down.

Combines all the features of both
the Model 1075 and Model A107

- | | |
|---|---|
| COMPLETE R.F. and I.F. | HI-VOLT INDICATOR |
| VIDEO TEST PATTERN | YOKE and HI-VOLTAGE
TRANSFORMER TEST |
| COMPOSITE SYNC | Also Now Provides: |
| FM MODULATED AUDIO | SWITCH-TYPE TUNER |
| COLOR PATTERNS | NEGATIVE BIAS SUPPLY |
| HORIZONTAL and VERTICAL
PLATE and GRID DRIVE | AGC KEYING PULSE |
| B+ BOOST INDICATOR | PICTURE TUBE MODULATION |

B&K

B & K MANUFACTURING CO.
1801 W. BELLE PLAINE AVE • CHICAGO 13, ILL.
Canada: Atlas Radio Corp., 50 Wingold, Toronto 19, Ont.
Export: Empire Exporters, 277 Broadway, New York 7, U.S.A.

See Your B&K Distributor or Write for Bulletin AP18-T

FREE LITERATURE

To receive the literature below without charge, simply circle the number on the coupon

1 Stereo Amplifiers: Literature covers the Knight-Kit KX-60, reported as the first all-transistor stereo amplifier available in kit form. 25 watts/channel. 50 watts total IHFM output. Allied Radio Corp.
- - - for more details, circle 300 below

2 Capacitors: Catalog dp 110 covers miniaturized Elmenco dipped Mylar-paper capacitors. Arco Electronics, Inc.
- - - for more details, circle 301 below

3 Receivers and Tuners: Model RP40A SoundSpan stereo receiver, with built-in multiplex and 44-watt amplifier is covered in all-new stereo-hi-fi catalog. Bogen-Presto.
- - - for more details, circle 302 below

4 Compounds: Literature covers pin-point jet stream action No Arc hi-voltage insulator, No. 830. Provides 20,000v dielectric strength. Chemtronics, Inc.
- - - for more details, circle 303 below

5 Cartridges: Literature covers turret action ceramic cartridges, reported to replace all ceramic stereo cartridges and most ceramic mono cartridges. Euphonics Corp.
- - - for more details, circle 304 below

6 Stereo Components: Available is the 1962 Fisher Handbook, a 40-page illustrated reference guide and component catalog for custom stereo installations. Fisher Radio Corp.
- - - for more details, circle 305 below

7 Test Equipment: Model 36-562 radio trouble shooter lab, an all-new time saver, is covered in a 16-page test equipment catalog. GC Electronics Co.
- - - for more details, circle 306 below

8 TV Tables: Literature describes the Mardi Gras line of TV tables, designed to accommodate any portable or table TV set. JFD Electronics.
- - - for more details, circle 307 below

9 Stereo Kits: Colorful and detailed 20-page "Guide to Custom Stereo" includes complete technical information on Scottkits. H. H. Scott, Inc.
- - - for more details, circle 308 below

10 Transistor Testers: Literature covers Model TR110 which tests all transistors in-circuit or out-of-circuit. A complete transistor tester, signal tracer, voltmeter, battery tester, milliammeter. Sencore.
- - - for more details, circle 309 below

11 Transformers: A handy 8½ x 11-inch wall chart, printed on index paper stock, shows EIA color codes for power audio, output and i-f transformers. Stancor Electronics.
- - - for more details, circle 310 below

12 Crystals: Catalog No. 961, eight pages, covers crystals for citizens band and other purposes. Circuit diagrams and prices included. Texas Crystals.
- - - for more details, circle 311 below

CUT HERE

12-61

Cut out and mail to **ELECTRONIC TECHNICIAN, 1 East First Street, Duluth 2, Minn.**

Use this coupon, or your letterhead, before **January 20, 1962**

Please send me literature of companies whose code numbers I have circled below (includes editorial and advertised items):

ADVERTISED PRODUCTS

10	22	34	46
11	23	35	47
12	24	36	48
13	25	37	49
14	26	38	50
15	27	39	51
16	28	40	52
17	29	41	53
18	30	42	54
19	31	43	55
20	32	44	56
21	33	45	57

NEW PRODUCTS

400	405	410	415
401	406	411	416
402	407	412	417
403	408	413	418
404	409	414	

FREE LITERATURE, CATALOGS, BULLETINS

300	303	306	309
301	304	307	310
302	305	308	311

Name.....Position.....

Firm.....Address.....

City.....Zone.....State.....

Note: If you have given your residence address, please enter your company name and address on this line:.....

**NOW
REPLACE
WITH
FACTORY
ORIGINALS...**

*New RCA
All-American
Transistors*

Replace with

ALL AMERICAN TRANSISTORS

The same RCA transistors used in original equipment

 2N405 LOW COST	 2N406 LOW COST	 2N407 LOW COST	 2N407 LOW COST
 2N408 LOW COST	 2N408 LOW COST	 2N409 LOW COST	 2N409 LOW COST
 2N410 LOW COST	 2N410 LOW COST	 2N411 LOW COST	 2N412 LOW COST

portable radio receivers • tape recorders • table radio receivers • portable equipment

Free RCA transistor replacement guide

Do not use. The use of this article does not convey any license under patent claims or circuits, or any combination of this article with other articles, devices or systems.

PRINTED IN U.S.A. FORM NO. 33-1

RCA, a major supplier of entertainment transistors to U.S. transistor radio manufacturers, now offers these same transistor types to service technicians for direct replacement use.

Check the types shown in the All-American Display . . . RCA 2N405, 2N406, 2N407, 2N408, 2N409, 2N410, 2N411 and 2N412. . . All eight are original equipment types—the same types used in many of today's transistor radios. This means

no circuit changes, no guesswork, next time you replace.

And to help you further, you can now obtain the new RCA 12-page transistor replacement guide with each All-American package. It lists over 80 brands and a total of 450 models.

So why substitute when you can get factory originals. Call your RCA Distributor for one-stop service and fast local delivery of this new RCA All-American Transistor package.



You can get this new 12-page RCA Semiconductor Replacement Guide FREE when you buy the new RCA ALL-AMERICAN TRANSISTOR PACKAGE

Semiconductor Products
Distributor Sales
Harrison, N.J.



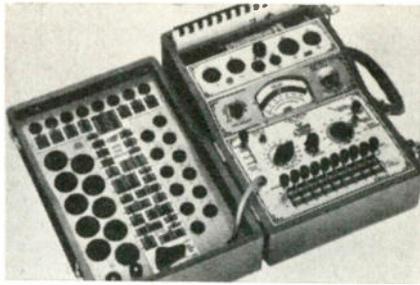
The Most Trusted Name in Electronics

NEW PRODUCTS

Continued from page 17

Seco TUBE TESTERS

A new model of the firm's finest tube tester, 107A, takes nine-pin novars, twelve-pin compactrons, new ten-pin tubes and nuyistors, in addition to all standard domestic and foreign tube types. It retains such capabilities as the dynamic mutual conductance test on pre-wired chassis, the cathode emission test by free point selector system, and the grid circuit



test with electron-eye tube. The grid circuit test provides up to 11 positive, simultaneous checks for leakage, shorts and grid emission. \$149.50. Seco Electronics Inc., 5015 Penn Ave. South, Minneapolis 19, Minn.

... for more details, circle 403 on page 52

Tarzian offers

**FAST, DEPENDABLE
TUNER
REPAIR SERVICE**

**ALL
MAKES**



ONLY
\$850
INCLUDING

It just makes sense that a manufacturer of tuners should be better-qualified, better-equipped to offer the most dependable tuner repair and overhaul service.

Sarkes Tarzian, Inc., pioneer in the tuner business, maintains a complete, well-equipped Factory Service Dept.—assisted by Engineering personnel—and staffed by specialized technicians who handle ONLY tuner repairs . . . on ALL makes and models.

Tarzian-made tuners received one day will be fixed and shipped out the next. Cost is only \$8.50 and \$15 for UV combinations. That includes ALL parts and labor, and a 6-month guarantee against defective workmanship and parts failure due to normal usage. Replacements available at low cost on tuners beyond practical repair.

Tarzian-made tuners are identified by this stamping. When inquiring about service on other tuners, always give tube complement . . . shaft length . . . filament . . . voltage . . . series or shunt heater . . . IF frequency . . . chassis identification. All tuners repaired on approved, open accounts. Check with your local distributor for Sarkes Tarzian replacement tuners, replacement parts, or repair service.

SERVICE MANAGER • TUNER DIVISION • DEPT. 2B
SARKES TARZIAN INC
101st hillside drive • bloomington, indiana
edison 2-7251

MANUFACTURERS OF TUNERS . . . SEMICONDUCTORS . . . AIR TRIMMERS . . . FM RADIOS . . . AM-FM RADIOS . . . AUDIO TAPE . . . BROADCAST EQUIPMENT and SHISH-KABOB GRILLES

**ALL PARTS
and LABOR**

**24-HOUR SERVICE
6-MONTH WARRANTY**

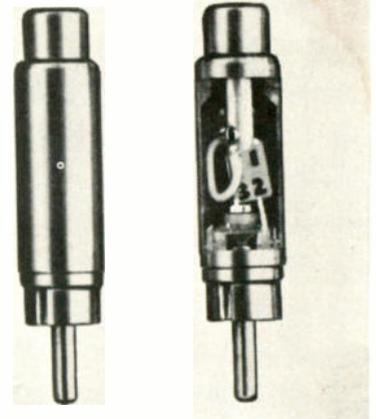
**Tuners Repaired on
Approved, Open Accounts**

See your distributor, or
use this address for fast,
factory repair service

For more details, circle 41 on page 52

Switchcraft AUDIO EQUALIZER

Model 328A audio equalizer enables a ceramic phonograph cartridge to be plugged directly into the magnetic input of any amplifier without any modification. The signal from a ceramic cartridge passes into the audio equalizer and is converted, by the corrective resistor-capacitor network housed inside the brass shell, to a velocity response fitted for RIAA equalization hum, if caused by a magnetic cartridge or by the wiring to the cartridge, can be eliminated by utilizing the 328A with a ceramic cartridge. Can be used with mono or stereo ceramic phono

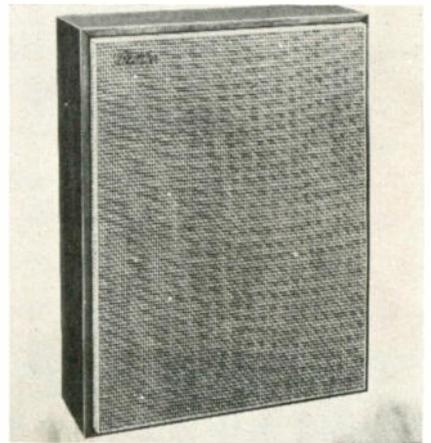


cartridge. One is needed for mono, two for stereo. Switchcraft, Inc., 5555 N. Elston Ave., Chicago 30, Ill.

... for more details, circle 404 on page 52

Fisher SPEAKERS

Model KS-1, reported as the first slim-line speaker kit in the hi-fi field, has been designed to permit complete



assembly, even by an unskilled person, in less than an hour. It includes a three-way speaker system with crossover networks, finished-sanded birch or walnut cabinet, grille cloth, Acousti-Glas padding and stage-by-stage easy-to-follow instructions. Features are: speaker complement, 10-inch woofer, 5-inch mid-range, 3-inch super tweeter; crossovers @ 1400 and 5000 cps; impedance, 8 ohms; dimensions, 24 x 18 x 5 3/4 inches deep. Kit, in finished sanded birch, \$59.50. Fully assembled, \$84.50. Kit, also available in sanded walnut, ready for staining, \$64.50; this

TUBES



ARRIVE

SAME DAY!



Shipping parts or entire sound units? Remember, speedy shipment of delicate goods is a specialty of Greyhound Package Express. Shipments going hundreds of miles can arrive *the same day they're sent!*

Whatever the destination of your shipment, chances are, a Greyhound is going there anyway...*right to the center of town.* Greyhound travels *over a million miles a day!* No other public transportation goes to so many places—so often.

You can ship anytime. Your packages go on regular Greyhound passenger buses. Greyhound Package Express operates twenty-four hours a day...seven days a week...*including weekends and holidays.* What's more, you can send C.O.D., Collect, Prepaid...or open a charge account.

**CALL YOUR LOCAL GREYHOUND
BUS TERMINAL TODAY...OR MAIL
THIS CONVENIENT COUPON TO:**

GREYHOUND PACKAGE EXPRESS
Dept.M-17,140 S. Dearborn St., Chicago 3, Illinois

Gentlemen: Please send us complete information on Greyhound Package Express service...including rates and routes. We understand that our company assumes no cost or obligation.

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____ PHONE _____

CITY _____ ZONE _____ STATE _____

IT'S THERE IN HOURS...AND COSTS YOU LESS!

For more details, circle 28 on page 52

MAKING ROOM AT THE TOP



AC VTVM & AMPLIFIER #250



Kit \$49.95 Wired \$79.95

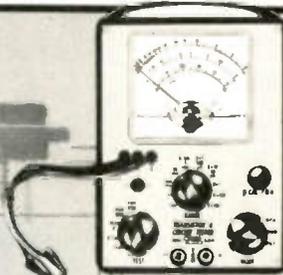
Phenomenally good AC VTVM, bound to make room for itself at the top of the professional market. 12 ranges from 1 mv to 300 V full-scale, 10c-600kc ± 0 db response, 10 megohms input impedance, $\pm 3\%$ of full scale accuracy. At the flick of a switch, the internal wide-band amplifier is available for external use. Provides 8c-800kc ± 0 db response, 5 VRMS output, 5 kilohm output impedance, gain control, noise -40 db. Regulated power supply, frame grid tubes.

AC VTVM #255

Kit \$44.95
Wired \$72.95

All the precision VTVM facilities of the #250, less the external use of the wide-band amplifier.

ARMED TO THE TEST LEADS FOR THE TRANSISTOR GAME



TRANSISTOR AND CIRCUIT TESTER #680

Kit \$25.95 Wired \$39.95

Measure ICEO, ICBO & $dc\beta$ directly, $ac\beta$ indirectly, without charts or special settings—plus all dc volts, currents, and resistances needed to service transistor equipment. 50 μA , $3\frac{1}{2}$ " face meter movement provides sensitivity and scale length necessary for accurate measurements. Built-in 20,000 ohms/volt VOM facilities let you work on transistor equipment with minimum equipment tie-up.

SITTING DUCKS FOR THIS SNOOPER



IN-CIRCUIT CAPACITOR TESTER #955

Kit \$19.95 Wired \$39.95

- Leave those capacitors where they are! Without unsoldering:
 - check for shorts (even in the presence of as little as 1 ohm shunt resistance)
 - check for opens (determine the presence of as little as 5mmf in the circuit), and to confirm open indication . . .
 - measure capacitance with $\pm 10\%$ accuracy between 0.1 mf and 50 mf
 - measure RC product, convertible into dissipation or power factor.

Also New From EICO:



Battery Eliminator and Charger #1064
Kit \$43.95
Wired \$52.95



AC Bench Supplies: Model 1073—Kit \$35.95
Wired \$47.95
Model 1078—Kit \$42.95
Wired \$54.95



AC Volt-Watt Meter #260
Kit \$49.95
Wired \$79.95



For complete catalog of over 80 EICO kits and wired units—hi-fi, test equipment, citizens radio, ham gear—plus name of nearest distributor, write to dept. ET-12 ELECTRONIC INSTRUMENT CO., INC., 3300 N. BLVD., L. I. C. 1, N. Y.

Add 5% in the West

Export Dept: Roburn Agencies, Inc. 431 Greenwich St., N. Y. 13, N. Y.

For more details, circle 22 on page 52

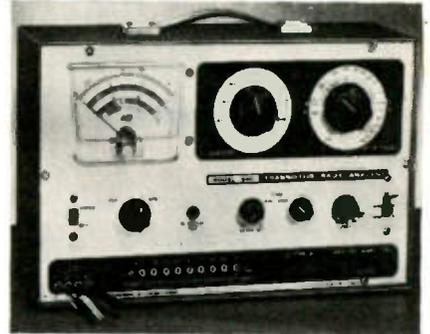
NEW PRODUCTS

unit assembled, \$89.50. Fisher Radio Corp., 21-21 44th Drive, Long Island City 1, N. Y.

— for more details, circle 405 on page 52

B & K TRANSISTOR RADIO ANALYST

Model 960 transistor radio analyst, featuring the Dyna-Trace single-point probe, is reported as a complete tran-



sistor radio service shop in one instrument. It includes: signal generator, power supply, VTVM, milliammeter, ohmmeter and both in-circuit and out-of-circuit transistor tester. By point-to-point signal injection, quick and easy troubleshooting is made to check all circuits stage-by-stage. Meter has "Good-Bad" scale for both leakage and beta; also direct-reading beta scale. Automatically determines whether transistor is NPN or PNP. Meter is protected against accidental overload and burn-out. Operates on 117v, 50-60 cps a-c. \$99.95. B & K Mfg. Co., 1801 W. Belle Plaine, Chicago 13, Ill.

— for more details, circle 406 on page 52

Heath VTVM

Features of the new Heathkit IM-11 include; single ac/ohms/dc probe with switch; seven a-c, seven d-c and seven



ohms ranges; easy-to-read $4\frac{1}{2}$ inch 200 μA meter; 1 percent precision resistors for high accuracy; and extended



NEW RCA VICTOR COLOR TV!



PROVED IN SERVICE! PROFITABLE TO SERVICE!

New RCA Victor Color TV incorporates more than seven years of refinements based on field and service experience. Experience that tells you why RCA's new High Fidelity picture tube has been accepted as the industry standard. It's the same experience which has proved the greater dependability and serviceability of RCA's "road-mapped" printed circuits.

A proved chassis, with easy-to-find, accessible test points, proved-in-use replacement parts, and proved-in-practice service

literature make RCA Victor Color TV *easy and profitable to service.*

Join the growing corps of servicemen who have found new interest and opportunity in Color TV. Ask your RCA Victor Distributor to help you.

SEE WALT DISNEY'S "WONDERFUL WORLD OF COLOR," EVERY SUNDAY, NBC-TV NETWORK



The Most Trusted Name in Television

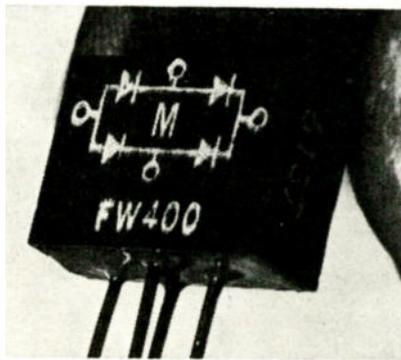
NEW PRODUCTS

low end only frequency response \pm 1 db from 25 cps to 1 Mc. Front panel controls include a rotary function switch (with d-c polarity reversing position to eliminate lead switching when alternately measuring positive and negative voltages), a rotary range selector, zero adjust and ohms adjust controls. Zero and ohms controls feature small phenolic shaft knobs to minimize accidental change in setting. Kit, IM-11, \$29.95. Assembled, IMW-11, \$46.75. Heath Co. Benton Harbor, Mich.

- - - for more details, circle 407 on page 52

Mallory SILICON RECTIFIERS

Type FW silicon rectifier circuit package has 50 percent fewer lead connections to solder and can thus reduce assembly costs for users. Its in-



itial cost is of course less than that of four single rectifiers, and inventory is simplified because there are 75 percent fewer units to stock. Unit price, \$1.30 to \$2 each in lots of 1,000 to 4,999, depending on voltage rating. Applications of this new full-wave bridge silicon rectifier circuit include hi-fi systems for d-c filament supply, battery chargers, and low ripple supplies for transistor circuits. P. R. Mallory & Co., Inc., Du Quoin, Ill.

- - - for more details, circle 408 on page 52

Philco SPEAKERS

A special counter display has been designed for the firm's 4-inch stereo extension speakers. These are general

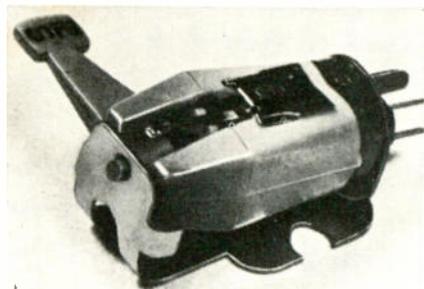


purpose speakers mounted in a beige-colored, molded plastic cabinet which contains a coaxial connector socket. A mating plug is provided for making cable connection. The speakers have .68 oz. Alnico magnet, eight ohms voice coil and the housing measures 5-inches wide, 3½-inches deep and 5¼-inches high, including stand. Available as Part No. 326-5029 without individual volume control and as Part No. 326-5029-1 with an individual volume control mounted at the center of the grille. Philco Corp., C. & Tioga St., Philadelphia 34, Pa.

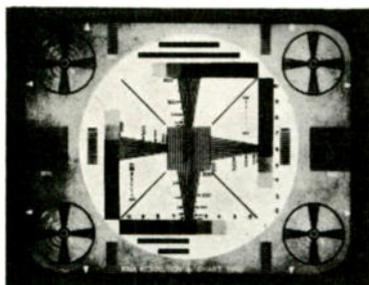
- - - for more details, circle 409 on page 52

Euphonics CARTRIDGE

A new group of ceramic phono-graph cartridges has been announced. It is called the U-series, and is avail-



able in both stereophonic and monophonic types. A special feature of this design is the turret action turnover arrangement which both eliminates lead wire twisting and also decouples



TV TIPS FROM TRIAD

NO. 15 IN A SERIES

A Professional Television Man we know had a nasty problem. One of his customers owned a 21" metal tube receiver — which shall be nameless — that was a service repeater. When it worked, it worked very well indeed, but when it was bad it was awful. Which was often. Every three or four months a new 6CD6 was needed, and every couple of 6CD6's, a new flyback was called for.

This PTM was typically conscientious. He installed highest quality tubes — and got failure. He tried "exact" replacement flyback. Again, failure. He tried "original" replacement flyback. Still the wax heated up and oozed all over. Results: one very peeved customer, one very perplexed PTM.

About the time it dawned that the original set circuit was something less than perfect, a parts salesman handed him the brochure "Taking the Heat off Flybacks."

"Heat comes from high B plus, defective linearity coils, bad screen resistors — and as many as twelve other causes," he read first off. Immediately our PTM, who reads too fast, said he'd take a B plus dropping resistor, screen resistor, new flyback and linearity coil.

The parts man interrupted — which was just as well. "If this is for that direct drive receiver with the 21" metal kine, we have a complete kit of all these parts. The Triad people call it their D-153. When you install, which is almost as easily done as said, good things happen. Your plate current drops from 150 to about 100 milliamps, and you can expect normal life from tubes and flybacks."

When our PTM installed the parts according to instructions, he had a cool running job with good high voltage and width, and a happy customer.

"Why," he said, "I could have spent \$100 worth of time just working this circuitry out myself." That night he told his wife, and the next day she spent most of the \$100 on new clothes.

MORAL: Never tell women anything. Also, just installing an "exact" or "original" flyback in this set is not enough. You need engineered parts and tested instructions to rewire and solve the problem permanently. Ask your distributor for Triad kit D-153. Like other products designed to make life happier, it is made by the **Triad Transformer Corporation**, a division of Litton Industries. Triad also publishes a series of service aids for Professional Television Men. These make fascinating reading. Are you on the mailing list? Our address is 4055 Redwood Avenue, Venice, California.

For more details, circle 49 on page 52

Wake Up



A new day is dawning in electronics. Transistors are here to stay... they are now being used everywhere; in radio, television, Hi-Fi, intercoms, and in nearly all new electronic equipment...

Why put off transistor circuit servicing any longer... there's gold in them thar hills. But you must be equipped to do the job fast and efficiently. Here are the tools that you will need.



NEW SENCORE TRANSI-MASTER

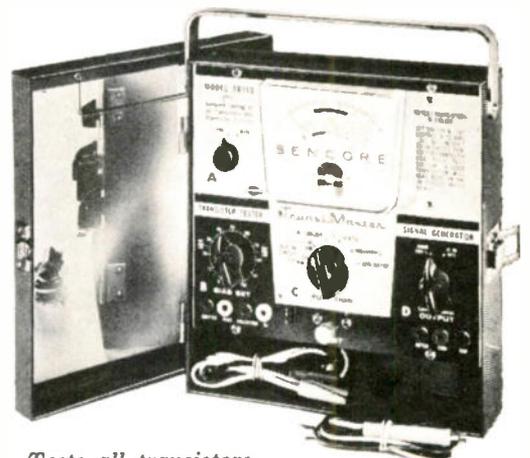
This Tester will analyze the entire circuit in minutes and test transistors in-circuit or out of circuit. Here is how you can pin point troubles step by step.

First, check the batteries with the 0 to 12 voltmeter. If the batteries are O.K., check the current drain with the 0 to 50 milliamp meter. A special probe is provided so that you do not need to break the circuit. Excessive current indicates a short; low current indicates an open stage or cracked board. All PF schematics indicate average current.

If trouble is not located by now, isolate the trouble to a specific stage by touching the output of the harmonic generator to the base of each transistor and note spot where sound from speaker (or scope where no speaker is used) stops or becomes weak. The generator becomes a sine wave generator for audio stages to help find distortion.

If trouble points to a transistor, check it in a jiffy with the exclusive in-circuit power oscillator check provided by the TR110. A special probe is also provided for this.

If the transistor checks bad in-circuit, remove it and give it an out of circuit check with the oscillator check or the more accurate DC check. The DC check is provided for comparison reasons, experimental or engineering work and to match transistors in audio output stages. Beta (current gain) is read direct or on a good-bad scale for service work. **DEALER NET. ONLY \$4950**



Tests all transistors in-circuit or out-of-circuit

Model TR110

It's a COMPLETE TRANSISTOR TESTER

- SIGNAL TRACER • VOLTMETER
- BATTERY TESTER • MILLIAMMETER



NEW SENCORE TRANSISTOR AND DIODE CHECKER

Here is a low cost tester that has become America's favorite. The TR115 provides the same DC out of circuit checks as the TR110; leakage and current gain. Beta (circuit gain) can also be read direct or as good or bad. Opens or shorts in the transistor are spotted in a minute. The TR115 checks them all from power transistors to the small hearing aid type. Japanese equivalents are listed also. This famous tester is used by such companies as Sears Roebuck, Bell Telephone and Commonwealth Edison. New circuits enable you to make service checks without set-up charts even though charts are provided for critical checks.



Model TR115
Dealer Net
\$1995



SENCORE BATTERY ELIMINATOR AND TROUBLE SHOOTER

For replacing batteries during repair. Many servicemen say that they wouldn't service transistor circuits without this power supply. The tried and proven PS103 is a sure fire answer. It can be used to charge the nickel cadmium batteries as well. Dial the desired output from 0 to 24 volts DC and read on meter. Low ripple insures no hum or feedback. Total current drawn can also be read on the PS103 by merely flicking the function switch to milliamps. The PS103 is the only supply that will operate radios with tapped battery supplies such as Philco, Sylvania and Motorola. No other supply has a third lead.



Model PS103
Dealer Net
\$1995

Now in stock at
your Authorized
Sencore Distributor



SENCORE
ADDISON, ILLINOIS

For more details, circle 43 on page 52

NEW PRODUCTS

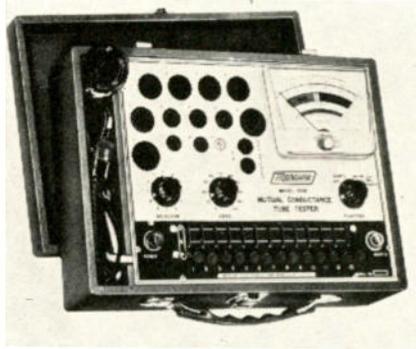
the unused needle. The cartridge is reported to be a direct replacement for millions of original cartridges now in wide use. Euphonics Corp., Box 2746, Rio Piedras, Puerto Rico, U. S. A.

- - - for more details, circle 410 on page 52

Mercury TUBE TESTERS

Introduced as a true dynamic mutual conductance tube tester, to sell

at a popular price, model 1000 can accommodate all the new tube types including nuvistors, compactrons, new ten pin tubes and novars. Its range of

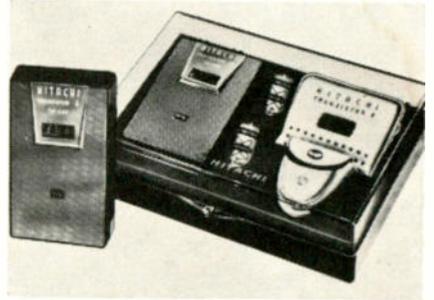


operation includes tests for true dynamic mutual conductance (Gm), tests for shorts and leakage between any tube elements, tests for gas and grid emission with a sensitivity of over 100 megohms, and also tests picture tubes. \$79.95. Mercury Electronics Corp., 111 Roosevelt Ave., Mineola, N. Y.

- - - for more details, circle 411 on page 52

Hitachi RADIOS

Model TH-660 pocket-size portable radio is shown in personal gift presentation case. It features a quick-action

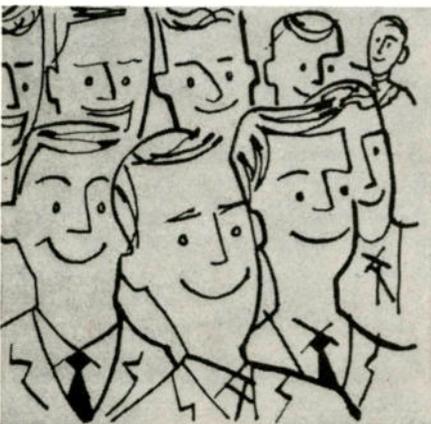


battery release by which the two penlite batteries drop out without opening the back of the cabinet. Reported output, 100 mw, undistorted; 150 mw, maximum. It has six transistors, two diodes plus thermistor, dynamic 2-inch speaker, magnifier tuning dial, self-contained ferrite core antenna, and tuning range of 535—1605 kc. Size, 2½ x 3-11/16 x 1½ inches. \$24.95. The Sampson Co., 2244 S. Western Ave., Chicago 8, Ill.

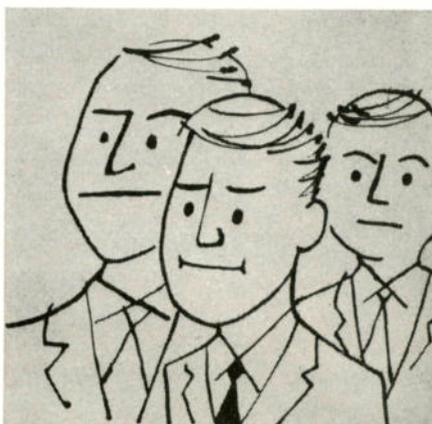
- - - for more details, circle 412 on page 52

There are 2 Kinds of Radio-TV Servicemen-

Those who use
QUAM
replacement loudspeakers | Those who use
other brands of
replacement loudspeakers



We're proud to say that
this group is bigger*



- * According to the findings of Brand Name Surveys, Chicago, Illinois in March and April 1961, more servicemen prefer Quam speakers than all other replacement brands combined. Major reasons stated for the preference: Quality! Availability! Performance!

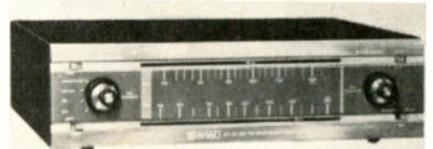
QUAM-NICHOLS COMPANY

226 East Marquette Road, Chicago 37, Illinois

For more details, circle 36 on page 52

Knight STEREO FM-AM TUNER KITS

Model KF-90 features improved wide-band FM circuitry and a multiplex section designed to reproduce the



full dynamic range of stereo FM broadcasts with no loss of response. A front panel dimension control allows the listener to vary channel separation during stereo FM broadcasts. It employs dynamic sideband regulation that reduces FM distortion stemming from overmodulation at the station or weak signals in fringe areas. Afc is provided for lock-in tuning. Separate magic eye tuning indicators for both FM and AM close to a slit when a station is perfectly tuned. The AM section offers a choice of sharp or broad tuning, a 10-kc whistle filter and built-in loopstick antenna. \$99.95. Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.

- - - for more details, circle 413 on page 52

WORTH SHOUTING ABOUT!

NEW IMPROVED
MIGHTY MITE

Reaching New Peaks in
Performance, Portability and Price

MIGHTY MITE II

They're shouting from the hill tops. Technicians, engineers and test labs all say that the original Mighty Mite finds the tubes that large expensive testers miss. And now . . . here is the new improved Mighty Mite! Designed for the present and far into the future. Tests all of your present tubes plus the new RCA Nuvisitors and Novars, GE Compactrons and Sylvania 10 pin tubes.

A complete tube tester that is smaller than a portable typewriter yet outperforms testers costing hundreds of dollars. A real money maker for the serviceman and a trusty companion for engineers, maintenance men and experimenters.

Even though the Mighty Mite weighs less than 8 pounds, new circuitry by Sencore enables you to use a meter to check grid leakage as high as 100 megohms and gas conditions that cause as little as one half microamp of grid current to flow. Then too, it checks for emission at operating levels and shorts or leakage up to 120,000 ohms between all elements. This analytical "stethoscope" approach finds troublesome tubes even when large mutual conductance testers fail. And it does all this by merely setting four controls labeled A, B, C, & D.

Check these plus Sencore features: Meter glows in dark for easy reading behind TV set • Stainless steel mirror in ad-



67⁵⁰
DEALER NET

Remember . . . there is
only one Mighty Mite

justable cover for TV adjustments • Rugged, all steel carrying case and easy grip handle • Smallest complete tester made, less than one foot square. Mighty Mite II will test every standard radio and TV tube that you encounter, nearly 2000 in all, including foreign, five star, auto radio tubes (without damage) plus the new GE Compactrons, RCA Nuvisitors and Novars and Sylvania 10 pin tubes.

Mighty Mite II also has larger, easy-to-read type in the set-up booklet to insure faster testing. Why don't you join the thousands of servicemen, engineers, and technicians who now own a Mighty Mite tube tester? Tube substitution is becoming impossible and costly with nearly 2000 tubes in use today. Ask your authorized Sencore Distributor for the New Improved Mighty Mite. Size: 10¼" x 9¼" x 3½" Wt. 8 lbs.

MODEL TC114

Sencore Sam says . . . "They all agree . . .
the Mighty Mite is the real answer for the man on the go."



SENCORE ADDISON, ILLINOIS

For more details, circle 44 on page 52

NEW PRODUCTS

DeWald MULTIPLEX UNITS

Model P-400 multiplex adapter may be played with the majority of tuners which are equipped with a multiplex jack. It has a stereo blend control for stereo separation of all frequencies, and uses two dual-purpose tubes, one power rectifier and two high frequency diodes. It takes a single mono channel signal and splits it into dual channels. \$57.95. Also, not shown, model R-1103 AM-FM stereo multiplex tuner (multiplex built in). It uses ten



tubes plus three diode detectors, and rectifier ABC to eliminate overload. It also has the stereo-blend control. \$119.95. DeWald Radio Div., United Scientific Labs Inc., 35-15 37th Ave., Long Island City 1, N. Y.

--- for more details, circle 414 on page 52

Build Your Own Superb Scott Kits

Have fun... save money... get the best! Now you can build your own world-famous Scott components... and you can make substantial savings compared to the costs of the nearest equivalent factory assembled units.

H. H. Scott kits feature the same engineering, same high performance, same features and parts as do the factory wired components. Tuners have exclusive Scott Wide-Band design with factory aligned silver-plated front ends. Amplifiers use H. H. Scott's superb conservatively rated transformers.

Scott kits are fun to build, too. The wires are pre-cut to exact length and pre-stripped. Instruction books are in full color to help you see exactly what you're doing. Mechanical parts are factory-riveted to the chassis.

For a genuine H. H. Scott system at a real saving, choose from these fine kits:

LT-110 FM Multiplex Stereo Tuner Pre-wired and aligned front end and multiplex sections; Wide-Band design; 2.2 uv sensitivity (IHFM); \$159.95*

LK-48 48-Watt Stereo Complete Amplifier Kit A truly superior amplifier with power enough to drive even the most inefficient speaker systems. Only \$119.95*

LK-72 72-Watt Stereo Complete Amplifier Kit Fabulous Scott features never before available in a kit: derived center channel controls; tape monitor; \$159.95*

LT-10 FM Tuner Kit Unique Ez-A-Line alignment system. Sensitivity 2.2 uv (IHFM). \$99.95*

LC-21 Stereo Pre-Amplifier Kit Exceptional versatility. 16 front panel controls; frequency response for optional laboratory applications 8 to 50,000 cps! \$99.95*

LK-150 150-Watt Stereo Power Amplifier Kit Conservative design, massive transformers unsurpassed performance. \$169.95*

*slightly higher West of Rockies.

LT-110 FM Multiplex Stereo Tuner Kit



Rush me complete details on money-saving Scottkits.

Name.....
 Address.....
 City..... Zone..... State.....

H.H. SCOTT Export: Morhan Exporting Corp., 458 Broadway, NYC

H. H. Scott, Inc., Dept. 140-12
 111 Powdermill Rd., Maynard, Mass.

For more details, circle 42 on page 52

FREE!

Colorful and detailed 20-page "Guide to Custom Stereo" including complete technical information on Scottkits.

Chemtronics CHEMICALS

A new line of electronic chemicals is now available with a free floor display rack. In keeping with its an-



nouncement of six new aerosol products, the firm is providing an attractive display rack in gold finish with a brightly colored illustrated sign board. Descriptive illustrations on the sign show suggested uses of the chemicals. It is reported that over 95 percent of all technician's chemical needs are in the display rack. Chemtronics, Inc., 870 E. 52nd St., Brooklyn 3, N. Y.

--- for more details, circle 415 on page 52

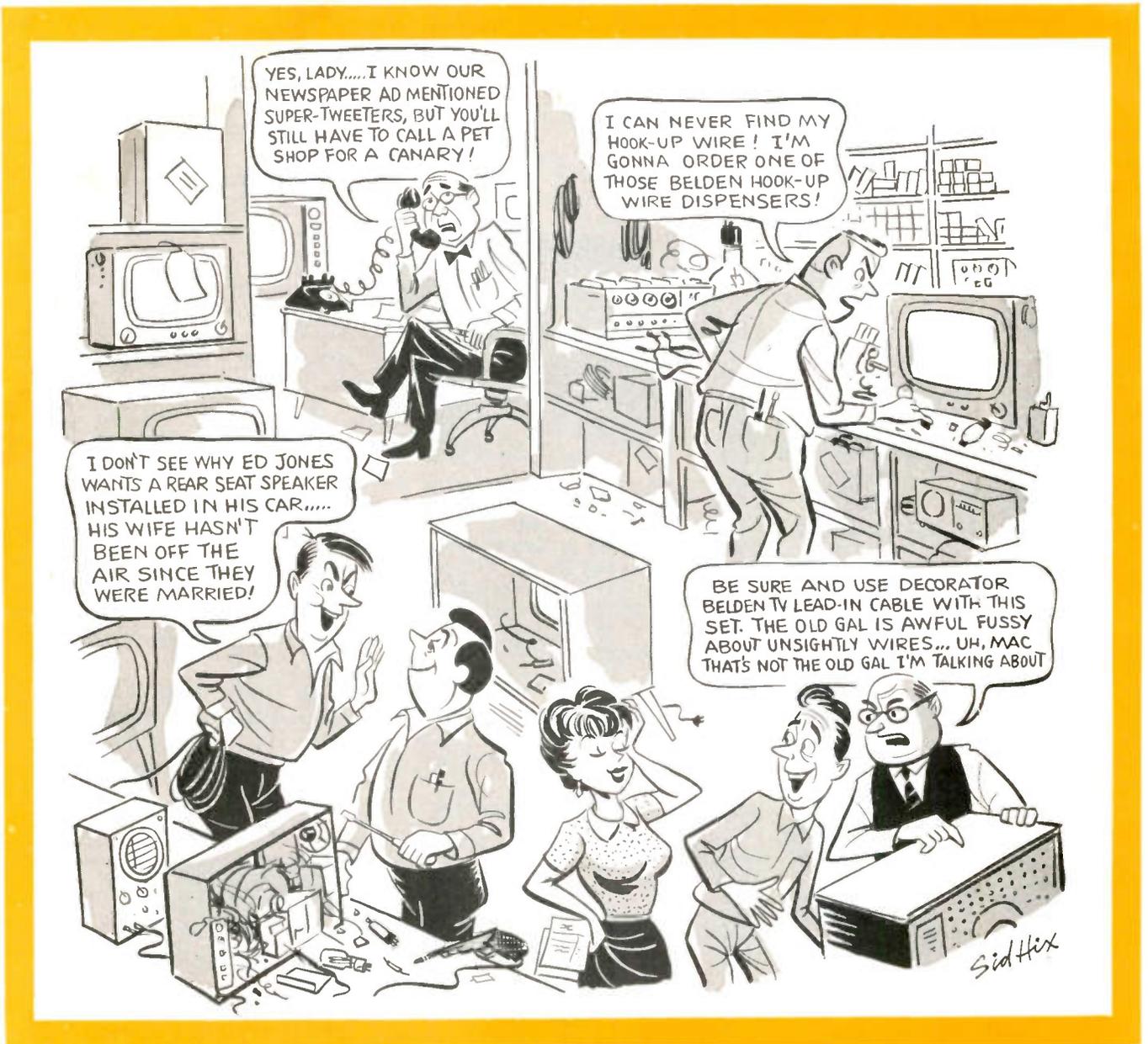
REAC RADIATION INSTRUMENTS

Announced as the first commercially available radiation instrument, designed specifically for fallout shelters,



the Sensor provides radiation level information of the immediate shelter vicinity without the necessity of going outside of the shelter. It employs basic proven features of radiation measuring devices for years. The detector contained in a rugged waterproof housing, is mounted outside on a post, or the side of a building. The indicator is pushbutton operated to conserve battery life. The instrument dial is direct reading, with dangerous radiation levels shown in red. A 50-foot cable leads from the detector into the shelter and connects to the indicating unit. Optional probe on a 3-foot cable converts the unit to a portable instrument. \$99.95. Radiation Equipment & Accessories Corp., 665 Merrick Rd., Lynbrook, N. Y.

--- for more details, circle 416 on page 52



Here's the Decorator 300 ohm TV lead-in cable they're talking about...



Its neutral color blends into any interior decorating arrangement. This popular cable comes in 25, 50, 75 and 100 foot lengths—put-ups in pancake coils for easy handling and display (8226).

This is the work-bench hook-up wire dispenser. No fumbling around for the right spool. It's always in the same place—right in front of you.



Your Belden jobber carries a complete line of TV lead-in cable... also microphone and shielded power supply cables; hi-fi, stereo and phonograph cables; power supply cords; rubber-vinyl, multi-conductor portable cordage; antenna rotor cables; hook-up wire; TV and cheater cords; aluminum ground wire... and related items. It's all in his stock.

ATR PRODUCTS FOR MODERN LIVING



ATR PLUG-IN TYPE PORTABLE INVERTERS*

A.C. Household Electricity Models
 Anywhere . . . In your own car, boat or plane
 Operates Standard A.C. Record Players, Dictating Machines, Small Radios, Electric Shavers, Heating Pads, etc.
 In your own car or boat!

ATR "A" Battery ELIMINATOR



For Demonstrating and Testing Auto Radios—TRANSISTOR or VIBRATOR OPERATED!

Designed for testing D.C. Electrical Apparatus on Regular A.C. Lines—Equipped with Full-Wave Dry Disc-Type Rectifier, assuring noiseless, interference-free operation and extreme long life and reliability.

MAY ALSO BE USED AS A BATTERY CHARGER
 MODEL 610C-ELIF . . . 6 volts at 10 amps. or 12 volts at 6 amps. Shipping weight 22 lbs.
 DEALER NET PRICE \$49.95
 MODEL 620C-ELIT . . . 6 volts at 20 amps. or 12 volts at 10 amps. Shipping weight 33 lbs.
 DEALER NET PRICE \$66.95

AUTO-RADIO VIBRATORS



By every test ATR Auto-Radio Vibrators are best! . . . and feature Ceramic Stack Spacers, Instant Starting, Large Oversized Tungsten Contacts, Perforated Reed, plus Highest Precision Construction and Workmanship and Quiet Operation!

There is an ATR VIBRATOR for every make of car! Ask your distributor for ATR's Low Priced type 1400, 6 volt 4-prong Vibrator; and 1843, 12 volt 3-prong; or 1840, 12 volt 4-prong Vibrator. THE WORLD'S FINEST!

There is a trim plate kit for YOUR CAR!

ATR CUSTOMIZED KARADIO

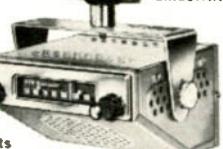


Vibrator-Operated with Tone Control

ATR KARADIO . . . is ideal for small import cars or compact American cars! Unit is completely self-contained—extremely compact! Powerful 8-tube performance provides remarkable freedom from engine, static, and road noises. The ATR Customized Karadio comes complete with speaker and ready to install. Can be mounted in-dash or under-dash—wherever space permits! No polarity problem. Neutral Gray-Tan, baked enamel finish. Overall size, 7" deep, 4" high, and 6½" wide. Shipping weight, radio set, 7 lbs. Model K-1279—12 for 12V Dealer Net Price. . . \$33.57 Model K-1279—6 for 6V Dealer Net Price. . . \$33.57

Airplane Style Overhead Mounting under Cab Roof NO PRINTED CIRCUITRY

ATR TRUCK KARADIO



Excellent Tone, Volume, and Sensitivity!
 Compact, yet powerful. Fits all trucks, station wagons, most cars and boats. Just drill a ¾ inch hole in roof and suspend the one-piece unit (aerial, chassis and speaker) in minutes. Watertight mounting assembly holds antenna upright. Yoke-type bracket lets you tilt radio to any angle.
 Extra-sensitive radio has 6 tubes (2 double-purpose), over-size Alnico 5 PM speaker for full, rich tone. Big, easy-to-read illuminated dial. Fingertip tuning control. Volume and tone controls. 33-in. stainless steel antenna. Neutral gray-tan enameled metal cabinet, 7 x 6½ x 4 in. high over-all. Shipping weight 10½ lbs.
 Model TR-1279—12A for 12V Dealer Net Price \$41.96
 Model TR-1279—6A for 6V Dealer Net Price \$41.96

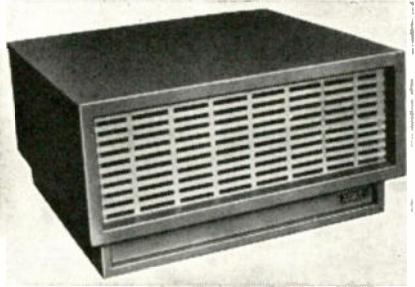
SEE YOUR ELECTRONIC PARTS DISTRIBUTOR WRITE FACTORY FOR FREE LITERATURE . . .

ATR ELECTRONICS, INC.
 Formerly American Television & Radio Co.
 Quality Products Since 1931
 ST. PAUL 1, MINNESOTA—U.S.A.

NEW PRODUCTS

Utah IONIZERS

Two models of negative ion generators are: the ION-2 which has a single motor, fan and rectifier circuit



to maintain a negative charge in an area of about 10 x 12 feet; and the ION-3 which has 2 motors, fans and rectifier circuits to handle twice the area. Air charged with positive ions tends to induce headaches and cause a feeling of stuffiness though the room temperature and humidity are correct. These units are designed to maintain a negatively charged atmosphere free of dust and pollen. ION-2, \$49.95. ION-3, \$74.50. Utah Electronics Corp., Huntington, Ind.

... for more details, circle 417 on page 52

Steelcraft WALL CABINETS

Announced is a line of completely recessed equipment cabinets for flush wall mounting to house audio and



electronic equipment with full front access. Made in easily assembled sections. All housing cabinets and parts finished in durable heavy-duty baked gray enamel finish. Vertical piano hinge supports several hundred pounds of equipment, yet allows it to swing out easily for service and maintenance. Model WM-3675, shown, is 42 inches high, 28 inches wide, 18¾ inches deep, panel space, 36¾ inches, and is reported the most popular size for most general public address installations. Steelcraft, Inc., 1296 E. Keating, Muskegon, Mich.

... for more details, circle 418 on page 52

HUM SYMPTOMS . . .

Continued from page 41

vertical and horizontal sections through B+ lines.

A defective filter in the B+ supply, or in a supply's negative bias section, can cause alternately light and dark vertical hum bars on a TV screen.

A defective agc bus filter capacitor or a-c feedback in the agc bus can cause hum symptoms on a TV set's screen. A scope check on the agc bus can determine if a-c ripple is present.

Some TV power transformers may be insufficiently shielded or improperly grounded. A troublesome amount of hum can originate from this source. Metal lock washers should always be used under mounting bolts or nuts and the bolts should be tight. Deflection yoke leads should also be dressed well away from power transformers.

By careful study of hum symptom details, the technician can develop his own optimized speed for trouble shooting and repair of "hum-bugged" TV sets.

the business-like approach

to SERVICE CHARGES and RECORD KEEPING

For customer's prices on every replacement part, plus flat rate and hourly service charge data, regional and national. Dave Rice's OFFICIAL PRICING DIGEST, listing over 63,000 items. \$2.50.

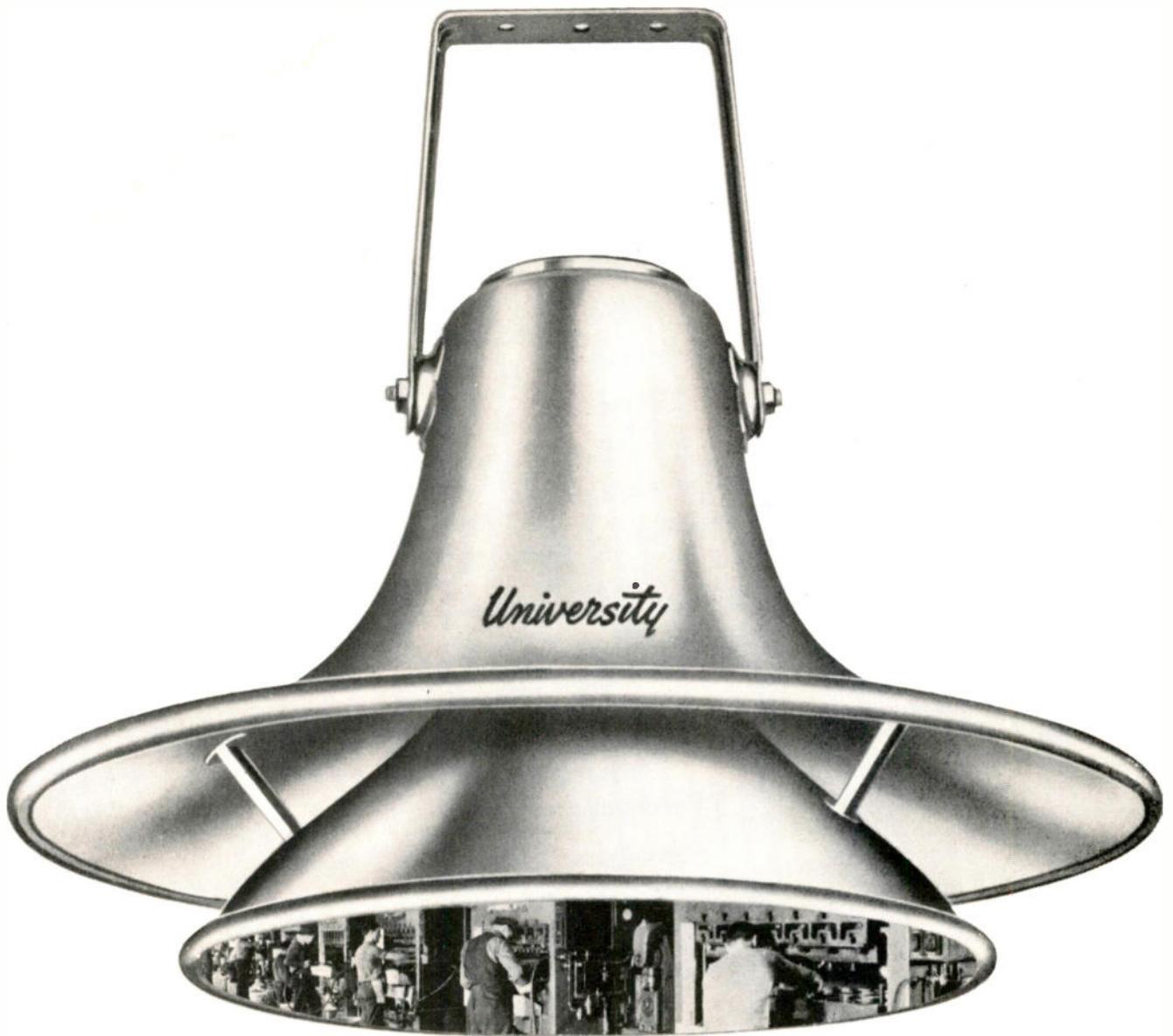
▲ AVAILABLE FROM YOUR DISTRIBUTOR ▼

If you want to operate on a professional level, Dave Rice's OFFICIAL ORDER BOOKS give you triplicate forms for order, invoice, and office records . . . spaces for tubes, parts, serial numbers, labor and tax charges, signatures, etc. 75c per book, \$6.50 for dust-proof box of 10.

Dave Rice's
OFFICIAL ORDER BOOK

ELECTRONIC PUBLISHING COMPANY, INC.

For more details, circle 25 on page 52
ELECTRONIC TECHNICIAN



ATTENTION, PLEASE!

Heard clearly through production noises at the plants of the Ford Motor Co., General Motors, Curtiss-Wright and other leading companies . . . over UNIVERSITY Radial Trumpets.*

And there are good reasons why University Radial Reflex Projectors are chosen to carry important messages to factory personnel. The higher efficiency of University Reflex Radial Projectors is one of the reasons. Rugged, weather resistant construction making them ideal for installations subject to weather extremes and for dust-laden atmospheres . . . plus uniform (and economical) 360° overhead sound distribution from a single projector, are additional reasons for their world-wide popularity.

More of the story? There are 3 models to choose from: the RLH, with the longest air column—suggested where maximum low frequency response is desired; the RPH, with higher cut-off for both music and speech; the RSH, most suited where high clarity of speech is more essential than music.

And that's only the beginning of the University paging story! For optimum sound reinforcement and penetration with low power systems, there's the MIL-A, CMIL-A, IB-A—for wide area coverage in medium noise level areas . . . the CIB-A—for long, narrow corridor installations . . . the bi-directional 2WP!

But for the complete story of University Public Address speakers, write Desk Z-12, University Loudspeakers, Inc., White Plains, New York.

NOTE: All University P.A. Loudspeakers are F.C.D.A. approved.

*Engineered with HIGH 'A'—HIGH AUDIBILITY—exclusive with University!

For more details, circle 52 on page 52



A Division of Ling-Temco-Vought, Inc.

CATALOGS AND BULLETINS

CAPACITORS: New 32-page Servicemens Catalog SE 561 covers a-c capacitors, auto-radio, ceramic, electrolytic, mica, Mylar, oil-paper, and paper tubular capacitors, in addition to filters, hardware, instruments and capacitor kits. Aerovox Corp., New Bedford, Mass.

ANTENNAS: Literature available includes: Form No. SD-176 describing

the Magnum 27, model M-81, end fed, $\frac{1}{2}$ wavelength, 6 db citizens band base station antenna; also two-color circular, form No. SD-158 over 22 models specifically designed for citizens band (27 mc) operation. Illustrations and prices included. The Antenna Specialists Co., 12435 Euclid Ave., Cleveland 6, Ohio.

RECEIVERS: Technical bulletin 516-RV-RU covers a new fixed frequency crystal controlled superheterodyne unit. Frequency range, 108 to 152 mc or in UHF 225 to 400 mc. Erco Radio Labs., 637 Stewart Ave., Garden City, N. Y.

TUBES, COMPONENTS, INSTRUMENTS: Fall-winter 1961 catalog #23, 48-pages cover the firm's complete line. Well illustrated. Includes prices. Fay-Bill Distributing Co., 79 White St., New York 13, N. Y.

CAPACITORS: Bulletin GEA-7226 covers 85°C Tantalytic foil "A Case" capacitors. New ratings up to 100v. Size, .470" long, .131" in diameter. Bulletin provides characteristics, performance graphs and dimensional drawings. Capacitor Dept. General Electric Co., Irmo, S. C.

TRIODES: Literature covers two new subminiature twin triodes, 6D-HH12 and 6D-HH13, designed for VHF TV tuners and introduced by Toshiba. Mitsui & Co., 2nd Machinery Dept., 530 Fifth Ave., New York 36, N. Y.

TV SERVICING DATA: A colorful, four page circular describes the newly published "1962 Television Servicing Manual" and other available books. Supreme Publications, Highland Park, Ill.

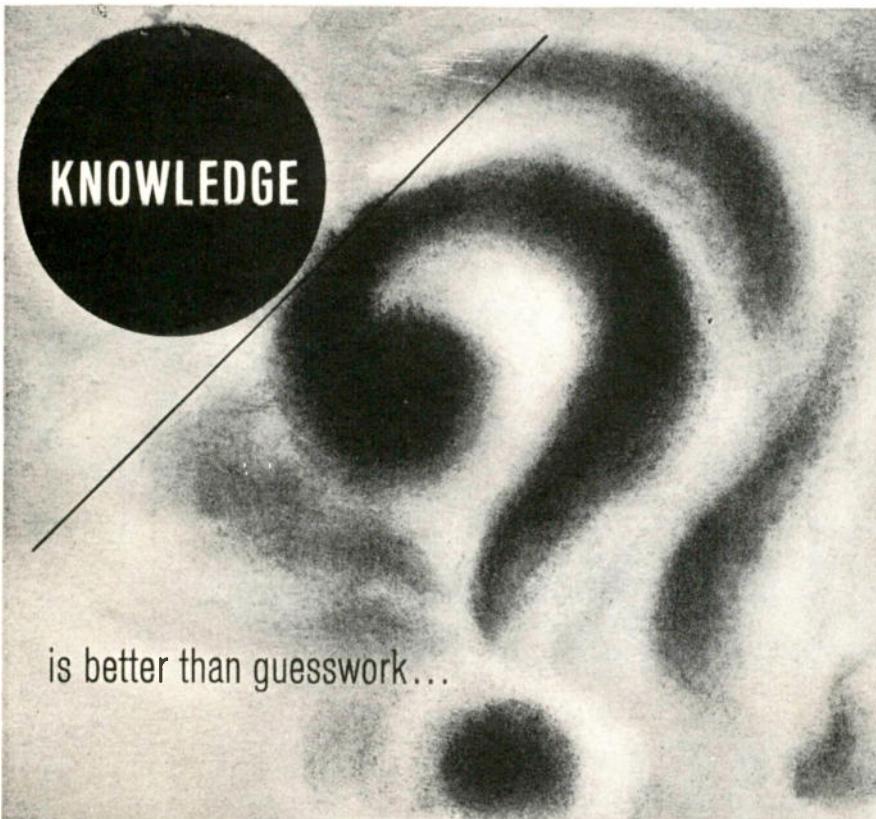
HAND TOOLS: Two-color circular covers No. SA-75 display assortment containing 40 all-hollow-shaft nut drivers, eight each of five most popular sizes in the line. Circular provides a convenient order form. Vaco Products Co., 317 E. Ontario St., Chicago 11, Ill.

... TOUGH DOG

Continued from page 50
set's sound resumed normal operation.

But now I remembered the regeneration problem. Experimental shielding of uncovered coils did not help. Recalling that signal injection had solved the other problem, I decided to stick with it.

I now injected a signal at the 5AM8's diode cathode (video detector). This test gave a somewhat weak but apparently satisfactory signal as indicated on the CRT. Little or no loss appeared at the 5AM8's diode plate. The signal generator's probe was now placed at the 5AM8's grid. Little or no gain was evident. Could this be another bad tube socket? Boiling this part of the story down to essentials, pin 2's indirect connection in the socket was broken. The small amount of signal getting through was probably being capacitively coupled. A second socket replacement brought the set back to new (almost) operating condition.—
Eugene Fleming, Naturita, Colo.



and **STANCOR** takes the guesswork out of TRANSFORMER REPLACEMENTS

When you use Stancor exact replacements, you *know* that you have a transformer that duplicates in every way the original manufacturer's electrical and physical specifications.

What's more, you know in advance that you'll be able to use a Stancor unit, because Stancor offers virtually complete coverage on flybacks and yokes . . . and the Stancor TV Guide, the most detailed in the industry, gives you exact information on the right transformer to use.

Contact your Stancor distributor for information on how to get your copy of the Stancor TV Guide.

*Take all the guesswork out of transformer replacements—
always specify Stancor.*

STANCOR
ELECTRONICS, INC.

formerly Chicago Standard Transformer Corporation • 3501 West Addison Street • Chicago 18, Illinois



"There's nothing like our Yellow Pages advertising for bringing in newcomers and transients!" says K. W. Spornitz, V.P., Phil's Fix-All, Inc., Rochester, Minn. "Since IBM moved into our area, many newcomers have moved in, too. Our Yellow Pages advertising has introduced us to them and helped double our business! We're so satisfied with our Yellow Pages program, we advertise under 9 different headings and 2 trade-marks."

House of Electronics . . .
*Your Electronic Products are as good
 as the Service Behind Them*

SALES MOTOROLA PRODUCTS TELEVISION STEREO HOME & CAR RECORDER COMMUNICATION SYSTEMS	SALES NAME BRANDS TAPE RECORDERS FM RECORDERS RECORDERS TUBES
---	---

Service

No Charge If We Can't Fix It In
 Your Home
 Prompt Radio Dispatched Service

TWO CONVENIENT LOCATIONS

3249 SE 1st Av.
 1 Blk. So. Of Outdoor Theatre
AT 2-3808
 Southgate

Phil's Electronic Center
 1134 NW 7th St.
AT 9-0465
 Miragille
 Shipping Center

PHIL'S FIX-ALL, INC.
ELECTRONICS



Display this emblem. It builds your business!

Display ad (shown reduced) runs under TELEVISION SERVICING. Call the Yellow Pages man at your Bell Telephone Business Office to plan your program.

For more details, circle 11 on page 52

ASSOCIATION NEWS

California

IPET, South Pasadena, reports that radio and service dealer Dallas E. Speers has been presented with the coveted All-American Award, established by General Electric four years ago. The award is given to radio-TV dealers and service technicians for outstanding community service, technical competence and good business practices. Speers had previously received the Distinguished Service Award of 1959, presented to him by the combined service clubs of the community. Only 24 All-American Awards have thus far been issued to service dealers.

Appliance VP Supports Servicemen

APA, Los Angeles, delegates to its annual convention held in Berkeley recently heard Harold P. Bull, vice president of Norge division, Borg-Warner Corp., say that the customers negative attitude toward the service technician was not the service industry's fault. "The appliance serviceman," said Mr. Bull, "has borne the worst of the criticism because he is the first person the consumer sees." Mr. Bull promised his personal backing of the APA. He advised technicians to "sell hard, keep your skills on a high level, watch your operating expenses. Stay in business—we need you," he concluded.

ACTRA, Alameda County, members were recently briefed on Motorola's transistorized 19-inch portable TV by Tom Aaron, W. J. Lancaster Co's. service manager. Organization members' knowledge was enriched by nearly two hours of detailed study and analysis of the set's circuitry and its operation. The association also reported exploratory steps were being taken on a cooperative customer credit information system which would parallel but strengthen the group's present "Warnagram" phone net. The system would provide quick exchange of information between members regarding problems encountered with deadbeat and other "poor credit risk" customers.

Illinois

NATESA, Chicago, announced that its directors' conference will be held in Miami, April 28 and 29, 1962. The national organization also reported that a free service training school was operating in Morgan City. The announcement came from Wayne Cork-

IF YOU CHANGE YOUR ADDRESS

Notify us at 1 East First Street, Duluth 2, Minn. Please include the address label from a recent issue and allow 30 days for the change.

ern, district service training manager for Westinghouse, and Jack Johanson, NATESA director for TESA of St. Mary. Technical data, service techniques and procedures for Westinghouse radio, TV and hi-fi equipment was being covered.

Indiana

Business Management Clinic IESA, Indianapolis, reported that its clinic on business management held September 26 and 27, proved highly enlightening for those who attended. The course was geared to the state's

Solves all your TV Tuner Problems



**VHF TUNERS
UHF TUNERS
UV COMBINATIONS***

*UV combination tuner must be of one piece construction.

**ALL MAKES
ONE PRICE** **9⁹⁵**

90 Day Warranty

Simply send us your defective tuner complete; include tubes, shield cover and any damaged parts with model number and complaint.

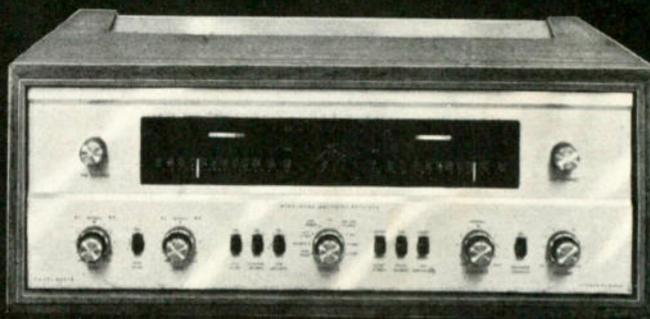
Send for **FREE Mailing Kit** and complete details.

CASTLE Pioneers in TV Tuner Overhauling
TV TUNER SERVICE, INC.

5710 N. Western Ave., Chicago 45, Illinois • 653 Palisade Ave., Cliffside Park, New Jersey
In Canada: 136 Main St., Toronto 13, Ontario

For more details, circle 18 on page 52

For your custom stereo installations



THE FISHER 800-B

Three of the world's finest components on one chassis

- 1** **AM-FM-Stereo Multiplex Tuner:** separate tuning indicators for FM and AM; exclusive Fisher STEREO BEAM automatically shows whether an FM station is broadcasting in stereo.
- 2** **High-Power Stereo Amplifier:** 65 watts music power; special center-channel output connection for third speaker.
- 3** **Master Audio Control-Preamplifier:** complete, easy-to-use control system assures total flexibility; provisions for every type of input. **Price \$429.50***

*Walnut or Mahogany cabinet \$24.95; prices slightly higher in the Far West

USE THIS COUPON FOR DETAILED INFORMATION

Fisher Radio Corporation
21-24 44th Drive, Long Island City 1, N. Y.

Please rush the following **FREE** literature:

- Complete specifications on the Fisher 800-B Receiver.
- The 1962 Fisher Handbook, a 40-page illustrated reference guide and component catalogue for custom stereo installations.

Name _____

Address _____

City _____ Zone _____ State _____

For more details, circle 26 on page 52

small TV service business—the “one man and wife,” or the three-or four-man operation. Sessions were conducted by Newell Twist, Bookkeeping Business Service, Pomona, Calif. Subjects ranged from simple bookkeeping to inventory control and expense analysis—including tips on proper tax reporting. Some off-beat discussion arose because of the number of ladies attending the clinic. Closer investigation, however, confirmed what everyone already suspected: lady-brains was behind most TV-service-shop record-keeping. Clinic sessions also gave technicians a chance to compare ideas on business management and sales.

Michigan

MEA, Macomb, elected the following officers: president, Walter Gargala; vice president, John D. Brown; secretary, Edward Ballentine; treasurer, Carl Batkins.

RTA, Lansing, announced the following officers had been elected: president, Mel Parks; vice president E. Snyder; secretary, Dean Pope; treasurer, Ralph Sheldon.

Missouri

Color TV Course

TESA, St. Louis, recently participated in a two-day color TV refresher course on the new Zenith Color TV set. The class was conducted by Jim Muehlenbrock and Tom Fogerty, of Hollander & Co., local distributors.

Ohio

TESA, Springfield, has elected the following officers: president, Jerry Bar-koukis; first vice president, Paul Le-Coy; second vice president, Marvin Miller; third vice president, Grady Hays; secretary, Joe Phillips, and treasurer, Vic Felton.



“This is one dog that dorned dog of the Brodleys won't soon forget!”

REPS AND DISTRIBUTORS

Almo Radio—appointed exclusive distributor in Philadelphia, southern New Jersey, Wilmington, Del., and Salisbury, Md., for ALLIED RADIO'S “Knight-Kits”.

Electronic Representatives Assn. (ERA)—17-hour salesmanship course will be presented by the Chicagoland Chapter, in cooperation with the Dartnell Institute, Dec. 8 and 9, at the Concord Motel, Chicago.

Semitronics Corp.—A FRIEDMAN & ASSOC. named as firm's rep. in New York City metropolitan area.

Sinclair Electronic Associates—new rep. firm for the San Francisco Bay Area is seeking lines in the northern Calif. area. Address is: 1085 Clarendon Crescent, Oakland 10, Calif. Art Sinclair formerly with PACIFIC WHOLESALE Co., heads the new rep. firm.

United Catalog Publishers—special promotion includes a bonus to sales reps. who sell 50 or more copies of the current RADIO-ELECTRONIC MASTER CATALOG to a new account.



EXACT REPLACEMENT INDOOR TV ANTENNAS

- ✦ Pre-priced for full profit markup
- ✦ Skin packed for identification and protection
- ✦ 72 models covering 22 TV makes
- ✦ Color coded by set manufacturer
- ✦ Same as original equipment
- ✦ From GC-Radion, the pioneer in indoor TV antennas

Radion exact replacement indoor antennas let you cash in on big profit potential. Each package is cross referenced to manufacturer's Part Numbers, and contains fresh, new equipment.

Your GC-Radion Distributor has full information. Ask him for a copy of the free 24-page “Indoor Replacement Antenna Cross Reference Guide,” or write us.



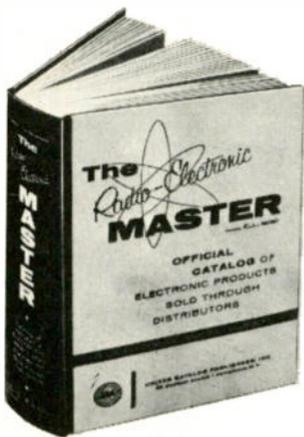
GC ELECTRONICS COMPANY

a division of Textron Electronics, Inc.
400 S. WYMAN ST., ROCKFORD, ILLINOIS

For more details, circle 27 on page 52

every standard electronic part you'll ever need is pictured and described in the 1962 RADIO ELECTRONIC MASTER

JUST OUT!
'62 EDITION



1600 PAGES
world's largest electronic catalog

It's new! Covers all the latest parts and equipment necessary to repair and maintain radio-TV-audio electronic equipment.

It's the world's biggest electronics purchasing guide! 1600 pages, more than 175,000 items — with descriptions, specs, illustrations and prices.

It's easy to use! organized in 32 product sections for rapid references; fully indexed to save you time. At parts distributors, \$3.95 (\$4.95 in Canada).

THE RADIO-ELECTRONIC MASTER
60 Madison Ave., Hempstead, N.Y.

For more details, circle 39 on page 52

... TRANSISTOR OPERATION

Continued from page 39

and connect them into all six stages in a transistor radio to see just what would happen? This would certainly give you some idea of just how critical transistor substitution is. This is exactly what was done on this transistor radio. We reached back in the audio transistor drawer and picked out six transistors of the smaller variety. None were power transistors. All were of the PNP formation because this is what the transistor radio used. Fig. 2 shows the substitutions. Refer to the chart at the top of page 71.

Note that there was very little change in the operation of the radio until the audio amplifier type transistors were substituted for the power transistors in the audio output stage.

Subsequent tests were made by substituting the output transistors with that of a power type selected at random. The results proved that the power type was required and the radio operated normally. Even though this sounds simple, one problem was encountered. The first transistor substituted in the 1st i-f amplifier was a 2N406 which caused a parasitic oscillation. Referring to the set-up chart which accompanied the transistor tester on our bench, we noted a great difference in the gain and leakage settings of these two transistors. (The beta of the 2N406 is 100 and only 25 for the Philco T1233.)

A 2N525 was then tried because the settings were similar and the radio worked satisfactorily.

Slight realignment of the radio was all that was necessary to cause us to believe that it worked as well as before the substitute transistors were installed.

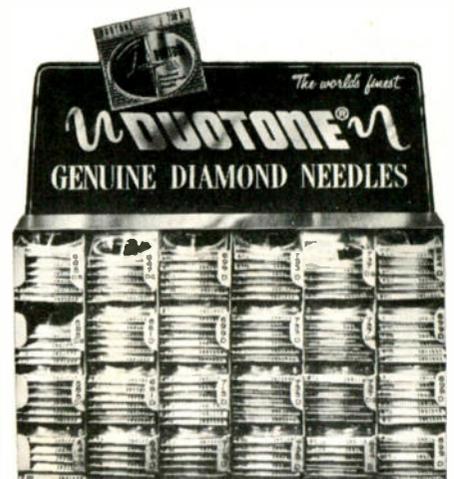
One can ascertain from this experiment that you can't just substitute any transistor, but that transistors can be easily substituted with good success if a little logic is followed. First, try to find a transistor that is of the same type. If it is an r-f type, it should work satisfactorily in an r-f stage. Try to use an i-f type for i-f substitution, etc.

Secondly, either refer to the manufacturer's data, which is seldom available, or to the set-up



WHAT EVERY NEEDLE DEALER SHOULD HAVE...

DUOTONE'S NEW DIAMOND NEEDLE DISPENSER!



Because...your needle sales will skyrocket. This attractive display contains the most wanted stereo and monaural diamond needles. The dispenser, by being constantly in front of your customers, will stimulate point-of-purchase needle sales...and it will save you Inventory Time.

The dispenser is FREE! You just pay for the 32 Duotone Diamond needles it contains. They're newly and handsomely packaged for customer eye appeal.



SEE YOUR DUOTONE DISTRIBUTOR TODAY!

DUOTONE
COMPANY, INC.

KEYPORT, N.J.

For more details, circle 21 on page 52

ELECTRONIC TECHNICIAN

data that accompanies most transistor testers to see that the transistors compare favorably in gain and allowable leakage. Some companies offer about ten transistors to cover the entire line of about 2,000 transistors now on the market. From a practical standpoint, this pretty well does the job.

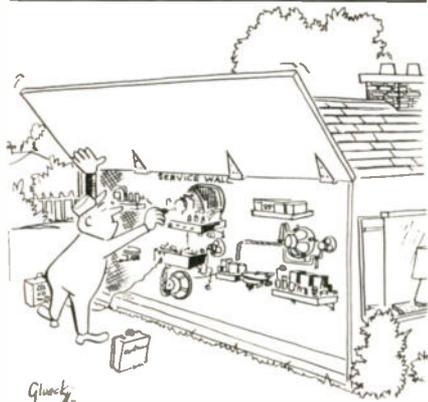
A service company that is known to repair all the tough dog transistor radios in the area was contacted. They indicated that it takes about 12 PNP types and 15 NPN types to do the best job. This is considerably better than trying to stock 2,000.

The biggest problem in substitution and the reason that most experts can't agree on the number of transistors that are required for over-all substitution is because of the mechanical problems.

At this point, you may be wondering why these unconventional measurements were made. You may even wonder whether it pays to test transistors and the circuits in which they work. These tests were made to find out just how "sloppy" one can get and still get by in servicing transistor circuits. It is worth your time to go through these type tests on a transistor radio that you might pick at random. Prove to yourself that you can get pretty far off base and still get by.

On the other hand, you will realize that a great deal of time is wasted in approaching service in this manner. You will also understand that super accurate measurements are not what you, as a practical technician, are looking for.

The information developed in this article will serve as a useful background for an early forthcoming article on practical transistor circuit servicing techniques. ■



NEW BOOKS

HOW TO SOLVE PHYSICS PROBLEMS. By Edwin M. Ripin. Published by John F. Rider Publisher, Inc. 122 pages, soft cover. \$1.80.

Written primarily for the teacher and student in high school and college, this book asks some 200 physical science questions—and shows how to answer them easily. A brief explanation of the fundamental dimensional technique leads directly into basic problems of length, area, volume, velocity

and acceleration. The confusion prevalent in mass and weight concepts is cleared up by explaining their individual characteristics and pointing out their proportional relationship. The fundamental laws of force, momentum, pressure and density are reviewed. Problems in work, energy and power are covered adequately. Torque, statics and vector analysis methods are described. Basic electrical and magnetism problems are solved. Miscellaneous topics include thermal expansion and contraction, sound and electromagnetic waves, optics and others. Highly recommended to anyone interested in the subjects covered.



IMPROVED MODEL PS-3

Regulated, Transistorized
DC POWER SUPPLY

0-25 VDC variable output

only \$79.50 net

Regulation now 100 MV max.

... just what you asked for—AND MORE!

Now even better than ever . . . regulation has been reduced from 500 to 100 MV for the complete range of output ratings: 0-200 MA, 0-15 V . . . 0-100 MA, 15-25 V.

Set it and forget it . . . voltage remains constant at any output setting regardless of load or fluctuations of AC supply between 110 V and 130 V.

Extremely low ripple . . . less than 1MV RMS for all conditions of rated operation . . . less than ½ MV for 115 to 120 AC line voltage.

One full year warranty . . . your assurance of superior quality.

2% accuracy D' Arsonval meter has 3 ranges: 0-25 V, 0-100 MA and 0-200 MA.

Available through Electronics Distributors everywhere



Write for New Catalog PS-561 giving all advantages
ELECTRO PRODUCTS LABORATORIES
4501-V Ravenswood, Chicago 40, Ill., Longbeach 1-1707
Canada: Atlas Radio Ltd., Toronto 1286

For more details, circle 23 on page 52

MERCURY TV TUNER SERVICE

890-2 River Ave., Bronx 51, N.Y.

"Largest in the East"

VHF-UHF TUNERS

7 Months Warranty

Price Includes Labor & Minor Parts

TUBES & MAJOR PARTS
AT NET PRICES

When Shipping Tuner: Include Tubes,
Shields and Damaged Parts.
Give Model Number and State Complaint

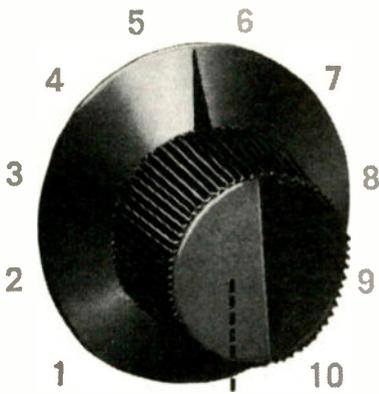
PACK WELL AND INSURE
24 HOURS ON POPULAR TYPES

ALL MAKES
ONE PRICE!

\$9.50

For more details, circle 32 on page 52

MASTER



**YOU WON'T FIND
THIS CONTROL
ON ANY OTHER P.A.
AMPLIFIER IN
THIS PRICE CLASS**



That's a fact. But all Harman-Kardon COMMANDER Series public address amplifiers incorporate a master volume control. These unique, popular-priced units include features generally found on much costlier "deluxe" equipment. For instance: Outputs for tape recorder, booster amplifiers and both 25 and 70 volt speaker lines; input for magnetic cartridge; DC on filaments of hi-gain stages; locking covers, etc. PLUS COMMANDER exclusives such as: multiple inputs for greater installation flexibility and optional single-control mixing of two program sources for convenience and ease of operation. Discover why sound men are switching to COMMANDER for all their needs. Write today, Commercial Sound Division, Harman-Kardon, Plainview, L.I., N.Y.

Send free detailed catalogs: Desk 12G

Name _____

Address _____

City _____ State _____

harman kardon

For more details, circle 29 on page 52

NEWS OF THE INDUSTRY

Centralab—acquires WILRITE PRODUCTS, INC., Cleveland manufacturer of film type fixed resistors.

Perma-Power—A cultured pearl heart pendant on a gold-filled chain, value \$3.95, is offered free with each package of Vu-Brite TV tube brighteners. Offer applies to both C-401 parallel and C-402 series, and continues until Dec. 15, 1961.

Euphonics Corp.—Puerto Rico, U. S. A. appoints EARL OLSON to the EUPHONICS AMERICA Chicago office.

Littelfuse—appoints two new members to the Board of Directors: DR. E. H. SCHULZ, vice president for research operations, ARMOUR RESEARCH FOUNDATION; and KENNETH L. BLOCK, partner, A. T. KEARNEY & Co., management consultants.

Raytheon—EDWARD J. KUKULA, former district manager of RAYTHEON's Distributor Products Div., Detroit, has



Kukula



Mullin

been named a product specialist for the division's line of communications products. He will direct sales of citizens band two-way radio from the Franklin Park offices. THOMAS M. MULLIN, former district manager, St. Louis, named district manager, Detroit.

Hickok—co-sponsored with D & H DISTRIBUTING Co. recent clinic on servicing color TV sets at a profit. Two hundred TV technicians in the Harrisburg, Pa., area attended.

Electronic Instrument—HARRY R. ASHLEY, president, spoke at the recent NEDA dinner in New York. His subject was "Seven Ways of Getting More Business".

Westinghouse—Electronic tube division appoints ANTHONY P. TRAFFORD renewal sales rep. for the Los Angeles area.

Triad—RICHARD A. HAGBERG named vice president and general manager.

Sylvania—Parts division appoints STEWART A. WILLITS and JOHN E. HILL as field sales reps.

STEP UP TO A STANTON

... before you decide on a new stereo pickup — do yourself — your family — your friends this service: Listen to your favorite stereo or mono record, reproduced with all of the leading stereo pickups. Check stylus pressure and tracking (for record wear) and, most of all—the quality of music reproduction. Only in this way can you really know the worth of the STANTON Stereo Fluxvalve*—with its wonderfully practical, easily replaceable V-GUARD stylus.

*Covered under U.S. Patent No. 2,917,590

SERIES: 380-381-198-199
from \$29.85

Send for your complimentary copy of Tech-Specs — a handy guide for planning a stereo high fidelity system ... write Dept. T-121



FOR THOSE WHO CAN HEAR THE DIFFERENCE



Pickering

PICKERING & CO., INC., PLAINVIEW, NEW YORK
For more details, circle 35 on page 52

ROBINS PHONO & RECORDER DRIVES

More than 188 parts — including 'O' rings, idler drives, belts and cam tires, pulleys, roller assemblies and bumpers.

Every Robins replacement part is engineered to precise OEM specifications, individually packaged for maximum protection. To speed parts selection, replacement data appears on every package.

Look for the time-saving Robins display at your distributor. Free reference guide—ask your distributor.

At dealers or write:

ROBINS INDUSTRIES CORP. Flushing 56, N. Y.
For more details, circle 40 on page 52

Cumulative Article Index

All feature articles appearing in ELECTRONIC TECHNICIAN
from January through December 1961

AUDIO, HI-FI, PA

<i>Get Ready for Stereo</i>		
<i>Multiplexing</i>	Alan Andrews	2/61-38
<i>Reverberation:</i>		
<i>The New Sound of Hi-Fi</i>	L. M. Dezettel	3/61-40
<i>How to Measure Hi-Fi</i>		
<i>Distortion</i>	Mannie Horowitz	4/61-46
<i>Center Speaker for Stereo</i>	L. M. Dezettel	5/61-36
<i>Here's the New FM Stereo</i>		
<i>System!</i>		6/61-36
<i>PA Microphone Ratings</i>	Arnold Haber	7/61-40
<i>Background Music Franchise for</i>		
<i>TV Service Dealers</i>		7/61-67
<i>Installing Background Music</i>		
<i>Systems</i>	David Bain	8/61-38
<i>How Stereo Components Work</i>		9/61-78
<i>A Technical View of FM Multiplex</i>		9/61-89
<i>The Good (and the Bad) of</i>		
<i>Factory-Authorized Hi-Fi</i>		
<i>Service Agencies</i>		9/61-94
<i>Hi-Fi Installation Methods</i>	Mannie Horowitz	9/61-97
<i>Comments on New Stereo</i>		
<i>Developments</i>	N. H. Crowhurst	9/61-101
MANUFACTURER AND PRODUCT		
STEREO DIRECTORY		9/61-105
<i>Troubleshooting Audio Power</i>		
<i>Amplifiers</i>	Mannie Horowitz	10/61-38
<i>The Hi-Fi Role of Audio</i>		
<i>Accessories</i>		10/61-46
<i>Examining Hi-Fi</i>		
<i>Preamplifiers</i>	Mannie Horowitz	11/61-40
<i>Examining Audio Power</i>		
<i>Output Stages</i>	Mannie Horowitz	12/61-42

BUSINESS

<i>Service Industry Votes on</i>		
<i>TV Licensing</i>		1/61-32
<i>1960 Electronic Statistics</i>		1/61-51
<i>New Tax Ruling on</i>		
<i>Depreciation May Save</i>		
<i>You Money!</i>	Paul Lockwood	3/61-48
<i>Be Sure It's In The</i>		
<i>Contract</i>	E. W. Fair	4/61-48
<i>Technician Associations—</i>		
<i>1961 Roster</i>		5/61-43
<i>Electronic Schools</i>		5/61-44
<i>Technical Societies &</i>		
<i>Industry Associations</i>		5/61-44
1961 ELECTRONIC TECHNICIAN DIRECTORY		
<i>Alphabetical Listing of</i>		
<i>Manufacturers</i>		5/61-45
<i>1961 Parts Show Preview</i>		5/61-55
<i>Why Can't You Give Me a</i>		
<i>TV Repair Estimate Right</i>		
<i>Now?</i>		5/61-69
<i>Getting the Most</i>		
<i>out of Volkswagens</i>		
<i>in TV Service</i>	Jack Darr	5/61-80
<i>How to Choose a Vehicle</i>		
<i>for TV Servicing</i>	E. W. Fair	6/61-38
<i>Don't Murder Your Business</i>	Irving Elbaum	7/61-41
<i>Building Business</i>		
<i>Friendships</i>	E. W. Fair	9/61-42
<i>TV Service Earnings</i>		9/61-100
<i>On-the-Spot Report:</i>		
<i>TV in Germany</i>	Albert J. Forman	10/61-41
<i>Distributors Dress Up</i>		
<i>for Dealers</i>		12/61-45

COMPONENTS — TUBES — TRANSISTORS

<i>Understanding "Magic-Eyes"</i>	Herman Burstein	1/61-30
<i>How to Substitute "Unavailable"</i>		
<i>TV Parts</i>	Harold West	3/61-34
<i>Using Relays in Industry</i>	H. A. Schwartz	6/61-42
<i>Buying Guides for TV</i>		
<i>"Twin Lead" Wire</i>	Al Goldstein	8/61-50
<i>Replacing Components in</i>		
<i>Transistor Radios</i>	Lothar Stern	11/61-44
<i>Solid-State I-F Transformers</i>		11/61-83
<i>Just How Critical is Transistor</i>		
<i>Operation?</i>	Herb Bowden & Jim Neuman	12/61-38

EDITORIALS

<i>The Business Picture</i>		1/61-27
<i>The Licensing Vote</i>		1/61-27
<i>Loyalty . . . Or Else</i>		1/61-27
<i>Improving TV Set Serviceability</i>		2/61-27
<i>Those Long Warranties</i>		2/61-27
<i>Keeping Records</i>		3/61-31
<i>Put It In Writing</i>		3/61-31
<i>Color TV—Ready For An Upswing?</i>		4/61-29
<i>The Price of Mandatory UHF</i>		5/61-29
<i>Distribution Practices and Legal Woes</i>		6/61-29
<i>Readers Become Authors</i>		6/61-29
<i>Dealers Kick at Extended Warranty</i>		7/61-29
<i>Two Tube Makers Quit</i>		7/61-29
<i>TV Non-Interference Seal</i>		7/61-29
<i>Service Dealer Discounting On the Rise</i>		8/61-29
<i>Hi-Fi Repair Dilemma</i>		9/61-29
<i>Stereo 1962</i>		9/61-29
<i>Are You Prepared for the Antenna Boom?</i>		10/61-29
<i>Consumer Repair Attitude</i>		11/61-33
<i>F.C.C.'s Crucial UHF-TV Test</i>		12/61-37

INDUSTRIAL ELECTRONICS AND COMMUNICATIONS

<i>Installing Citizens Band</i>		
<i>Radios</i>	Allan Lytel	1/61-38
<i>Electronics in Photography</i>	Lee Craig	2/61-36
<i>Transistorized Ignition</i>		
<i>Systems</i>	G. E. Spaulding, Jr.	3/61-38
<i>Servicing Electro-Medical</i>		
<i>Equipment</i>	Charles Maduell, Jr.	3/61-44
<i>Communications at Timken</i>		
<i>Roller Bearing Co.</i>		4/61-42
<i>Troubleshooting Marine</i>		
<i>Radio Transmitters</i>	Barron Kemp	5/61-38
<i>Limiters Circuits Clean-Up</i>		
<i>Citizens Band Reception</i>	Allan Lytel	8/61-42
<i>Business Microwave Systems</i>	L. G. Sands	9/61-36
<i>Infrared Wireless Telephone</i>		9/61-100
<i>How Citizens Band Radios</i>		
<i>Squelch Noises</i>	Allan Lytel	10/61-34

SHOP HINTS

<i>Heat-Sink Clip</i>	J. G. Gross	1/61-44
<i>Component Strain-Relief</i>	Ralph Rinaldi	1/61-44
<i>Auto Static Elimination</i>	Stanley Clark	1/61-66
<i>Pseudo Color-Bar from</i>		
<i>Video Analyst</i>	Jack Darr	2/61-41
<i>Recorder Extension Feet</i>	G. F. Stillwell	2/61-41
<i>Solder Tool Tip Removal</i>	H. J. Miller	2/61-41
<i>Volume Control Signal</i>		
<i>Pickup</i>	R. R. Fitzmaurice	2/61-41
<i>Instrument Face Protector</i>	H. Leeper	3/61-39
<i>Resistor-Capacitor Carrier</i>	Leonard Cox, Jr.	3/61-39
<i>Transistor Radio</i>		
<i>"Hearing Aid"</i>	O. G. Shuler	3/61-39

What Would You Do?	Jack Darr	3/61-39	New TV Booster-Antenna System		4/61-54
Paper Trimmer Cuts Wire	H. Leeper	4/61-52	Servicing UHF TV Tuners	John Haskell	5/61-40
Rectifier and Fuse Changes	Jack Darr	4/61-52	Rotor Control Converts "Manual" Types to "Automatic"		5/61-74
Tuner Repair	C. B. Randall	4/61-52	UHF-TV Tuner Installation? . . . It's A Snap!	H. L. Davidson	6/61-32
Plastic Control Shaft Repairs	H. L. Davidson	5/61-42	Servicing Transistor Radios	Barron Kemp	6/61-44
Replacing PC Tube Sockets	Don Beroff	5/61-42	Ghost Rejection Depends on the Channel		6/61-74
Signal Tracing Electric Blankets	D. M. Strange	5/61-42	Remedy for Noisy 1960 Mercury Auto Radios	Herb Carrier	7/61-37
Troubleshooting with Shaving Mirror	H. Leeper	5/61-42	Installing and Servicing Home Air Conditioners	Arnold Mandon	7/61-38
CRT Tester Conversion	N. C. Cumberlin	6/61-50	TV Low Voltage Power Supply Problems	John Haskell	7/61-44
Lamp Reveals PC Breaks	H. Leeper	6/61-50	Cash In On Summer Portable TV Antennas	Scott Turner	7/61-52
Magnetic Iron Holder	H. L. Davidson	6/61-50	A Closer Look at Color TV Controls	D. R. Anderson	8/61-32
Pliers Converted to Third Hand	G. F. Stillwell	6/61-50	How to Repair Pesky TV Tuner Defects	Dan George	8/61-47
Hand Cleaner Helps Service Image	H. J. Miller	7/61-48	A Bench View of Transistor Radio Defects	L. E. Garner, Jr.	9/61-32
Plastic Box Isolates HV Lead	Bill Varn	7/61-48	Locating Elusive TV Filter Problems	F. A. Salerno	9/61-38
Soldering Aid Tames Tuner Spring	Louis Lasch, Jr.	7/61-48	TV Master Antenna Systems for Shop and Showroom	Lon Cantor	10/61-32
Wire Reel Tool Holder	H. Leeper	7/61-48	TV Video Problems		10/61-36
Emergency Dial Spring	H. L. Davidson	8/61-54	Educational TV		10/61-52
Filter Causes Color TV Troubles	Paul Noel, Jr.	8/61-54	Electronically Controlled Home Laundry Dryer		10/61-65
Hypodermic Grease Gun	William White	8/61-54	How to Correct TV Sync Instability		11/61-34
Pen Cartridge Cures Intermittent Filament	P. Ross	8/61-54	Electronic Devices for TV Antennas		11/61-37
Preventing Tone Arm Damage	F. M. Dickinson	8/61-54	Analyzing a New Color TV		11/61-38
Repairing Broken Ferrite Cores	M. E. West	8/61-54	Fringe Area TV Antenna		11/61-82
Aligning Zenith Tuner Gears	Leroy Thrower	9/61-44	How to Diagnose TV Picture HUM Symptoms	Jack Hobbs	12/61-40
Repairing Slow-Running Turntables	H. L. Davidson	9/61-44			
Replacing G-E TV On/Off Switches	P. F. Wing	9/61-44			
Capacitor Prolongs Tube Life	R. R. Fitzmaurice	10/61-44			
Masking Tape Isolates A-C Cord	F. D. Gazzola	10/61-44			
Safety Pin Jumper	Joseph Di Sabantonio	10/61-44			
"Stretch" Your Wall Space	R. E. Diegoli	10/61-44			
Contact Cleaner Unplugs Corona Dope Spray	G. Hooper	11/61-48			
Loose Tuner Wafer	H. L. Davidson	11/61-48			
Revamped Ratio Transformer	N. B. Cook	11/61-48			
Simplify CRT Replacement	Pat Horvath	11/61-48			
Test CRT Modification	F. J. Will	11/61-48			
Bench Fastened Cheater Cords	G. E. Lytle	12/61-34			
Earphones on Series-String TV's	Harry Parker	12/61-34			
Installing Knob Compression Rings	Dee Bramlett, Jr.	12/61-34			
Misadjusted Horizontal Hold Triggers Remote	H. L. Davidson	12/61-34			
TELEVISION — RADIO					
Consumer Products					
Guide to Servicing Transistor Radio "Dogs"	L. E. Garner, Jr.	1/61-34	Modernize Your Tube Checker	Ronald Ives	3/61-37
Servicing TV Remote Controls	Bernard Green	1/61-36	TV Sweep Circuit Test "Analyzers" Part I	ET Editorial Staff	4/61-32
Transistorized Wrist-Watch		1/61-40	TV Sweep Circuit Test "Analyzers" Part II	ET Editorial Staff	5/61-32
Servicing Transistorized Hearing Aids	L. G. Sands	2/61-30	Choosing a Transistor Test Instrument	Mannie Horowitz	6/61-40
Misconceptions in TV Servicing	Wayne Lemons	2/61-34	ET Staff Examines Low-Priced Transistor Testers		7/61-32
Hand-Wired Chassis Soldering Problems	George Kravitz	2/61-42	ET Staff Rates Higher-Priced Transistor Testers		8/61-34
Troubleshooting TV AGC Circuits	Michael Krantz	3/61-42	How to Repair Your Own Oscilloscope	D. R. Anderson	9/61-34
New TV Turret Tuner		3/61-76	Speed Up Tube Testing with a Filament Warmer	H. L. Davidson	10/61-40
"Wizard" TV Antenna Coupler		3/61-78	New Test Instruments for Bench and Caddy		11/61-42
When to Choose Fringe TV Antennas for Strong Signal Areas	Dan George	4/61-39	Do You Choose the Right Test Probe for your Scope and VTVM?	D. R. Anderson	12/61-46
Auto Radio Noise Reduction Techniques	William Ashby	4/61-44			
			"TOUGH DOG" CORNER		
			Arcing Resistor Causes Spurious Pulses	F. A. Salerno	1/61-42
			Synchroguide Causes Poor Width	L. C. Huneault	1/61-42
			Filament Globar Kills Oscillator	M. F. McWilliams	2/61-33
			Sync Capacitor Weakens Video	Elmer Woods	2/61-33
			Dirty Retrace	John Yennetti	3/61-60
			Misaligned "Synchro-Guide"	L. C. Huneault	3/61-60
			Print Board Causes Vertical Rolling	R. Turner	3/61-62

Bars From HV Arcing	Maury Kerr	4/61-43
Sound & Picture Interference	George Wanless	4/61-43
Transistor Radio, Low Volume	M. G. Goldberg	5/61-41
"Upper" Vertical Compression	J. A. Beck	5/61-41
Erratic Auto Radio Traced to Battery	J. Behrens & R. Teitelbaum	6/61-35
Poor Ground—No High Channels	J. D. Dabour, Jr.	6/61-35
"Error" Feedback Upsets Horizontal Range	F. A. Salerno	7/61-45
Open Filter Kills Vertical Sweep	L. C. Huneault	7/61-45
Contrast Control Causes Horizontal Pulling	M. E. West	8/61-48
Horizontal Output Tube Causes Weaving	C. W. Blatchley	8/61-48
Leaky Audio Capacitor Kills Picture	P. A. Liker	9/61-40
Open VBO Xformer Causes Faulty Blanking	W. C. Beall	9/61-40
Filter Choke Improves Sync	L. R. Hale	10/61-42
Increasing Volume Reduces Width	P. H. Besler	10/61-42
Open Screen By-Pass Kills Video	Harry Parker	10/61-42
CRT Causes Vertical Roll	Harry Crystal	11/61-26
Raster Disappears On Off-Channels	L. E. Jafelice	11/61-26
Ungrounded Tuner Twists Picture	Carl Fisher	11/61-26
Audio Resistor Affects Sync	Howard Keilholtz	12/61-50
Double-Trouble With Sockets	Eugene Fleming	12/61-50

TV MANUFACTURERS TECHNICAL DIGEST (Alphabetical by Company)

ADMIRAL:

Son-R Tuner Hammer Replacement	4/61-30
TV Chassis 20B7—Remote Relay	8/61-30
TV Chassis 20B7, Run 12 & up—CRT & Horizontal Output Transformer Changes	10/61-30
TV Chassis 16B9B—New Noise Immunity Circuit	11/61-20

ANDREA:

Chassis VT-123—Multiple-Voltage Power Transformer	12/61-23
--	----------

DELCO:

Wonder Bar Radios—Battery Eliminator Testing	5/61-30
1961 Cadillac Auto Radio—Antenna Plug causes Dead or Noisy Radio	7/61-30
1961 Guide-Matic Headlight Control Missing Resistor	8/61-30
1961 Tempest Auto Radios—Reduce Motor Noise	9/61-30
1961 Auto Radios-R-F Plate Choke Change	10/61-30
1961 Chevrolet Auto Radios—Touchy Manual Tuning	11/61-22
1961 Chevrolet Auto Radios — Removal Procedure	11/61-22

ELECTROHOME (Canadian)

EMERSON:

FM Tuning Unit #47116A—Broken Nylon Tuning Shafts	8/61-30
TV Models 1554 & 1555 Line Cord Polarization	11/61-20

FLEETWOOD:

Chassis 1000 & 1010—Secondary Controls	5/61-30
---	---------

GENERAL ELECTRIC:

Chassis M6—Production Changes	1/61-28
Chassis M4, M5, early M6— Interference Bars	2/61-28
Chassis M5, U4—Remote Control Tube Replacement	2/61-28

Chassis M4, M5, M6, U4, U5—Testing Horizontal Detector Diodes	3/61-32
Addenda	3/61-33
"Sonic" Remote Relays—Contacts Remain Closed	4/61-30
Sound or Channel Functions Change Without Transmitter Use	4/61-30
Chassis M6—Overloaded Contrast Control...	5/61-30
Chassis MW—Substitute Power Box Permits Using Set Without Remote Receiver	8/61-30
LW Chassis-H.O.T. Connections Change	10/61-30
Color TV Chassis CW—Color Balance Stabilizer	12/61-18

HOFFMAN:

Limited Remote-Control Range	1/61-28
23" Models—Excessive Width	3/61-32
Chassis 426—Improve Horizontal Drive & Frequency Control	3/61-32

MAGNAVOX:

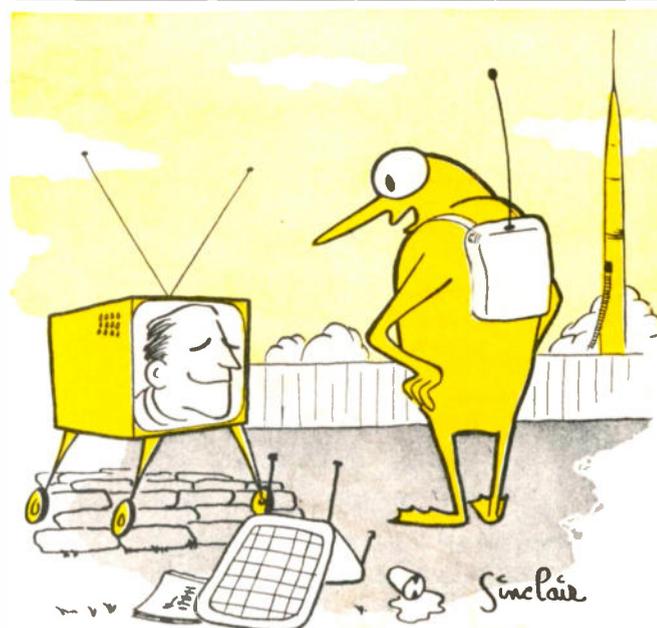
Model 1MV134—Hi-Voltage Failure	1/61-28
Chassis 33 Series—Vertical Sync Stability	2/61-28
Radio-Phonograph—Static Voltage Discharge	5/61-30
TV Chassis 30, 33 & 35 Series — Automatic Brightness— Contrast Control	6/61-30
62 Series—Radio Interference	7/61-30
Erratum—Static Voltage Discharge	8/61-31
Chassis 35 Series—Low Contrast	8/61-31
New Remote Receiver—Turns Set Completely Off	10/61-30
Chassis 35 Series—Damaged 1G3 Tube Socket	12/61-18

MOTOROLA:

Chassis TS-435 Code A-01, CS-B— Production Changes	2/61-28
Chassis TS-432—Production Changes	3/61-32, 5/61-30, 6/61-30, 7/61-30
Chassis 436 Series, Code/B-00—Production Changes	11/61-20

PACKARD-BELL:

Chassis V8-7, V8-9—Christmas Tree Effect	2/61-29
Chassis Series 88 & 98—Resistor Burnout	3/61-33
Models RPC-8R & RPC-9R— Increased Reverberation	4/61-30
TV Chassis 98CC-3 & 98CC-4— New Color CRT	6/61-30



"Hello earth man."

PHILCO:

Chassis 11N51, 11N51A, 11N53—
 Incorrect Tuner Tube Labeling 1/61-28
 Chassis 11N51—Run 2 Production Change
 Chassis 11N53, 11N54—Improved Sound
 Performance 4/61-31
 Chassis 11H25—Run 4 Production Change ... 6/61-31
 Measuring Current Drain of
 Transistor Radios 7/61-30
 1962 Portable TV's—New Horizontal
 Control Circuit 9/61-30
 Model J-1826—Production Changes to
 Prevent Microphonics 10/61-31
 Model J 1826 Audio Distortion 11/61-20
 Model H2010 Transistorized TV—Preventing
 Damper Diode Short 12/61-18

RCA:

Chassis KCS130—Inadequate
 Vertical Range 1/61-28
 23" TV Series—Tilt Caution 1/61-29
 VC-18, -24 Series—FM Dial
 String Revision 2/61-29
 Remote Control TV—Insensitivity 6/61-31
 KCS-132 Chassis—Kinescope Arc-Over 6/61-31
 Color TV—Purity and Performance 7/61-31
 Eliminate Hum Bars 9/61-30
 CTC 10 Chassis—Added Capacitor
 Improves Horizontal Phasing 10/61-31
 TV Chassis KCS 137 & 138 Series—
 Tube Filament Wiring Change 10/61-31
 TV Chassis KCS 136 Series—
 Deciphering Model Numbers 11/61-24
 TV Chassis KCS 136 Series—
 Automatic Brightness Control 12/61-18
 Ion Magnets for Modern CRT's 12/61-23

SETCHEL-CARLSON:

TV Chassis Model 159—Built-in
 CRT Booster 8/61-31

SYLVANIA:

Chassis 550-1, -2, -3, -7, -8, -9
 Code 05—Drive Line Elimination 1/61-29
 Model 19T01—Self-Interference 1/61-29
 Chassis 546-1, -2 Code 01 & Chassis
 552-1, -2, -9, Code 05—Height
 Control Protection 3/61-33
 Chassis 548-1, -2 Code 05—Reducing
 Video Amp Pulse Pickup 4/61-31
 Chassis 548-1, -2 Code 04—Latest
 Circuit Revisions 5/61-31
 Model 55P19—Hum Reduction 10/61-31
 Chassis 546-1, -2 Code 05—Improve
 Antenna Operation 10/61-31

WECOR:

Models 2001, 2005 thru 9, 2103, 2107,
 2150—Tape Pressure Pad Change 6/61-31
 Model 140, 141, 151, & 152 Record
 Changers—Cam Gear Renewal Kit 7/61-31
 Models 100, 101, 110, 113, 114, 115,
 116, 121, 122, 1121 & 1122 Record
 Changers—New Spindle Adaption 9/61-31
 Cartridge Substitution 12/61-18

WESTINGHOUSE:

Chassis V-2378, 2384 Series—Drive
 Lines & "S" Curve 3/61-33
 V-2378-1, 2, 3 & 4—Improved
 Sync & AGC 5/61-31
 Chassis V-2377, 2378, 2379, 2384,
 2389, 2409, 2411, 2412, & 2414
 —Vertical Circuit Modifications 9/61-31

ZENITH:

New Turret Tuner—Oscillator Slug
 Alignment 2/61-29

AUDIO POWER . . .

Continued from page 44

tical power output capabilities. Here, however (Fig. 5), lower distortion and lower output impedance characteristics are exhibited. This is due to the cathode follower action of each pentode circuit. Its main disadvantage is the large driving voltages required at the control grids.

In variation of this circuit, the screens are tied to B+. One winding on the output transformer is connected between the plates in the conventional manner. A second winding is connected between the cathodes to allow some cathode follower action. This circuit does not require as much grid drive as does the circuit shown in Fig. 5.

Bias & Balance Arrangements

The self-bias circuit shown in Fig. 2 is conventional. However, should a balancing arrangement be used, it will usually take the form shown in Fig. 6. The cathode current path for tube 1 starts at A and progresses through G, E, F and D. The cathode current path for tube 2 follows a similar path, starting at B and passing in turn through G, E, C and D.

Bias for the upper tube is determined by the voltage developed between A and F while the bias for the lower tube is determined by the voltage between B and C. If the tubes were identical and D would be at the exact electrical center of the balance control, both plate currents would be equal. The voltage from A to F would then equal the voltage from B to C providing equal bias voltages for each tube ($V_{AF} = V_{BC}$).

The balancing circuit takes the shape of the bridge shown in Fig. 7. The balance control may schematically be divided into two resistors, R_3 and R_4 . Under this balanced condition, when $R_3 = R_4$, $V_{FE} = V_{CE}$.

Let's assume that the tubes are not identical and more bias voltage is necessary for one tube than for the other for equal plate currents. By moving point D the bridge is upset so that R_3 is not equal to R_4 . The potentiometer is not set at the center. The voltages V_{FE} and V_{CE} will no longer be equal. Since V_{FE} and V_{CE} are a portion of the voltages applied between the cathodes and grids of tubes 1 and 2 respectively, it will affect the relative bias applied to each tube. This will in turn affect the quiescent plate currents.

The plate current for tube 1 is measured as a voltage across R_1 while that for tube 2 is similarly measured across R_2 . When the two voltages are equal, the tubes are d-c balanced. The balance control is adjusted until the voltages across both resistors are identical ($V_{AG} = V_{BG}$).

A convenient way of checking this adjustment is to connect a meter across the two resistors R_1 and R_2 . Both resistors are effectively connected in series. In the connection shown in Fig. 7, the voltages oppose or buck each other. When balanced, the two voltages are equal and they will just cancel each other. Thus a meter connected across these two resistors, at points A and B, will read 0 when the tubes are d-c balanced for equal plate current conditions.

Cumulative index of all Circuit Digests to date is published in every May issue. An interim six-month index was published in last month's November 1961 issue.

Fixed bias is required for high power amplifiers. Although the tubes are operated Class AB, they are usually biased so close to cutoff that the plate currents vary radically with the bias adjustments from tube to tube. In most instances, balance adjustments are necessary.

In Fig. 8, the bias voltage is adjusted by R₃ and the balance by R₄. As in Fig. 6, a voltage null between A and B indicates balance. The voltage developed across R₁ and R₂ will indicate the current passing through tubes 1 and 2 respectively, providing a point to check the bias voltage setting.

A cross between fixed bias operation and cathode bias operation is known as "low loading." This is actually cathode bias operation. However, the cathode resistor chosen is very large so that the bias voltage will be equal or nearly equal to the voltage used in fixed bias conditions. At the output, a sinusoidal wave will appear distorted, while the amplifier will properly reproduce the pulsed waveshapes common to music and speech.

Should you get a push-pull amplifier to service, first determine the conditions under which it was designed to operate. Next, feed a sinusoidal signal to the grids. If the amplifier is a low-loading type, the output will appear distorted, exhibiting the mirror symmetry illustrated in Fig. 9A. If the output has a shape similar to Fig. 9B, you can be sure that one side of the push-pull circuit is not operating properly. ■

2 YEAR FIELD TEST PROVES

U.S. PAT. NO.

2875440

\$14.95

List Price

Focus
F-38K

Dept. ET

RMS

ELECTRONICS, INC.

BRONX 62, N. Y.

- THE "FOCUS" F-38K OUTPERFORMS ALL OTHER INDOOR ANTENNAS!
- THE ONLY INDOOR ANTENNA COMPARABLE TO AN OUTDOOR ANTENNA!
- BEST RECEPTION ON VHF, UHF, COLOR, AND FM . . . EVEN IN SEMI-FRINGE AREAS!

FEATURES

1. 102" of Dipole when fully extended.
2. Patented Diamond Phasing Loops producing the Power of 3 separate switch type indoor antennas.
3. 12 Position Switch for maximum signal.

ELIMINATES GHOSTS AND CO-CHANNEL INTERFERENCE!

SOLD ON A MONEY BACK GUARANTEE BASIS!

For more details, circle 37 on page 52

IF YOU CHANGE YOUR ADDRESS

Notify us at 1 East First Street, Duluth 2, Minn. Please include the address label from a recent issue.

TRU-VAC

1-yr. guaranteed Radio & TV Tubes

35¢ ea.
\$33 Per 100 TUBES
Any tube not listed also available at 35¢ each!

FREE

UP TO 100
1-YR. GUARANTEED
TRU-VAC TUBES

TO QUANTITY BUYERS!

Now quantity buyers get a FREE assortment of individually-boxed, regular stock TRU-VAC tubes with each order.

PLACE YOUR ORDER TODAY!
GET UP TO 100 TUBES FREE!
Here's how this FREE offer works!

15 FREE TUBES	With Order of	\$25
25 FREE TUBES	With Order of	\$50
50 FREE TUBES	With Order of	\$100
100 FREE TUBES	With Order of	\$500

LOOK! 1,000 USED TV'S
Costly, famous make console models with little or no tube replacement! Re-no tube replacement! Re-quire only minor adjustment. Perfect for resale, or as your own second set! 16", 17" and 19" screens . . . none smaller! Sets shipped FOB, Harrison, N.J.

\$16.95
As Is

Factory Used or Factory Second Tubes! TRU-VAC will replace FREE any tube that becomes defective in use within 1 year from date of purchase!

ALL TUBES INDIVIDUALLY BOXED!
CODE DATED & BRANDED "TRU-VAC"

Partial Listing Only . . . Thousands More Tubes in Stock!

SPECIAL! 6SN7GT . . . 30¢ 6W4GT . . . 30¢

0Y4	3BN6	5V4G	6A4U5GT	6BQ5GT	6CS7	6SA7	7A4/XXL	7Q7	12BA7	12BN7GT	36
0Z4	3R26	6U6	6B06	6B07	6CU5	6SA7	7A3	7S7	12BD6	12S07	38
1A7GT	3CB6	5X8	6A4U8	6BR8	6CU6	6SD7GT	7A6	7X7	12BE6	12V6GT	39/44
1B3GT	3Q4	5Y3	6A4V5GT	6BS8	6D8	6SF5	7A7	7X8	12BF6	12W6GT	41
1H5GT	3S4	6A6	6A4V6	6SY5G	6DE6	6SF7	7A8	7Y4	12BH7	12X4	42
1L4	3V4	6AB4	6A4W8	6B26	6DG6GT	6SG7	7B4	7Z4	12BL6	14A7/12B7	43
1L6	4BQ7A	6AD7	6A4X4GT	6B27	6DF6	6SH7	7B5	12A8	12BQ6	14B6	50A5
1N5GT	4B9B	6AF4	6A4X5GT	6C4	6E5	6S17	7B6	12AB5	12BQ7	17	50B5
1RS	4BZ7	6AG5	6CB8	6CA8	6F5	6SK7	7B7	12AD6	12BY7	17AX4	50C5
1S5	4CB6	6AH4GT	6BA6	6CB6	6F6	6SL7	7B8	12AF6	12CA5	17D4	50L6
1T4	5AM8	6AH6	6BC5	6CD6G	6H6	6SQ7	7C4	12AQ5	12CN5	19AU4GT	56
1U4	5AN8	6AK5	6BC8	6CF6	6J4	6SR7	7C5	12AT6	12D4	19BG6G	80
1U5	5AT8	6AL5	6BD6	6CG7	6J5	6T4	7C6	12A77	12F5	19J8	84/6Z4
1V2	5AV8	6AM8	6BE6	6D8B	6J6	6T8	7C7	12A86	12FB	19T8	117Z3
1X2	5A24	6AN8	6BF5	6CH8	6J7	6U5	7E5	12AU7	12K5	24A	
2AF4	5BR8	6AQ5	6BG6G	6CL6	6K6GT	6U8	7E6	12AV6	12K7	25Z6GT	
2BN4	5CG8	6AQ6	6BH6	6CM6	6K7	6V6GT	7E7	12AV7	12L6	27	
2CY5	5J6	6AQ7	6BJ6	6CM7	6N7	6W6GT	7F7	12AX4GT	12Q7	35A5	
3A5	5R4	6AR5	6BK5	6DN7	6O7	6X4	7F8	12AX7	12R5	35B5	
3AL5	5T8	6AS5	6BK7	6CQ8	6Q4	6X5GT	7G7	12A27	12S47	35C5	
3AU6	5U4	6AT6	6BL7GT	6CR6	6S7	6X8	7H7	12B4	12S17	35W4	
3BC5	5U8	6AU4GT	6BN6	6CS6	6S8GT	6Y6G	7N7	12BA6	12SK7	35Z5	

Sensational Offer!
"Self Service"
TUBE CHECKERS

\$37.95

For Our Warehouse
Let your customers test their own tubes! These reliable, reconditioned 22-socket tube checkers will return your investment in one week or less with little or no effort on your part! Handmade, field-tested console models COMPLETE WITH KEY FOR BOTTOM DODGE AND NEON-LIGHTED HEAD!

TRU-VAC

Harrison Avenue • Box 107 • Harrison, N. J. • Humboldt 4-9770

For more details, circle 50 on page 52

Servicemen:
**Look to Rad-Tel for the
 newest tube types**

**UP TO 75% OFF
 RAD-TEL'S Quality
 Brand New
 Tubes**

**1-year
 Guarantee
 FAST
 ONE-DAY
 SERVICE**

Every Serviceman
 Should Stock These
 Popular New Tube Types
 Offered by RAD-TEL



Qty.	Type	Price	Qty.	Type	Price	Qty.	Type	Price
—	1G3	.79	—	6CE5	.57	—	7EY6	.73
—	1J3	.79	—	6CK4	.70	—	12D4	.69
—	1K3	.79	—	6CM8	.90	—	12DT5	.76
—	2EN5	.45	—	6CY5	.70	—	12DT7	.79
—	3DC4	.85	—	6DA4	.68	—	12DT8	.79
—	3DK6	.60	—	6DT8	.79	—	12DW8	.89
—	5AS8	.86	—	6EB5	.72	—	12EM6	.79
—	5BT8	.83	—	6EM5	.76	—	12EN6	.78
—	5CM8	.90	—	6EY6	.75	—	18FW6	.49
—	5CZ5	.72	—	6CK6	.79	—	18FX6	.53
—	6AX8	.92	—	6CN8	.94	—	18FY6	.50

EACH TUBE INDIVIDUALLY & ATTRACTIVELY BOXED & BRANDED RAD-TEL

Qty.	Type	Price	Qty.	Type	Price	Qty.	Type	Price	Qty.	Type	Price
—	D24	.79	—	6AF4	.97	—	6EY6	.57	—	12C5	.56
—	1AX2	.62	—	6AG5	.68	—	6F5GT	.39	—	12C05	.56
—	1B3	.79	—	6AH4	.81	—	6F6	.69	—	12CR6	.54
—	1DN5	.55	—	6AM6	.99	—	6FE8	.75	—	12CU5	.58
—	1L4	.68	—	6AK5	.95	—	6GM8	.80	—	12CU6	1.06
—	1R5	.62	—	6AL5	.47	—	6H6	.58	—	12CX6	.54
—	1S2A	.76	—	6AL7	1.43	—	6J5GT	.51	—	12DB5	.69
—	1S4	.59	—	6AM4	1.50	—	6J6	.67	—	12DE8	.75
—	1S5	.51	—	6AM8	.78	—	6K6	.63	—	12DL8	.85
—	1T4	.58	—	6AQ5	.53	—	6L6	1.06	—	12DQ6	1.04
—	1U4	.57	—	6AR5	.55	—	6N7	.98	—	12DS7	.79
—	1U5	.50	—	6AS5	.60	—	6S4	.51	—	12DU7	1.01
—	1V2	.50	—	6AS6	.80	—	6SA7GT	.76	—	12DW8	.89
—	1X2B	.82	—	6AT6	.43	—	6SG7GT	.41	—	12DZ6	.56
—	2AF4	.96	—	6AT8	.79	—	6SH7GT	.49	—	12ED5	.69
—	2BN4	.64	—	6AU4	.82	—	6S17	.88	—	12EC6	.54
—	2EA5	.70	—	6AU6	.52	—	6SK7GT	.74	—	12EK6	.56
—	2ES5	.68	—	6AU7	.61	—	6SL7GT	.80	—	12EL6	.50
—	3A3	.76	—	6AU8	.87	—	6SN7GT	.65	—	12EZ6	.53
—	3A4	.60	—	6AV6	.41	—	6SQ7	.73	—	12F8	.66
—	3AF4	1.02	—	6AW8	.90	—	6T4	.99	—	12FA6	.79
—	3AL5	.42	—	6AX4	.66	—	6T8	.85	—	12FM6	.43
—	3AU6	.51	—	6AX5	.74	—	6U8	.83	—	12FR8	.91
—	3AV6	.41	—	6AX7	.64	—	6VG6T	.54	—	12FX8	.85
—	3BA6	.51	—	6BA6	.50	—	6V8	.86	—	12GC6	1.06
—	3BC5	.54	—	6BA7	.84	—	6W4	.60	—	12J8	.84
—	3BE6	.52	—	6BA8	.88	—	6W6	.71	—	12K5	.65
—	3BN6	.76	—	6BC5	.61	—	6X4	.39	—	12L6	.58
—	3BU8	.78	—	6BC7	.94	—	6X5GT	.53	—	12SA7	.92
—	3BY6	.55	—	6BC8	.97	—	6X8	.80	—	12SF5	.50
—	3BZ6	.55	—	6BD5	1.25	—	6Y6G	.65	—	12SF7	.69
—	3CB6	.54	—	6BE6	.55	—	7A8	.68	—	12SH7	.49
—	3CF6	.60	—	6BF5	.90	—	7AU7	.61	—	12SJ7	.67
—	3CS6	.52	—	6BF6	.44	—	7B6	.69	—	12SK7	.74

NOT AFFILIATED WITH ANY OTHER MAIL ORDER TUBE COMPANY

—	3DT6	.50	—	6BG6	1.66	—	7F8	.90	—	12SL7	.80
—	3D4	.63	—	6BH6	.65	—	7N7	.90	—	12SN7	.67
—	3D5	.80	—	6BH8	.87	—	7S7	1.01	—	12SQ7	.78
—	3S4	.61	—	6BJ6	.62	—	7Y4	.69	—	12U7	.62
—	3V4	.58	—	6BJ7	.79	—	8AU8	.83	—	12V6	.53
—	4AU6	.54	—	6BK7	.85	—	8AW8	.93	—	12W6	.69
—	4BA6	.51	—	6BL7	1.00	—	8BQ5	.60	—	12X4	.38
—	4BC5	.58	—	6BN4	.57	—	8CQ7	.62	—	17AX4	.67
—	4BC8	.96	—	6BN6	.74	—	8CM7	.68	—	17BQ6	1.09
—	4BN6	.75	—	6BQ5	.65	—	8CN7	.97	—	17D4	.69
—	4BQ7	1.01	—	6BQ6	1.05	—	8CS7	.74	—	17DE4	.74
—	4BS8	.98	—	6BQ7	1.00	—	8CX8	.93	—	17DQ6	1.06
—	4BU8	.71	—	6BR8	.78	—	8E88	.94	—	17L6	.58
—	4BZ6	.58	—	6BS8	.90	—	8SN7	.66	—	17W6	.70
—	4BZ7	.96	—	6BU8	.70	—	9CL8	.79	—	19AU4	.83
—	4BZ8	1.10	—	6BX7	1.02	—	11CY7	.75	—	19BG6	1.39
—	4CS6	.61	—	6BY5	1.15	—	12A4	.60	—	19C8	1.14
—	4DE6	.62	—	6BY6	.54	—	12AB5	.55	—	19T8	.80
—	4DK6	.60	—	6BY8	.66	—	12AC6	.49	—	19V8	.79
—	4OT6	.55	—	6BZ6	.55	—	12AD6	.57	—	21EX6	1.49
—	4EW6	.58	—	6BZ7	1.01	—	12AE6	.43	—	25AV5	.83
—	5AM8	.79	—	6BZ8	1.09	—	12AE7	.94	—	25AX4	.70
—	5AN8	.86	—	6C4	.43	—	12AF3	.73	—	25BK5	.91
—	5AQ5	.52	—	6C8	.90	—	12AF6	.49	—	25BQ6	1.11
—	5AT8	.80	—	6CB6	.55	—	12AJ6	.46	—	25C5	.53
—	5AV8	1.01	—	6CD6	1.42	—	12AL5	.45	—	25CA5	.59
—	5AZ4	1.41	—	6CF6	.64	—	12AL8	.95	—	25CD6	1.44
—	5BC8	.79	—	6CC7	.61	—	12AQ5	.60	—	25CU6	1.11
—	5BE8	.83	—	6CG8	.77	—	12AT6	.43	—	25DN6	1.42
—	5BK7	.82	—	6CL8	.79	—	12AT7	.76	—	25EM5	.55
—	5BQ7	.97	—	6CM6	.64	—	12AU6	.51	—	25L6	.57
—	5BR8	.79	—	6CM7	.66	—	12AU7	.60	—	25W4	.68
—	5CG8	.76	—	6CN7	.65	—	12AV6	.41	—	25Z6	.66
—	5CL8	.76	—	6CQ8	.84	—	12AV7	.75	—	32EY5	.55
—	5CQ8	.84	—	6CR6	.51	—	12AX4	.67	—	32L7	.90
—	4CY5	.71	—	6CS6	.57	—	12AX7	.63	—	35B5	.60
—	5EA8	.80	—	6CS7	.69	—	12AY7	1.44	—	35C5	.51
—	5EU8	.80	—	6CU5	.58	—	12AZ7	.86	—	35L6	.57
—	5J6	.68	—	6CU6	1.08	—	12B4	.63	—	35W4	.42
—	5T4	.79	—	6CY7	.71	—	12BA6	.50	—	35Z5	.60
—	5T8	.81	—	6DB5	.69	—	12BA7	.84	—	36AM3	.36
—	5U4	.60	—	6DB6	.51	—	12BD6	.50	—	50B5	.60
—	5U8	.81	—	6DE6	.58	—	12BE6	.53	—	50C5	.53
—	5V3	.90	—	6DG6	.59	—	12BF6	.44	—	50EH5	.55
—	5V6	.56	—	6DK6	.59	—	12BH7	.77	—	50L6	.61
—	5X8	.78	—	6DN6	1.55	—	12BK5	1.00	—	5744	1.50
—	5Y3	.46	—	6DQ6	1.10	—	12BL6	.56	—	5763	1.00
—	5Y4	.59	—	6DT6	1.53	—	12BQ6	1.06	—	5784	1.50
—	6AG6	1.20	—	6EA8	.79	—	12BR7	.74	—	70L7	.97
—	6AB4	.46	—	6EB8	.94	—	12BV7	.78	—	70Z5	.69
—	6AC5	1.05	—	6EM7	.82	—	12BY7	.77	—	84/6Z4	.46
—	6AC7	.96	—	6EU8	.79	—	12BZ7	.75	—	807	.70
—	6AF3	.73	—			—			—	117Z3	.61

**SEND FOR FREE TROUBLE SHOOTING
 GUIDE AND NEW TUBE & PARTS CATALOG**

TERMS: 25% deposit must accompany all orders, balance C.O.D. Orders under \$5: add \$1 handling charge plus postage. Orders over \$5: plus postage. Approx. 8 tubes per 1 lb. Subject to prior sale. Prices subject to change. No C.O.D.'s outside continental U.S.A.

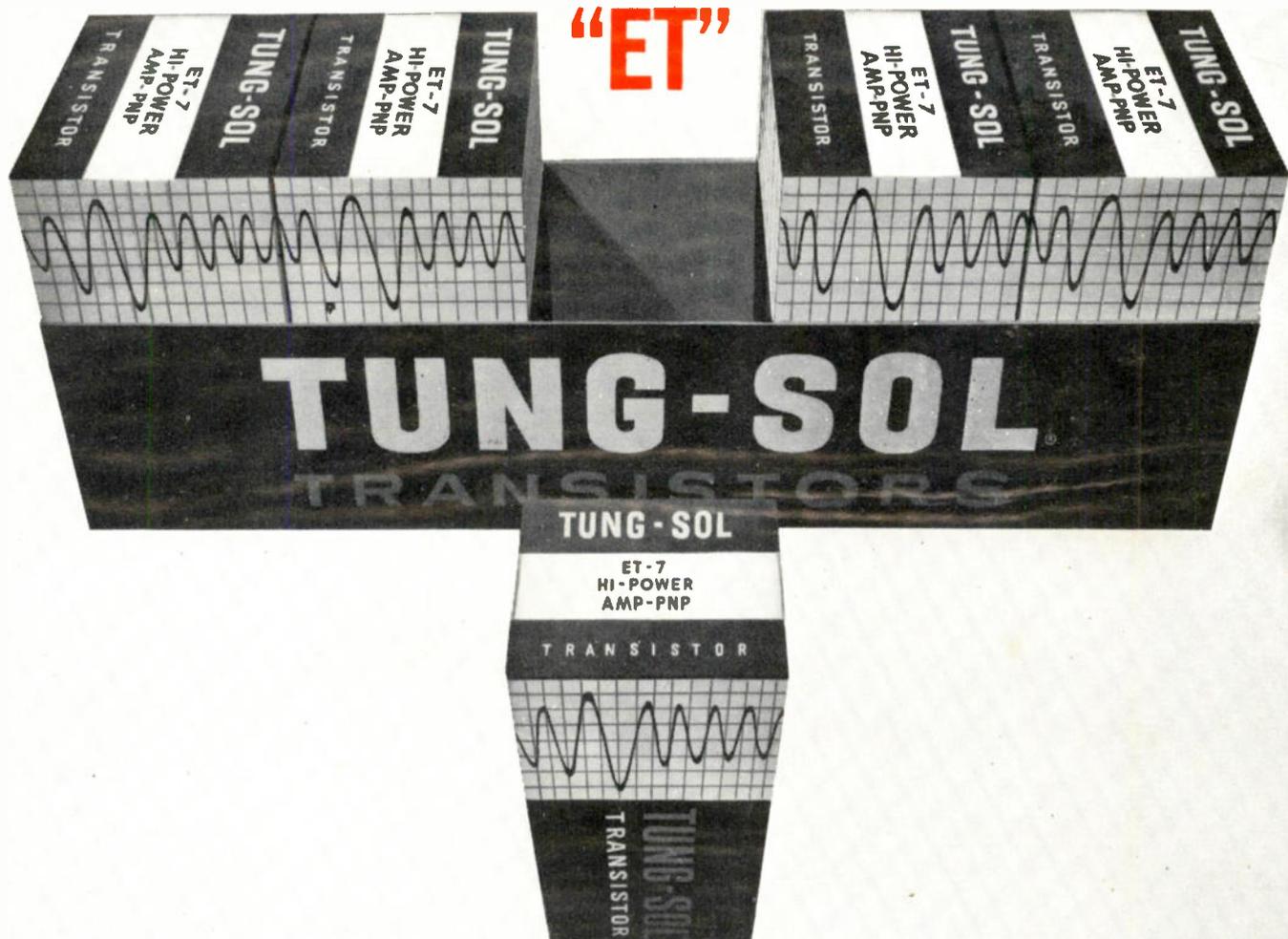


RAD-TEL TUBE CO.

Dept. ET-1261 55 CHAMBERS STREET, NEWARK 5, NEW JERSEY

For more details, circle 38 on page 52

BUY "ET"



THE TRANSISTOR LINE THAT TUNG-SOL TAILORED TO YOUR NEEDS

- LOW INVENTORY ■ HIGH TURNOVER
- RELIABILITY ■ PROFIT
- CUSTOMER SATISFACTION

"ET" is your guide to the compact transistor line engineered and packaged specifically for entertainment replacement. You can make just about every radio and TV replacement from only a handful-size inventory. Eleven PNP and NPN types replace hundreds of older numbers.

Each package is plainly marked with the type of service as well as the part number to save you time in selecting the units you need. Every Tung-Sol

transistor is fully warranted. Tung-Sol takes *your* responsibility seriously and spares no effort to provide the very highest in transistor performance. So make your transistor purchases with an eye to convenience, profit and customer satisfaction. Tell your supplier you'd rather have Tung-Sol "ET" transistors. Write for the Tung-Sol Transistor Interchangeability Guide. Tung-Sol Electric Inc., Newark 4, New Jersey

 **TUNG-SOL®**

A TYPE FOR EVERY JOB

PNP TYPES

Low power

- ET1 Mixer/oscillator/converter
- ET2 IF amplifier
- ET3 AF amplifier 6v.
- ET4 AF amplifier 12v.
- ET5 AF amplifier 9v.

Medium power

- ET6 AF power amplifier

High power

- ET7 AF high power amplifier

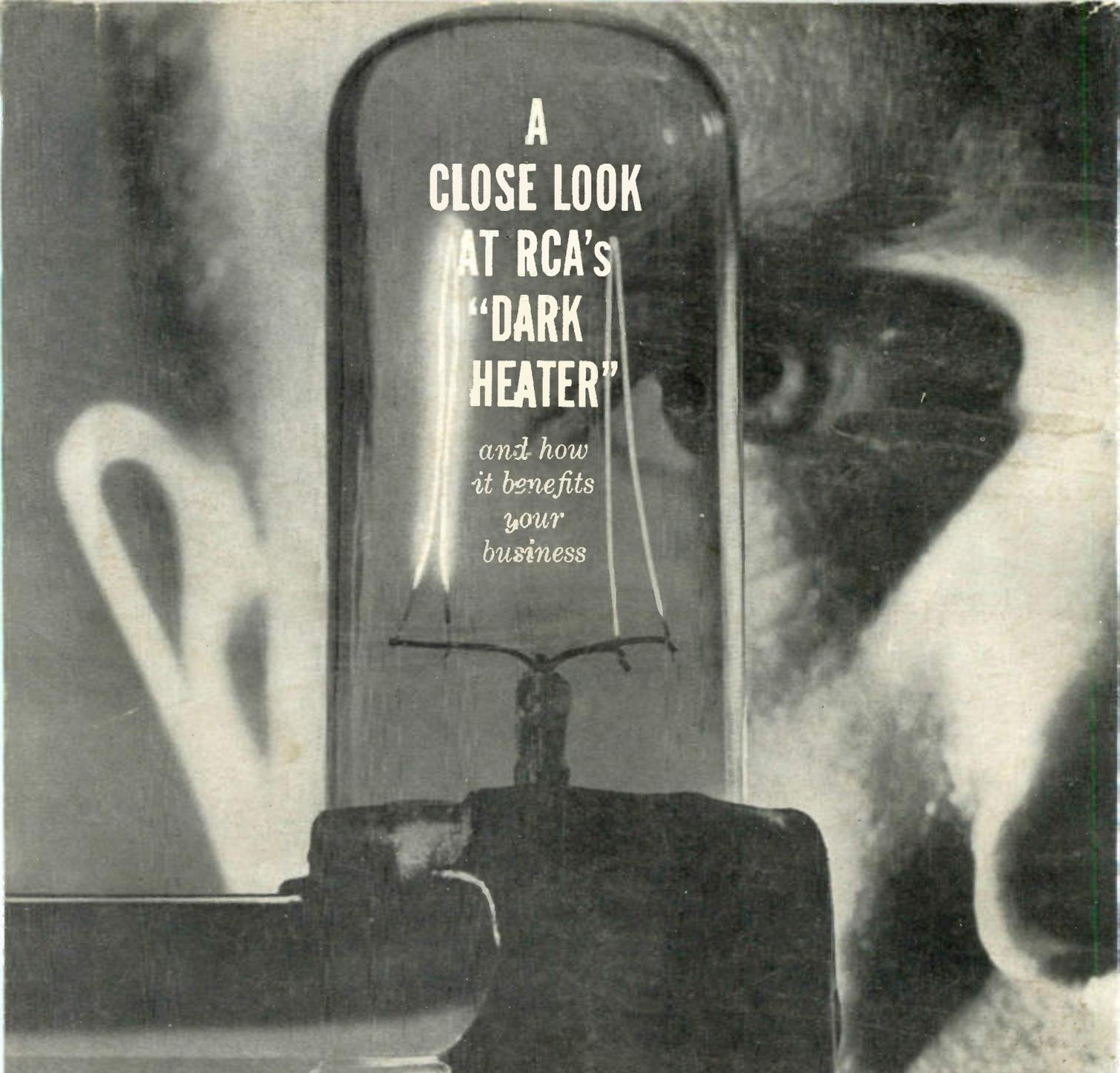
NPN TYPES

Low power

- ET8 Mixer/oscillator/converter
- ET9 IF amplifier
- ET10 AF amplifier 9v.
- ET11 AF amplifier 12v.



For more details, circle 51 on page 52



A
CLOSE LOOK
AT RCA'S
"DARK
HEATER"

*and how
it benefits
your
business*

You are looking at a dramatic example of RCA leadership in tube technology.

The wire at the right in the demonstration envelope is the new RCA "Dark Heater"—an exclusive RCA development. Operating at about 350°K below the temperature of a conventional heater (left), the remarkable "Dark Heater" reduces chance of heater failure, increases heater-current stability during the life of the tube, eliminates "spike" or pulse-leakage current, cuts AC heater-cathode leakage and hum, and provides greatly improved overall mechanical stability.

RCA Electron Tube Division, Harrison, N. J.

NET RESULT TO YOU: *even greater assurance* of customer satisfaction with your work—*even greater freedom* from callbacks, and in-warranty failures.

Now available in an increasing number of RCA receiving-type tubes, the RCA "Dark Heater" will be incorporated in those receiving-type tubes where potential benefits of increased life and reliability can be realized. This new RCA development is further assurance that you are working with the best and latest receiving tubes when you specify and install RCA.



The Most Trusted Name in Electronics