

ELECTRONIC TECHNICIAN

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION

SEPTEMBER 1964

Why Some Antennas
Have 'IT'

Are You Missing
The 'Sky' Boat

The UHF
'Aerial' Gravy Train

LETTER FROM THE EDITOR
BY THE EDITOR
REPLY TO THE EDITOR
BY THE EDITOR



Qualify for the most profitable service business of all...



**FM
STEREO
SERVICE**

**with the all new Sencore
MX129 FM STEREO MULTIPLEX
GENERATOR AND ANALYZER**

\$169.50



19 TRANSISTORS
ALL CRYSTAL CONTROLLED
TRULY PORTABLE ONLY 7-1/2 LBS.

It has been established by all Radio and TV manufacturers that you must have a generator of this type to service FM stereo receivers. Here is a new field just waiting for qualified men, a field that is growing as fast as color TV. Multiplex is simple to service with this generator. If you can service an FM receiver, you can service multiplex once you have the MX129.

Look at the outstanding features of this all transistorized Sencore unit and you will see why it is the most versatile, most portable, most trouble free unit on the market. It is just like having your own FM stereo transmitter on your bench or service truck. All signals are crystal controlled and instantaneous because there are no tubes to warm up. Powered by 115 volts AC to insure top performance at all times.

The MX129 produces all signals required for trouble shooting and aligning the stereo portion of the FM multiplex receiver and can be used as a stereo demonstrator by feeding in left and right audio signals into the jacks marked LEFT and RIGHT EXT. SIG. This unique feature will allow you to demonstrate stereo to the customer even when a stereo program is not being broadcast.

The MX129 becomes a complete trouble shooting analyzer with the addition of a meter calibrated in peak to peak volts and Decibels. No other equipment is required for checking channel separation or alignment. A jack marked EXT. METER is provided for connecting the meter to the stereo speakers or at other points after detection.

Here are the signals available on the MX129 for alignment, trouble shooting and analyzing:

- FM-RF carrier with composite multiplex audio signal just like that transmitted from the FM station: 38kc suppressed carrier, 19kc pilot and 67kc SCA signal. This signal available at RF output cable.
- Multiplex signal is formed by either 60 cycle or 1000 cycle internal tones for greater flexibility in testing.
- Full control over left and right channel amplitude (and therefore modulation). Built-in meter is used to set controls for equal modulation of FM carrier. Channels can be turned completely off when desired.
- 19kc pilot calibrated directly in percentage of modulation; can be generated separately for 19kc amplifier peaking by turning down left and right channels.
- External 67kc SCA (subscription) signal available at jack marked SCA OUT (67KC) for trap adjustment. This signal, not found on some high priced multiplex generators, is very important on new stereo receivers with adjustable 67kc traps.
- Composite signals, same as described above, available on jacks marked COMP. OUT for signal injection beyond the FM detector.

SENCORE

Quality at its finest

426 SO. WESTGATE • ADDISON, ILL.

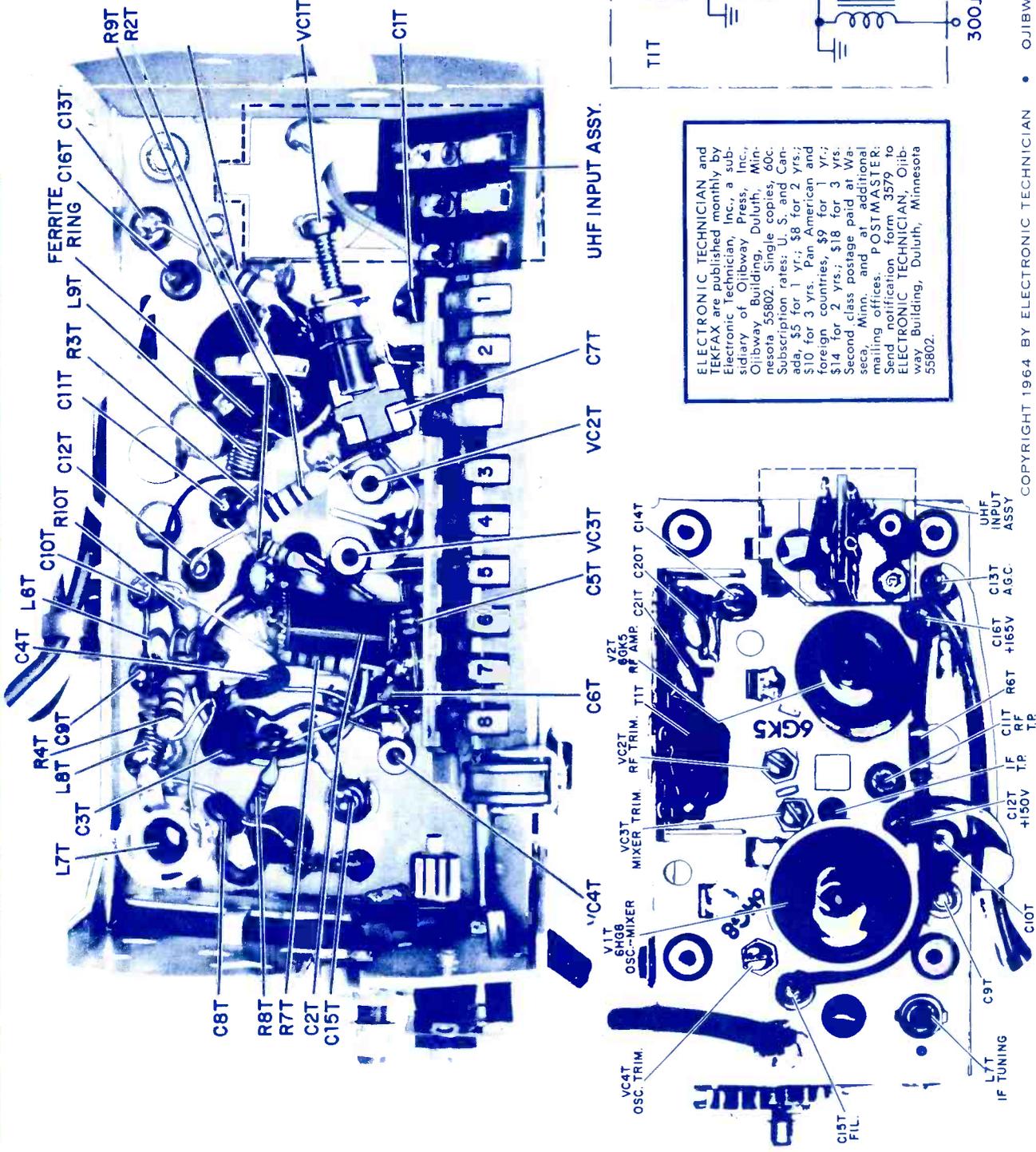
--- for more details circle 46 on post card

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

GROUP
145

Schematics No.

ADMIRAL	873	PHILCO	871
TV Chassis Run 10		TV Chassis	
7D43-1, 7D413-1		14N30 and VHF	
ELECTROHOME	874	Tuner TT-83 Data	
TV Chassis		WESTINGHOUSE	875
Orlando, Orlando U., Orlando CU		TV Chassis	
EMERSON	872	V-2474-1, -2, -3, -6, -7	
TV Chassis 120671, -673, -697,			
-698, -702, -740, -743, -744, -753			

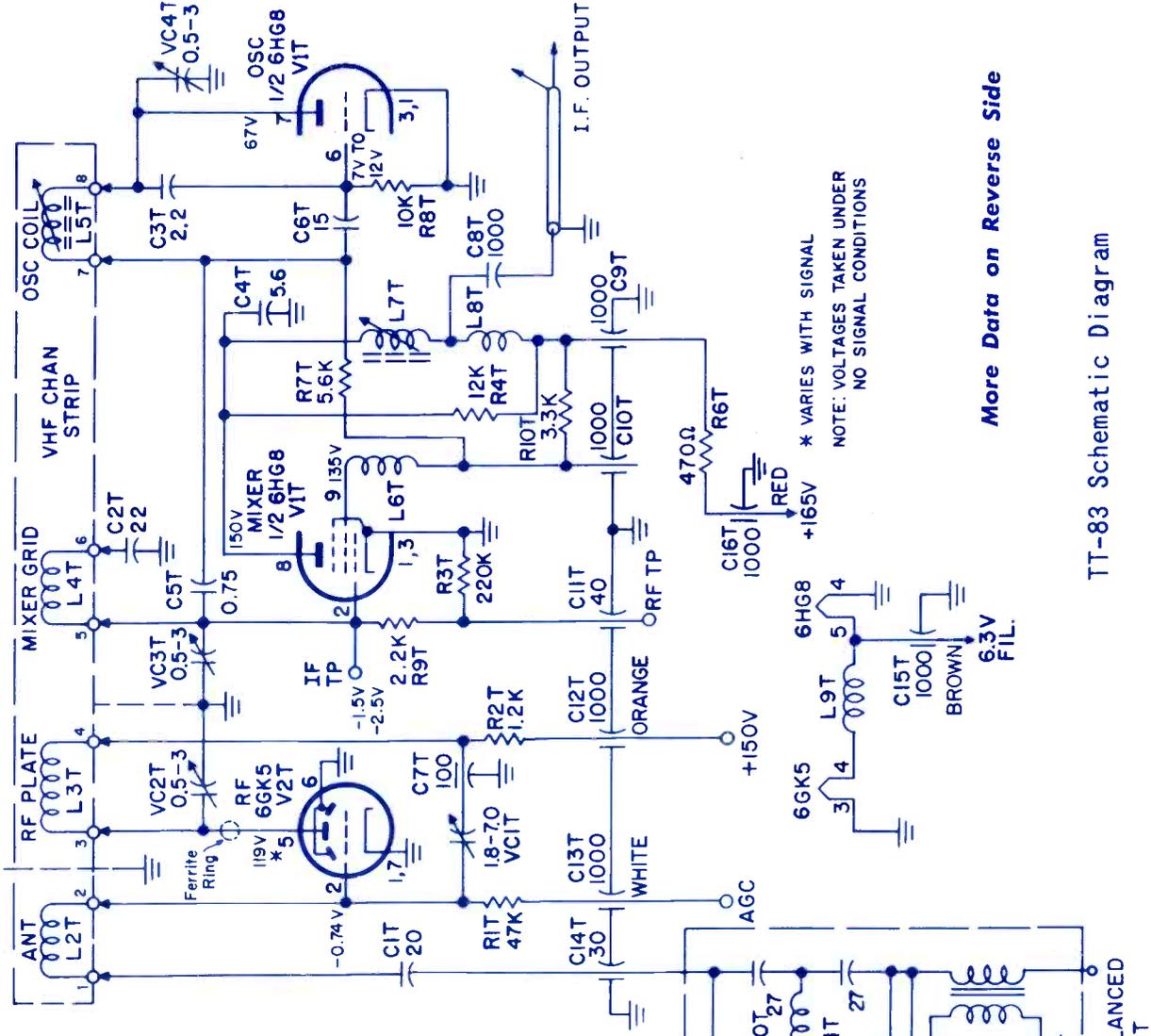
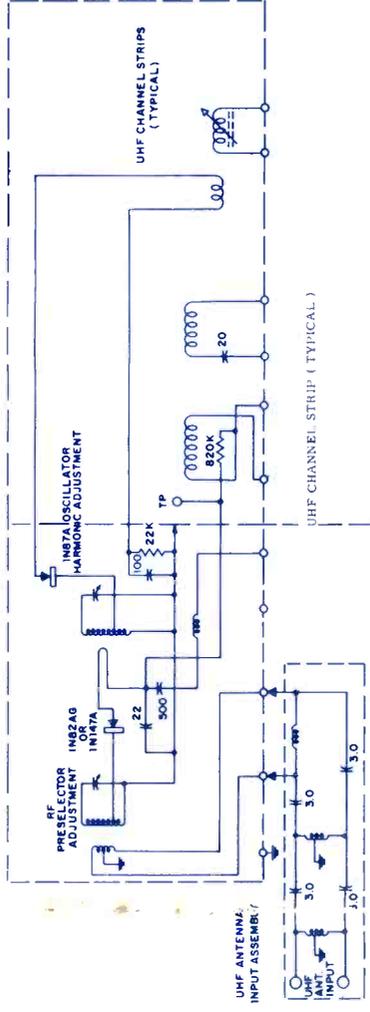


ELECTRONIC TECHNICIAN and TEKFAX are published monthly by Electronic Technician, Inc., a subsidiary of Ojibway Press, Inc., Ojibway Building, Duluth, Minnesota 55802. Single copies, 60c. Subscription rates: U.S. and Canada, \$5 for 1 yr.; \$8 for 2 yrs.; \$10 for 3 yrs. Pan American and foreign countries, \$9 for 1 yr.; \$14 for 2 yrs.; \$18 for 3 yrs. Second class postage paid at Waseca, Minn. and at additional mailing offices. POSTMASTER: Send notification form 3579 to ELECTRONIC TECHNICIAN, Ojibway Building, Duluth, Minnesota 55802.

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

PHILCO
TV Chassis
14N30 and VHF
Tuner TT-83 Data

SEPTEMBER 1964



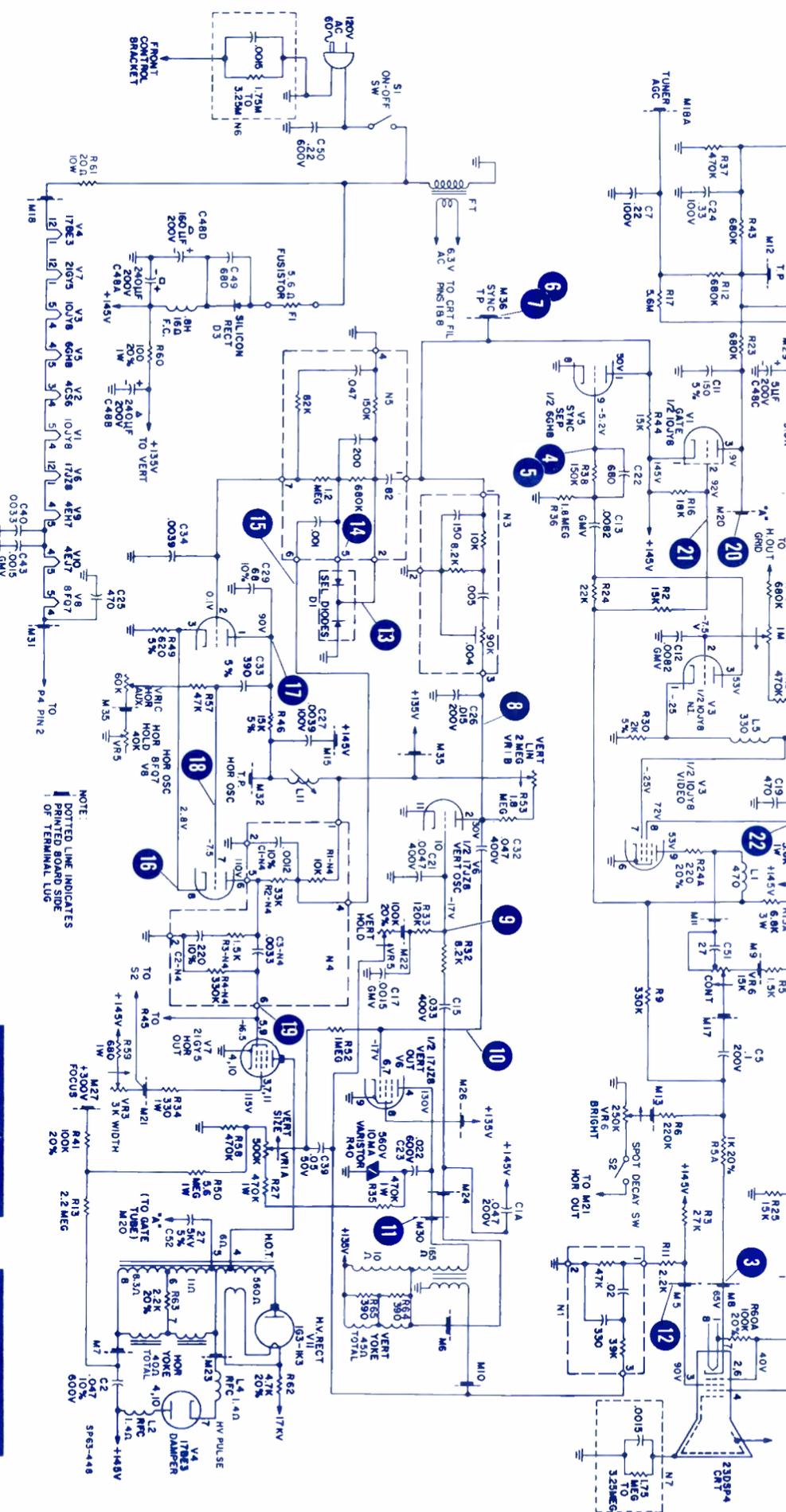
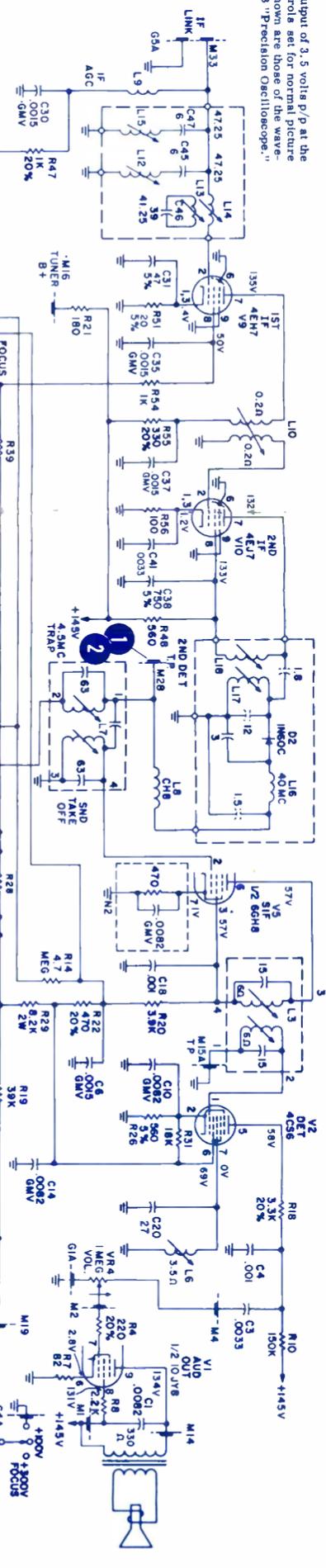
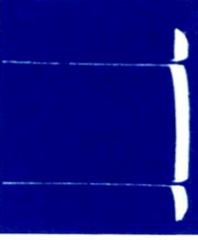
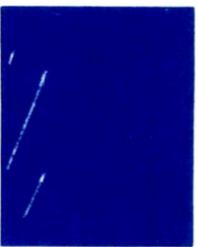
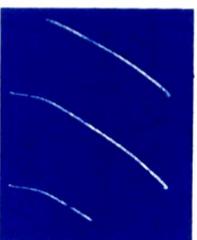
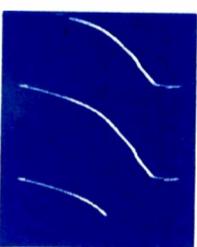
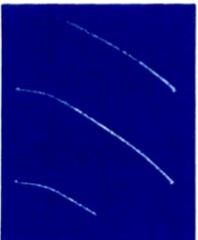
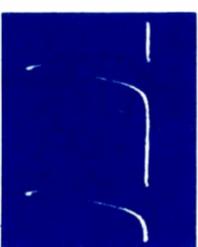
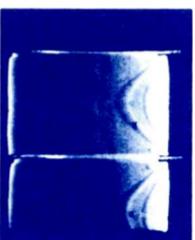
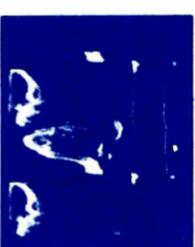
* VARIES WITH SIGNAL
NOTE: VOLTAGES TAKEN UNDER
NO SIGNAL CONDITIONS

More Data on Reverse Side

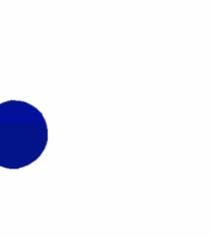
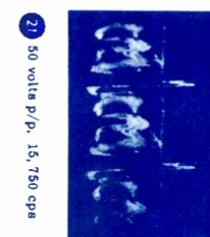
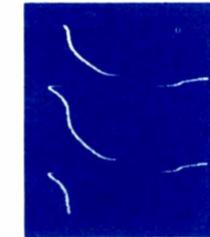
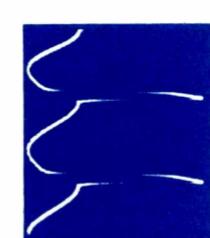
TT-83 Schematic Diagram

OSCILLOSCOPE WAVEFORM PATTERNS

These waveforms were taken with the receiver adjusted for an approximate output of 3.5 volts p/p at the video detector. Voltage readings taken with raster just filling screen and all controls set for normal picture viewing. The voltages are given approximate peak-to-peak values. The frequencies shown are those of the waveforms—not the sweep rate of the oscilloscope. All readings taken with Model ES-500B "Precision Oscilloscope."



NOTE:
DOTTED LINE INDICATES
PRINTED BOARD SIDE
OF TERMINAL LUG



PHILCO
TV Chassis
14N30 and VHF
Tuner TT-83 Data

**ELECTRONIC
TECHNICIAN**

871

More Data on Reverse Side

COPYRIGHT 1964 BY ELECTRONIC TECHNICIAN • QUIBWAY BUILDING, DULUTH 2, MINNESOTA

SEPTEMBER 1964

873

ELECTRONIC TECHNICIAN

TEKFAAX

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

ADMIRAL
TV Chassis Run 10
7D43-1, 7D413-1

SEPTEMBER 1964

TUBE COMPLEMENT

V201—12A11	V402—17J28	CR301—1N87A
V301—4BZ6	V403—9FQ7	CR401—93B5-6
V302—4DK6	V404—38HE7	CR501—93B12-1
V303—9Y8	V405—1636T	CR801—1N82A
V304—16B1P4	V701—3GK5	0801—SE-3002
V401—6GH8A	V702—6C68A	

MODEL IDENTIFICATION CHART					
Model	Chassis	Model	Chassis	Model	Chassis
P6200	7D43-1	UP6201	7D413-1	UP6204	7D413-1
UP6200	7D413-1	P6203	7D43-1	P6209	7D43-1
P6201	7D43-1	UP6203	7D413-1	UP6209	7D413-1
		P6204	7D43-1		

VHF CHANNEL ADJUSTMENT

These sets are provided with a channel adjustment slug for each channel, see illustration. Adjust as follows:

1. Turn receiver on and allow 15 minutes warm up.
2. Set Channel Selector at highest channel to be adjusted. Set Fine Tuning control at center of tuning range, by rotating it one third turn counter-clockwise from full clockwise rotation. See other tuning controls for normal picture and sound.
3. Remove Channel Selector and Fine Tuning knobs.
4. Using a non-metallic alignment tool with $\frac{1}{8}$ " blade (part number 98B30-22), carefully adjust channel slug for best picture. Note: Sound may not be loudest at this point. Repeat procedure for each channel to be adjusted.

AGC CONTROL ADJUSTMENT

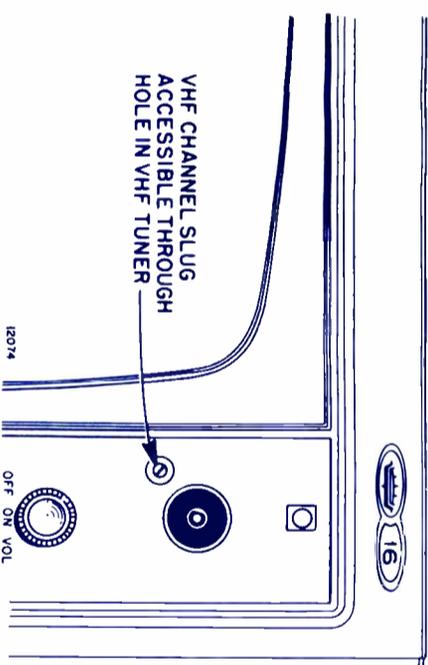
The AGC control is an AGC threshold control which is used solely to adjust the receiver for optimum operation under all signal conditions.

Note: This control is set at the factory and will not normally require field readjustment.

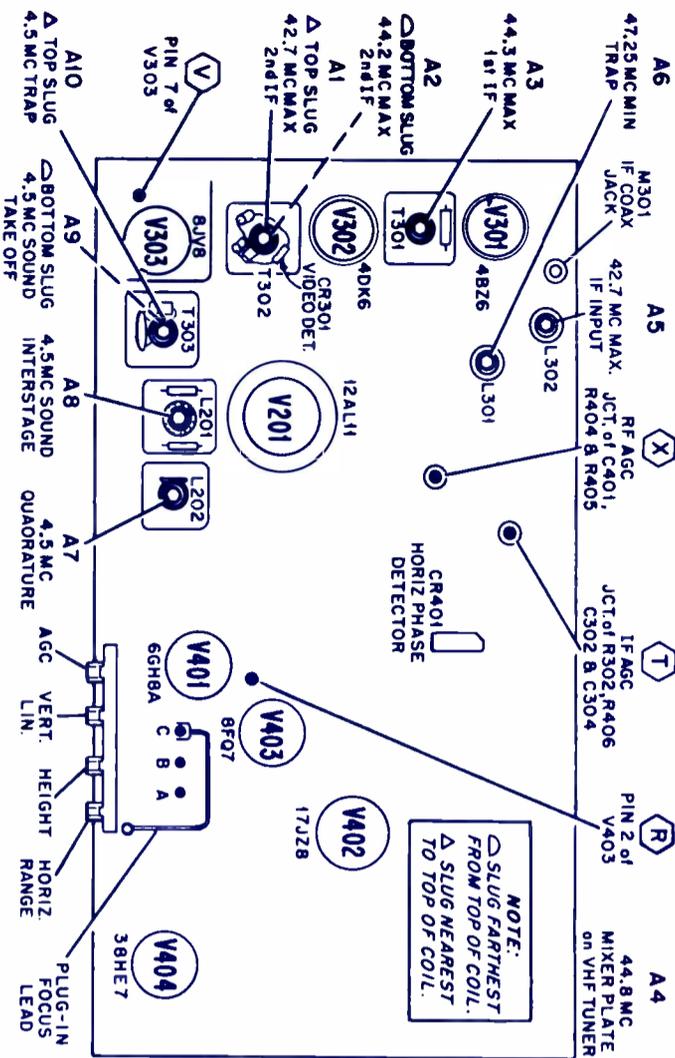
Improper AGC control adjustment can result in picture bending, tearing (overloading) or buzz in the sound. However, these same conditions can also be caused by other troubles in the set.

If adjustment is required, it should be made exactly as instructed.

1. Turn set on and allow 15 minutes to warm up.



Front View of Eutecticon, Channel Selector and Fine Tuning Knobs Removed.



SCHEMATIC NOTES

Numbers or letters inside hexagons indicate alignment points.
Fixed resistor values shown in ohms \pm 10% tolerance, $\frac{1}{2}$ watt; capacitor values shown in micro-microfarads \pm 20% unless otherwise specified.
B+ Circuit Breaker: B+ supply of this receiver is equipped with a thermal type circuit breaker having a manual reset button. Allow a few minutes for circuit breaker to cool off before pressing the reset button.

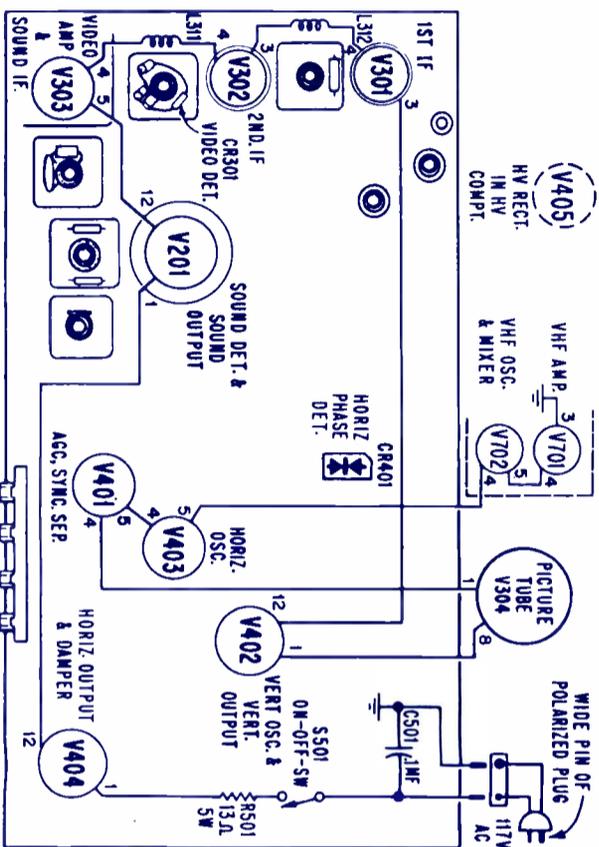
VOLTAGES AND WAVEFORMS

Isolation transformer used. Line Voltage: 117 Channel Selector on unused channel. Contrast control fully clockwise; all other controls counterclockwise. Do not disturb Horizontal Hold control. Antenna disconnected and terminals shorted. DC voltages measured with VTVM between tube socket and chassis, unless otherwise indicated. Voltages marked (°) will vary widely with control settings.

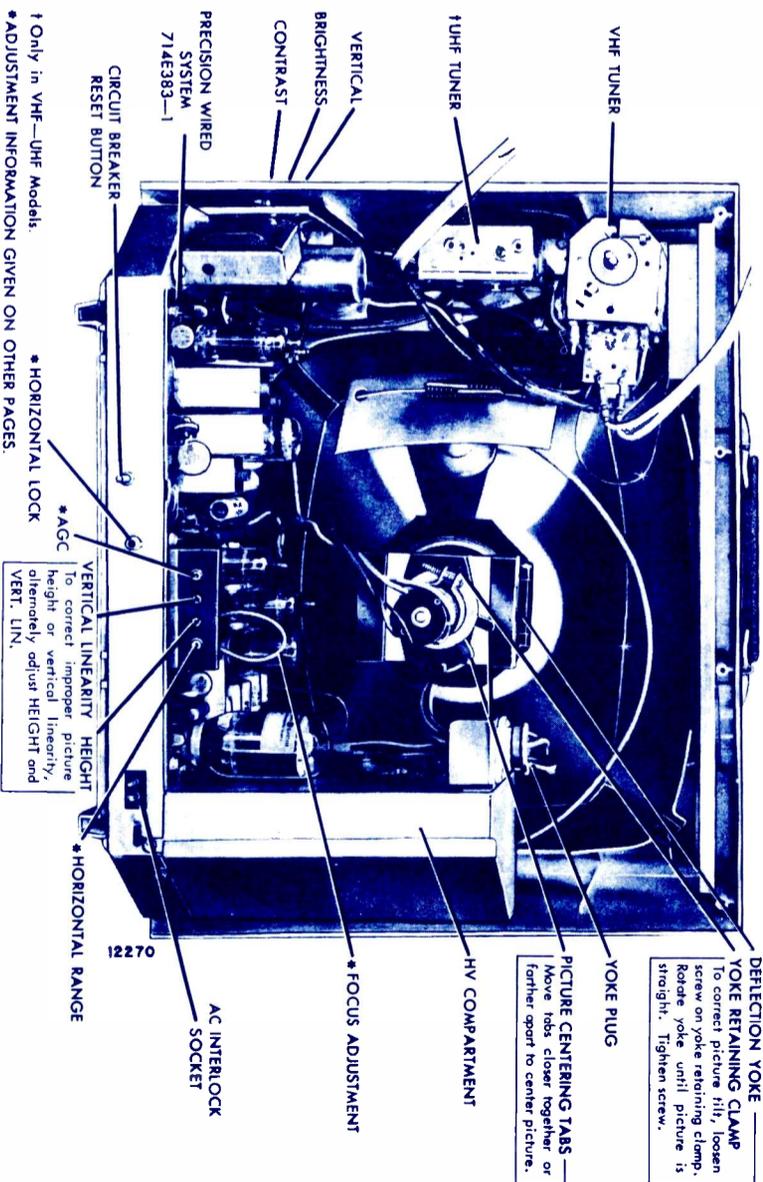
VOLTAGE WARNING

Pulsed high voltage is present at cap of V405, and pins 4 and 5 of V404. Use suitable test equipment at these points. Servicing receiver out of cabinet involves a shock hazard. Use proper line (cheater) cord and plug. Part number 89C 121-2.

Important: To prevent possibility of static discharge, bronze contact strip M303 (at top of cabinet), should only make contact with steel band around face plate of picture tube. Do not connect steel band to picture tube tag or chassis ground.



To simplify heater string diagram, tube socket pin numbers are not shown in actual locations.



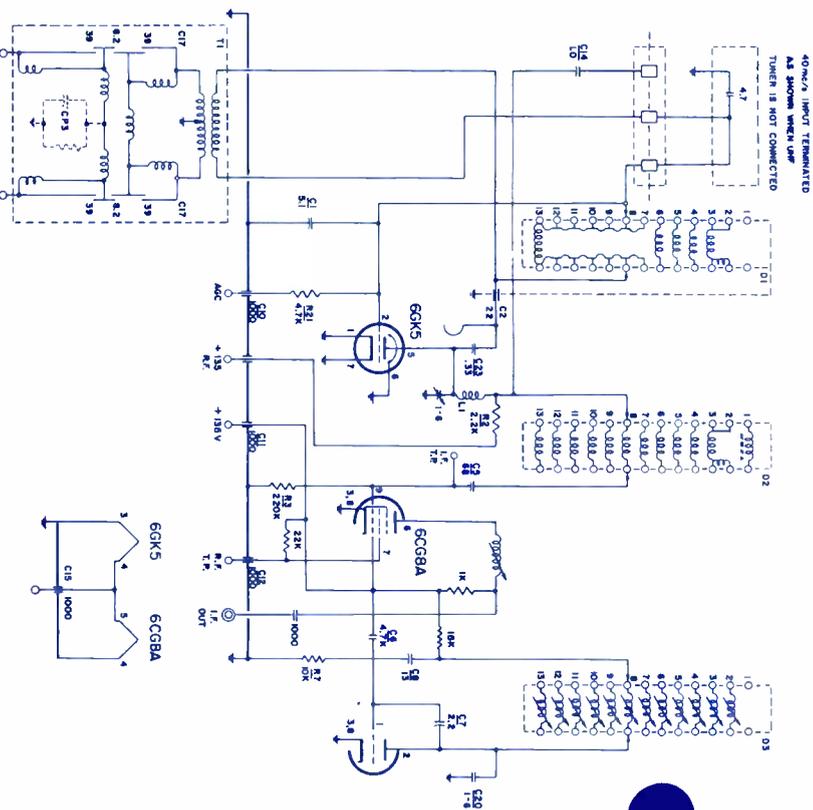
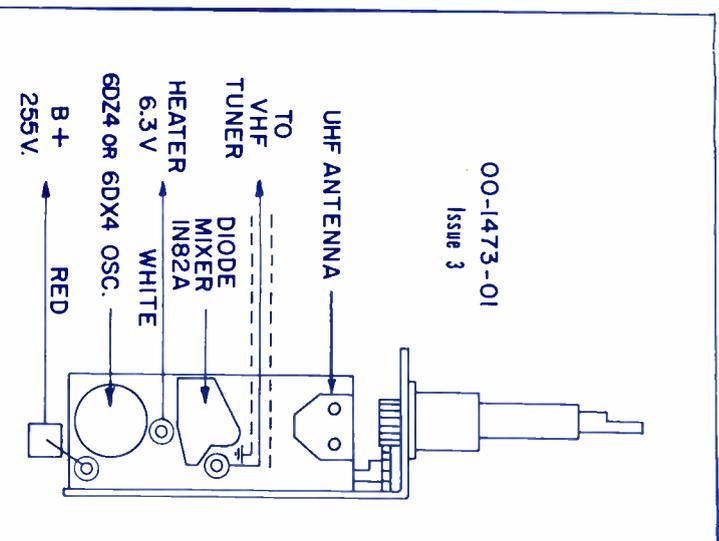
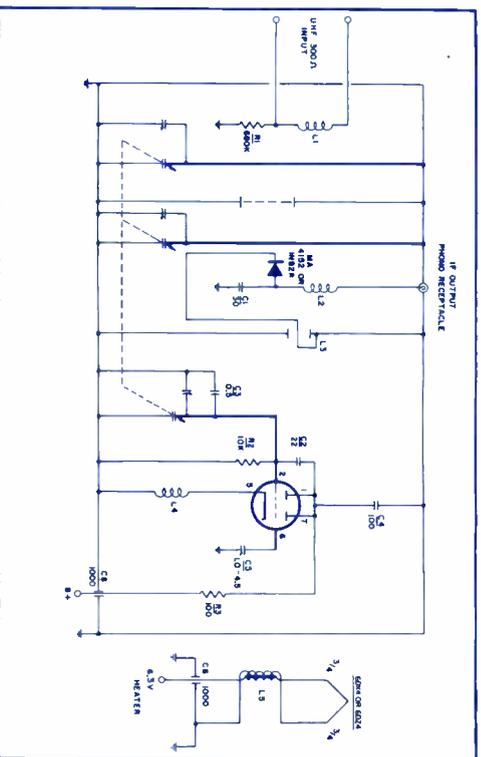
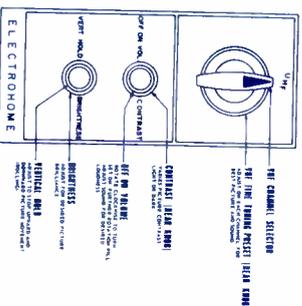
Rear View of Chassis Showing Adjustment Locations (VHF Tuner in 7D413-1 Chassis).

Tube locations and Heater String.

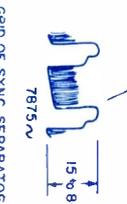
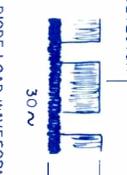
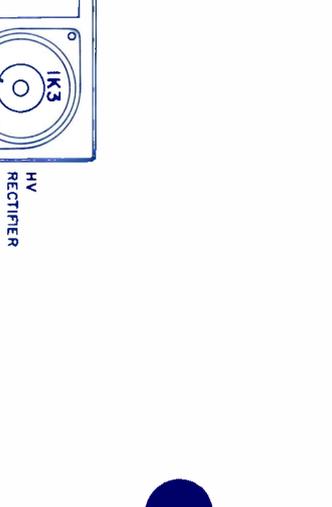
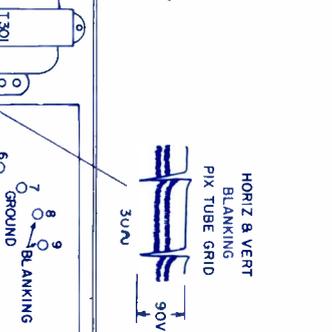
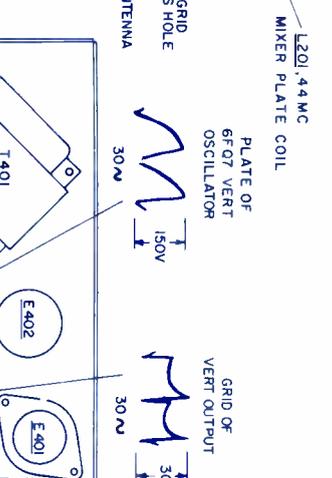
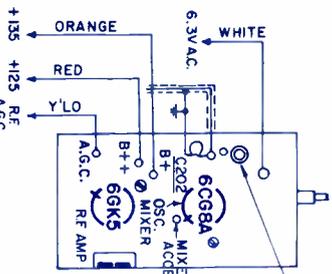
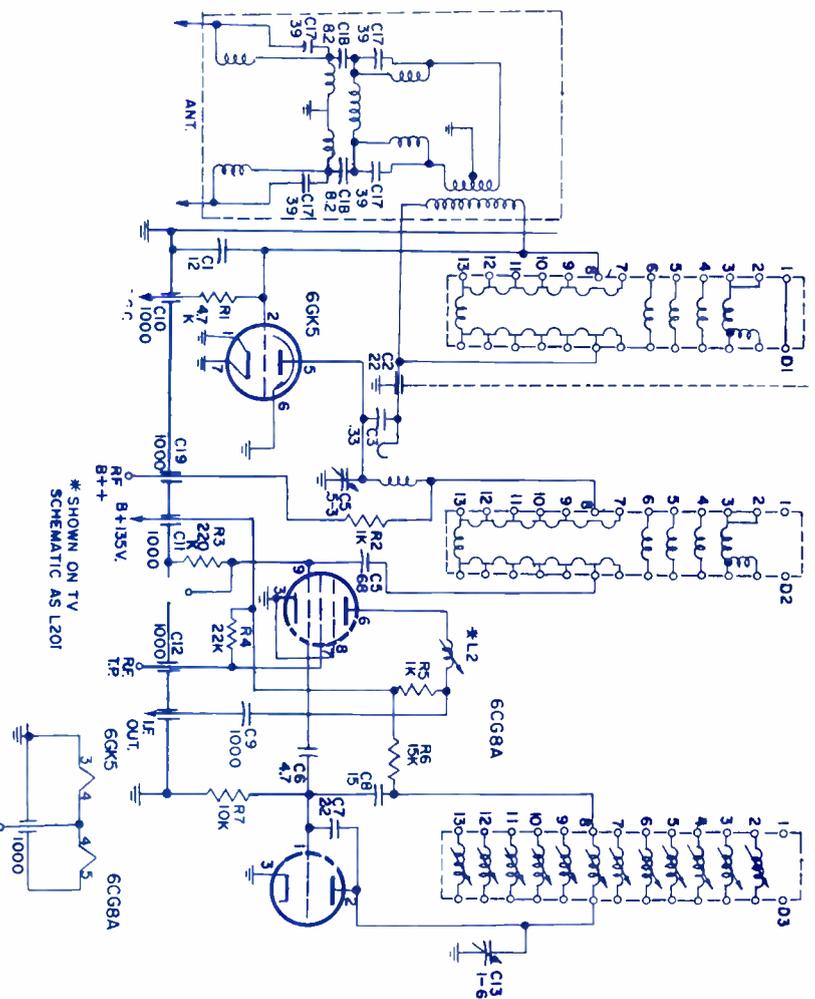
More Data on Opposite Page

ELECTRONIC TECHNICIAN TEEKFAAX

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



TUBE SUBSTITUTION CHART: 6F07 WILL REPLACE 6CG7, 193 WILL REPLACE 1K3, 19XP4 AND 19DJP4 CAN BE INTERCHANGED PROVIDED THAT COMPONENT CHANGES ARE MADE AS SHOWN IN CHART BELOW.



875

WESTING- HOUSE

TV Chassis
V-2474-1, -2, -3,
-6, -7

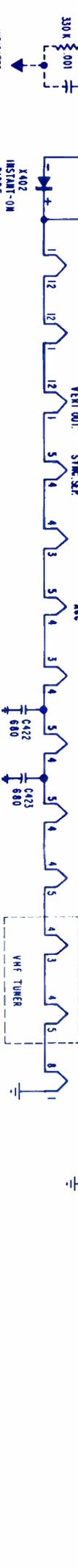
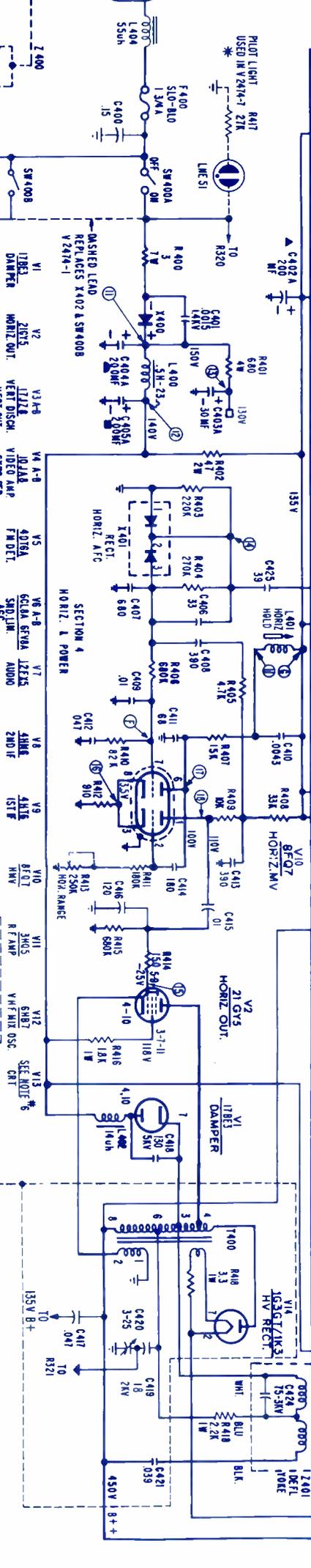
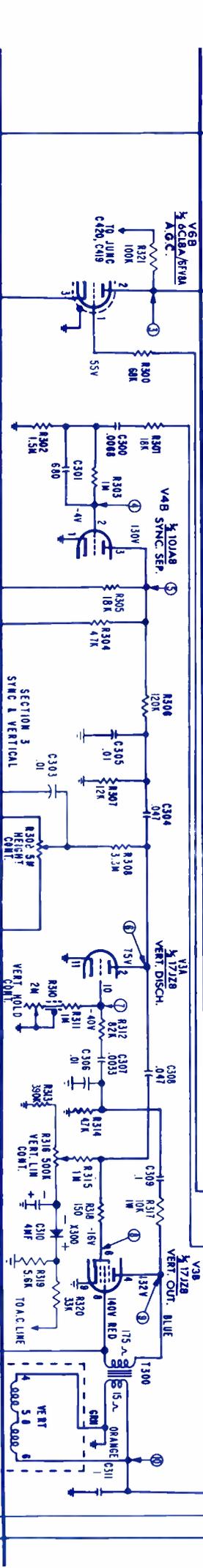
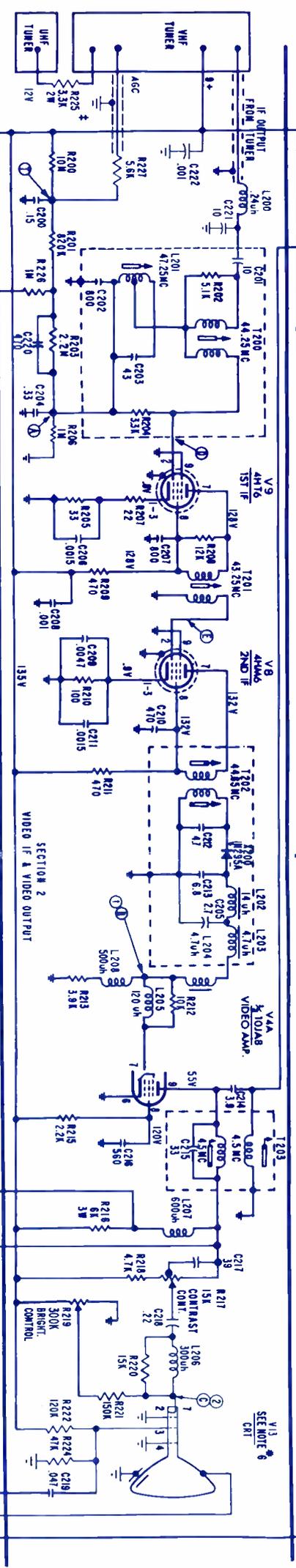
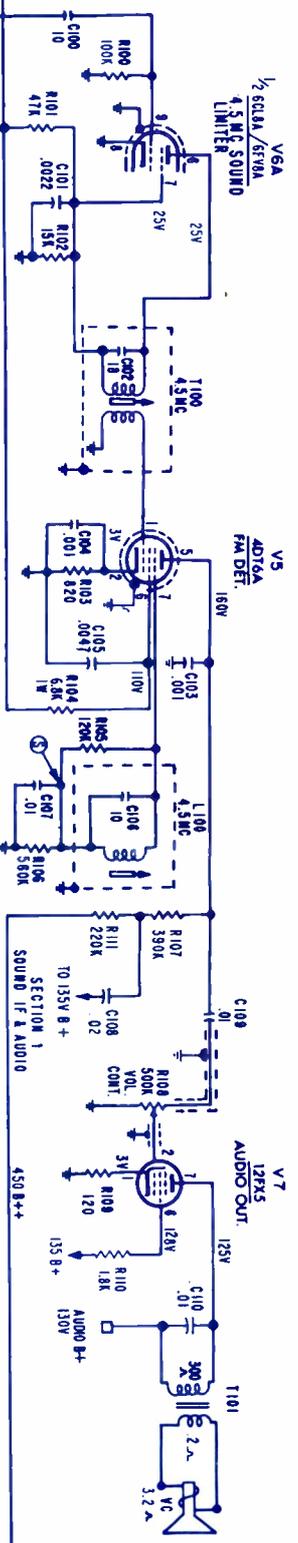
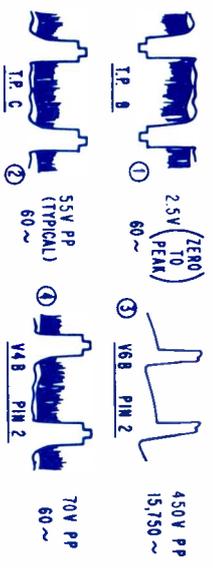
ELECTRONIC TECHNICIAN

TEKFAAX

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

SEPTEMBER 1964

- NOTES:
1. ALL CAPACITOR VALUES LESS THAN 1 ARE IN MFD. AND VALUES GREATER THAN 1 ARE IN PFMICROGRAMMERS. ALL RESISTANCE VALUES ARE IN OHMS UNLESS OTHERWISE INDICATED.
 2. DC VOLTAGES ARE MEASURED FROM POINT INDICATED TO CIRCUIT GROUND WITH A VTVM. LINE VOLTAGE AT 120 V.A.C., NO SIGNAL APPLIED.
 3. WAVEFORMS WERE TAKEN WITH CONTROLS SET FOR A NORMAL PICTURE.
 4. FOR VARIATION IN V2474-3 REMOTE CHASSIS SEE SUPPLEMENTAL SCHEMATIC.
 5. FOR V2474-1-2-3 CHASSIS R225 IS 6.8K 2W.
 6. FOR V2474-1-2-3 CHASSIS V13 IS 19CNP4.



INDICATES:
UNIPOLAR & HANDLE BRACKET
ISOLATED CHASSIS

Half of all TV lead-in cable needs replacement...now!

TV lead-in cable should be replaced at least once every two years. Hot summers, cold winters, and salty air do the dirty work.. and the picture suffers.

This means that you have a made-to-order replacement market. Automotive garages make extra profits by selling replacement spark plugs and fan belts. You can make extra profits simply by telling your customer how his old deteriorated cable keeps him from getting the best possible picture.

Tell him about the best . . . Belden. It is an insurance policy against weak signals and reception failure. And there is a Belden lead-in cable for every requirement, including Permohtm* for areas of salt or industrial contamination, Weldohm† with 2½ times the flexing strength of ordinary lead-in, Celluline* for resistance to sun and wind, RG59/U for multi-set operation and areas of extreme interference, neutral color Decorator lead-in, plus regular 300-ohm line, 150-ohm line, and 75-ohm line. Call your Belden jobber.

power supply cords • cord sets and portable cordage
electrical household cords • magnet wire • lead wire



*Belden Trademarks and Patents—U.S. Patent No. 2782251 and 2814666

†Belden Trademark—Reg. U.S. Pat. Off.

8-3-3



**Be a Cartoon
Gag Writer!
Win a \$25.00
Savings Bond**

Send us your gag ideas for future cartoons. For each of your gag ideas used, we'll send you a \$25 Savings Bond. Write Belden Manufacturing Company, Attention: Mrs. Madelsa Allison, P.O. Box 5070-A, Chicago 80, Illinois.

**This month's winner: Charles W. Forster,
3744 Charles Street, San Diego 6, California*



... for more details circle 16 on post card

Now, JERROLD's

great new line of

12 POWERMATES

gives you a transistor amplifier for every job

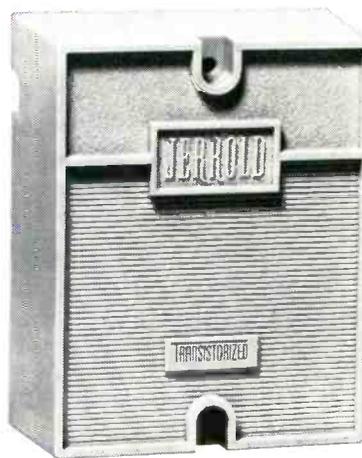
Leave it to Jerrold! We've expanded our fast-selling *Powermate* line of transistorized antenna amplifiers and indoor amplified couplers to give you a *Powermate* tailored to every VHF, UHF, and FM stereo reception problem you're likely to run into.

Now, from deepest fringe to suburban and metropolitan reception areas, you can offer TV viewers and FM listeners the perfect *Powermate* amplifier or coupler for their needs and their budgets. The chart here, designed to be hung on your wall, tells you which *Powermate* to recommend for each customer.

Ask your Jerrold distributor for complete information, or write *Jerrold Electronics, Distributor Sales Division, Philadelphia, Pa. 19132.*

CUT OUT THIS CHART AND SAVE FOR

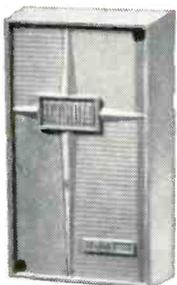
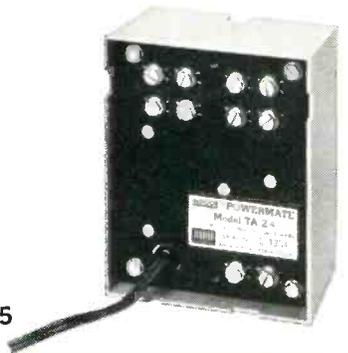
INDOOR POWERMATES



Model TA-24 List price \$24.95

NEW!

For four-set (VHF) indoor coupling in suburban to fringe areas—new economical one-transistor Indoor Powermate supplies up to four TV and FM sets from a single antenna.



For maximum indoor amplification of up to four VHF TV sets and FM receivers—indoor version of the twin-transistor Super Powermate SPM-102, featuring the industry's best gain-overload characteristics and low noise figure.

Model TA-66
List price \$34.95



NEW!

For two-set (VHF) indoor coupling in suburban to fringe areas—new Indoor Powermate Special supplies two VHF TV sets or a TV and an FM set from a single antenna.

Model TA-12
List price \$17.95
Available November.



NEW!

For FM stereo indoor amplification—new Stereo Range Extender is the Indoor Powermate for the FM band. Extends FM broadcast range and splits FM from TV signals to permit use of single broadband TV antenna for both.

Model SRX
List price \$29.95



NEW!

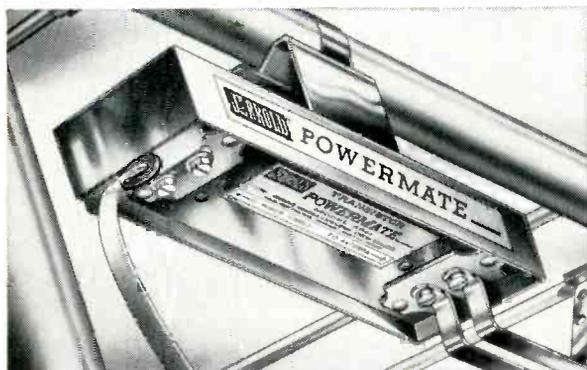
For UHF set coupling indoors—new UHF Indoor Powermate Special supplies clean signals to two UHF sets from a single UHF antenna. High isolation between outputs minimizes interference between sets.

Model TAU-12
List price \$29.95
Available October.



HANDY REFERENCE, OR HANG ON THE WALL OF YOUR SERVICE SHOP.

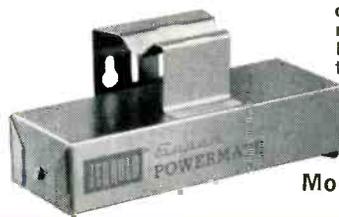
OUTDOOR POWERMATES



For snow-free VHF TV and noise-free FM where overload is no problem—the original Powermate has been improved with new power-supply circuitry. Unparalleled gain throughout hi and lo VHF bands, coupled with exceptionally low noise figure. Dual outputs.

Model APM-102

List price \$39.95



For bringing in weak VHF signals without overloading from strong local signals—the famous twin-transistor Super Powermate introduced last year. Exceptional gain-overload capabilities permit it to deliver signals from far-distant stations bright and clear, without overloading from strong signals "in your back yard."

Model SPM-102 List price \$44.95



NEW!

Model SPC-103

For best color and b&w reception in weak-signal areas—new Super Powermate Coaxial is the coax-downlead version of the famous twin-transistor Super Powermate Model SPM-102 described above. Coax downlead assures superb color and b&w reception by prevention of interference from auto generators and other transients... also is not affected by corrosion and bad weather.

List price \$47.95



NEW!

For low-cost VHF TV and FM reception in no-overload areas—the new Powermate Special delivers plenty of crisp, bright pictures and sound throughout the VHF and FM band—even from distant stations.

Model LPM-102

List price \$29.95



NEW!

Model SPC-132

For deepest fringe areas—Transistor successor to the famous "De-Snower" model DSA-132, this is the mightiest Powermate of them all. Works where all other units fail. Ideal for small public buildings as well as homes. Coax downlead assures excellent impedance match and minimum interference pick-up. Available October.

List price \$97.75



NEW!

Model UPM-104

For UHF reception in fringe to deep-fringe areas—new super-gain antenna-mounting UHF Powermate. Twin transistors bring in excellent clear pictures even in the most difficult UHF reception areas.

List price \$49.95



NEW!

For low-cost UHF antenna preamplification—antenna-mounting UHF Powermate Special with single transistor provides enough gain to bring poor UHF signals in out of the snow.

Model ULP-104

List price \$34.95

JERROLD
ELECTRONICS

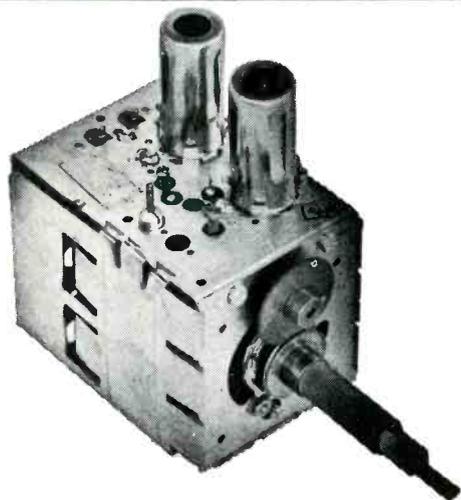
DISTRIBUTOR SALES DIVISION, Philadelphia, Pa. 19132

A subsidiary of THE JERROLD CORPORATION

--- for more details circle 34 on post card

Prices effective January 1, 1963

Tarzian offers
**FAST, DEPENDABLE
TUNER REPAIR
SERVICE (ALL
MAKES)**



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 two complete, well-equipped Factory Service Centers—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 repaired and shipped out the next. Allow a little more time for service on other than Tarzian-made tuners.

Tarzian offers a 12-month guarantee against defective workmanship and parts failure due to normal usage. And, compare our cost of \$9.50 and \$15 for UV combinations. There is absolutely no additional, hidden charge, for **ANY** parts except tubes. You pay shipping costs. Replacements on tuners beyond practical repair are available at low cost.

Ⓢ Tarzian-made tuners are identified by this stamping. When inquiring about service on other tuners, always give TV make, chassis and Model number. All tuners repaired on approved, open accounts. Check with your local distributor for Sarkes Tarzian replacement tuners, replacement parts, or repair service.

 **SARKES TARZIAN, INC.**
Bloomington, Indiana

MANUFACTURERS OF TUNERS . . . SEMICONDUCTORS . . . AIR TRIMMERS . . . FM RADIOS . . . AM/FM RADIOS . . . AUDIO TAPE . . . BROADCAST EQUIPMENT

ONLY
\$9.50
INCLUDING

ALL PARTS
(except tubes)
and LABOR

24-HOUR SERVICE
1-YEAR WARRANTY

**TWO SERVICE CENTERS
TO SERVE YOU BETTER**

**See your distributor, or use the
address nearest you for fast fac-
tory repair service**

**537 South Walnut St.
Bloomington, Indiana
Tel: 332-6055**

**10654 Magnolia Blvd.
North Hollywood, Calif.
Tel: 769-2720**

SEPTEMBER 1964
VOL. 80 NO. 3

ELECTRONIC TECHNICIAN

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION

RON KIPP Publisher
JACK HOBBS Managing Editor
QUINTO M. BOCCHI Technical Editor
DOUGLAS HEDIN Industrial Editor
JOHN BAILEY Assistant Editor
ALEX ORR Assistant Editor
EARL HINTZ Production Manager
MAGGIE KANE Advertising Production
JIM GHERNA Art Director
JOE WOLKING Circulation Mgr.
DONNA GEARY Circulation Fulfillment



AN OJIBWAY
PUBLICATION

OJIBWAY PRESS, Inc.

Ojibway Building
Duluth, Minn.
55802

AREA CODE 218 727-8511

Sales Offices:

NEW YORK: Ron Kipp, 555 Fifth Ave.,
New York, N.Y. 10017
AREA CODE 212 MU7-8080

CHICAGO: William Klusack, 221 N.
LaSalle St., Chicago, Ill. 60601
AREA CODE 312 CE 6-1600

CLEVELAND: Arnold T. Suhart, 6207
Norman Lane, Cleveland, Ohio 44124
AREA CODE 216 YE 2-6666

LOS ANGELES: Boyd B. Garrigan, 1655
Beverly Blvd., Los Angeles, Calif.
90026

AREA CODE 213 MA8-8556

SAN FRANCISCO: Stearns Ellis, 260
Kearny St., Room 206, San Francisco,
Calif. 94108

AREA CODE 415 GA1-0593



Copyright 1964 by Ojibway Press, Inc.,
Duluth, Minn. 55802. Reproduction and re-
printing prohibited except by written
authorization of the publication. Subscrip-
tion price: \$5 for 1 year, \$8 for 2 years,
\$10 for 3 years. Foreign, \$9 for 1 year,
\$14 for 2 years, and \$18 for 3 years.
If you have a change of address or a ques-
tion about your subscription, write: ELEC-
TRONIC TECHNICIAN, Circulation Depart-
ment, Ojibway Building, Duluth, Minnesota,
55802. BE SURE TO SEND ALONG THE AD-
DRESS LABEL FROM YOUR MOST RECENT
ISSUE.

Cover

Our artist has dreamed up a scene that will appear downright realistic in many areas of the country this autumn.

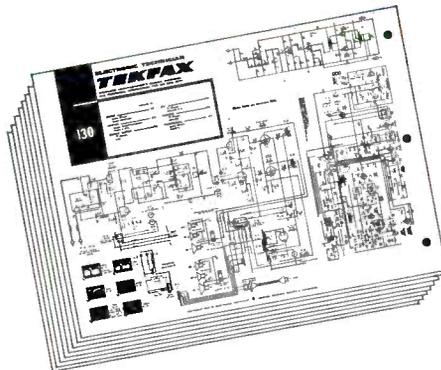
FEATURES

Why Some Antennas Have 'It'	43
<i>Keith Peterson reveals why some antennas have satisfied customers and some don't</i>	
Are You Missing the 'Sky' Boat?	46
<i>Jim Sarayotes says you are if you're not doing a profitable business in TV and FM antennas and accessories</i>	
Rotors Sweep the Horizon	49
<i>If you don't know what antenna rotators are for, read this one</i>	
Get Aboard the UHF 'Aerial' Gravy Train!	50
<i>Bob McDonald tells what every technician needs to know about UHF antennas</i>	
Detect. . . Select. . . Install	52
<i>J. E. Bayne draws a bead on the vast VHF/UHF antenna market potential</i>	
Vertical Lines	54
<i>Joe Hayes concludes a 'Bob' and 'Scoot' story about 'spooks'</i>	
Eliminating Hum in Audio Amplifiers	57
<i>Bob Batchelder shows how to handle this problem without strain</i>	
Another Approach to FM Stereo Demodulation	60
<i>Milt Langford and Jim Azbell describe the balanced peak detection system</i>	
INDUSTRIAL ELECTRONICS SECTION	71

DEPARTMENTS

Letters to the Editor	26	Shop Hints	66
New Literature	32	New Products	80
Editors Memo	34	Sync on Business	98
Technical Digest	37	Industry News	100
'Tough Dogs'	64	Advertisers Index	102

TEKFAX 16 PAGES OF THE LATEST SCHEMATICS



ADMIRAL: TV Chassis Run 10 7D43-1,
7D413-1

ELECTROHOME: TV Chassis, Orlando,
Orlando U, Orlando CU

EMERSON: TV Chassis 120671, -673,
-697, -698, -702, -740, -743, -744,
-753

PHILCO: TV Chassis, 14N30 and VHF
Tuner TT-83 Data

WESTINGHOUSE: TV Chassis, V-2474-1,
-2, -3, -6, -7.

The antenna that challenges

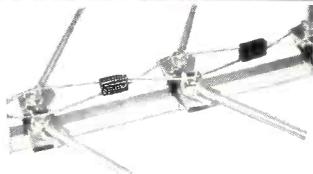
NEW Swept Element

"COLOR-VE-LOG"

BY

FINCO

Finco's Color Ve-Log challenges all competition on color or black and white reception and stands behind this challenge with a "Guarantee of Supremacy". ■ The swept element design assures the finest in brilliant color and sharply defined black and white television reception — as well as superb FM monaural and stereo quality. ■ FINCO precision-engineered features make these advanced-design antennas indispensable to good home sight-and-sound systems. And, of course, they carry the famous unconditional guarantee from the leading manufacturer in the field — FINCO. ■ Promote the Color Ve-Log Antennas with pride, sell them with confidence, and profit handsomely.



One-piece cross-over drive line assembly has no joints between adjacent driven elements. Eliminates loose connections, shorts, broken drive line sections. Polystyrene snap-lock spacers, with center 'air insulator' space.



Elements are made of triple thick aluminum to stand up in severe weather. Die stamped bracket fastened with tough, thick-gauge rivet holds proportional length sleeve reinforcing shell into which element fits.



First from Finco and exclusive — double contact between drive line and driven element bracket assembly for perfect drive-line support and electrical continuity. Positive, vibration-free, non-corrosive contact.



Boom reinforcing back up brackets at elements add triple strength to the riveted assembly, mounted on a rigid, non-crushable 1" heavy duty square boom. Boom rolled square from 1 1/4" diameter round aluminum for increased strength.

Write for color brochure #20-307, Dept. 110.

all competition!

LOG



VL-10
9 driven elements
1 parasitic element
List price \$34.95

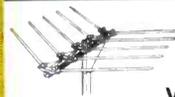
Featuring Finco's Exclusive Gold Corodizing



Finco's boom-mast bracket, rust-proofed by zinc plate-gold di-chromate dip process, is the finest available. It has positioned cleats to assure sag-free positive direction of the antenna. Locks tight. Can't tilt. Antenna stays in proper position at all times.



High impact polystyrene insulators are reinforced with strong aluminum shields. This gives quadruple strength in supporting triple-thick snap-in elements. Lifetime assembly with fitted aluminum cup to hold oversize aluminum rivet.



VL-5
5 element VHF-FM
5 driven elements
List price \$16.95



VL-7
7 element VHF-FM
7 driven elements
List price \$23.95



VL-15
15 element VHF-FM
9 driven elements
6 parasitic elements
List price \$46.95



VL-18
18 element VHF-FM
9 driven elements
9 parasitic elements
List price \$54.50

The FINNEY Company • 34 Interstate Street • Bedford, Ohio

• • • for more details circle 25 on post card



EVERYTHING IN A NUTSHELL

... Viking your source from beginning to end. Manufacturers of the Rainbow series of 59U and all featured mainline cables. Plus a complete line of taps, amplifiers, wall plates, connectors and every component to successfully and profitably install a small or large system. Specializing in all phases of the closed circuit industry. We plan, design, layout and supply everything you need. Viking is your one shop for every phase of Master Antenna, Educational and Instructional Television System Equipment and cable. For a look at what's in our nutshell drop a line on a company letterhead and we will do the rest.

Be smart like a squirrel, put all your nuts in one basket.



VIKING



Call Us Collect

400 NINTH STREET NEW YORK: (212) WH 3-5793
HOBOKEN, NEW JERSEY HOBOKEN: (201) OL 6-2020

LETTERS TO THE EDITOR

Deep-Fringe Ranch

The service I do is quite different from that of a Town Shop. I live 4 miles from a town of 200 and 200 miles from the nearest distributor. The sets I receive are from ranches in a 50 mile radius, so house calls are few.

This is all TV-deep fringe area and an exacting problem to both the technician and the TV viewer.

With no close contact with distributors of the various makes of sets, Technical Magazines are a "must."

ELECTRONIC TECHNICIAN does much to solve these problems and makes it possible to keep many ranch people entertained so they can weather out stormy winter evenings.

R. L. DIMMICK

Cody, Neb.

• *Do you ever get a 'dog' in the corral?—Ed.*

Poor Fringe Reception

A customer lives in a modern apartment house which has a CC-TV camera in the lobby (aimed at the doorbell panel). Channel 6 on their TV set is used as the monitoring channel. A master antenna system is used in the house and their TV reception is not too good and I am wondering if the CC-TV does, in some way, affect the reception. They have a 1964 Zenith color TV. I look forward to hearing from you.

EDWARD DENARDO

Bethpage, N. Y.

• *Long distance troubleshooting in specific cases like this is a dangerous endeavor practiced only by amateurs. But here goes: It is highly improbable that the CC-TV system is causing poor reception on the TV set, especially since an unused channel (6) is being employed. Bethpage is quite a distance from the Empire State Building and good, high gain antennas are needed out there for top-grade reception. Suggest you check other tenants in the same house to determine if the master antenna system is working up to par.—Ed.*

WHY

risk your reputation with "just-as-good" capacitors?

When you pay little or no attention to quality in tubular replacement capacitors, you leave yourself wide open for criticism of your work . . . you risk your reputation . . . you stand to lose customers. It just doesn't pay to take a chance on capacitors with unknown or debatable performance records when it's so easy to get guaranteed dependable tubulars from your Sprague distributor!

There's no "maybe" with these 2 great SPRAGUE DIFILM[®] TUBULARS!

The ultimate in tubular capacitor construction. Dual dielectric . . . polyester film and special capacitor tissue . . . combines the best features of both. Impregnated with HCX[®], an exclusive Sprague synthetic hydrocarbon material which fills every void in the paper, every pinhole in the plastic film *before it solidifies*, resulting in a rock-hard capacitor section . . . there's no oil to leak, no wax to drip. Designed for 105°C (220°F) operation without voltage derating.



DIFILM[®] BLACK BEAUTY[®]
Molded Tubular Capacitors

The world's most humidity-resistant molded capacitors. Tough, protective outer case of non-flammable molded phenolic . . . cannot be damaged in handling or installation. Black Beauty Capacitors will withstand the hottest temperatures to be found in any TV or radio set, even in the most humid climates.



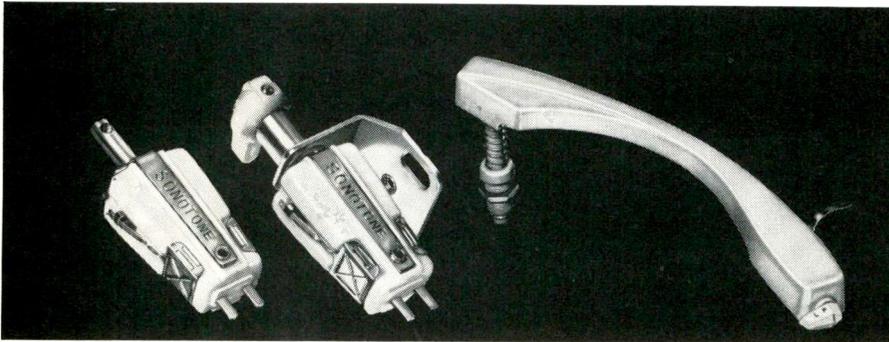
DIFILM[®] ORANGE DROP[®]
Dipped Tubular Capacitors

A "must" for applications where only radial-lead capacitors will fit . . . the perfect replacement for dipped capacitors now used in many leading TV sets. Double-dipped in rugged epoxy resin for positive protection against extreme heat and humidity. No other dipped tubular capacitor can match Sprague Orange Drops!

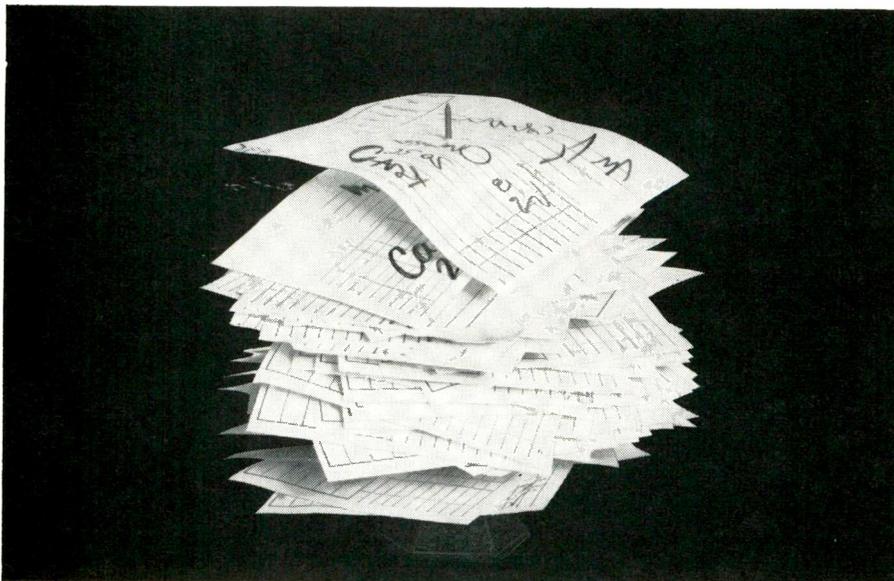
For complete listings, get your copy of Catalog C-616 from your Sprague distributor, or write to Sprague Products Company, 65 Marshall Street, North Adams, Massachusetts.



WORLD'S LARGEST MANUFACTURER OF CAPACITORS



How to turn crystal



into gold

You can strike it rich with the new Sonotone line of crystal cartridges. It offers direct replacements for "Ronette," "Vaco" and "BSR" models with typical Sonotone quality.

Here are the extras you get—New improved crystal elements for longer pickup life. Mono ("14T") and stereo ("20T") models. High output voltage. Modern turnover type for LP, 45 and 78 rpm records. Available with or without mounting brackets or turnover knobs to fit most arms.

Oh yes, they come in a slim, lightweight plastic tonearm, too. You have a choice of the mono ("14T") or stereo ("20T") cartridge. It's easy to install because it's prewired. It has a shielded cable, spring mounting post and a plated finger lift. It's complete with arm rest and all necessary hardware. Get details today. Write:

SONOTONE
audio products

Sonotone Corp., Electronic Applications Div., Elmsford, New York
Cartridges • Speakers • Microphones • Headphones • Hearing Aids • Batteries

— for more details circle 49 on post card

'Wealthy' Ignorers

I have a complaint (not against ET which I shall never be without) but against those little cards in the back of my ET where I make a circle to receive free literature, etc. So far I have made enough circles to orbit the earth but with only one result from good old M.....

Is Brand X so independently wealthy that they do not need the business of the small shop?

PARKS C. MOORE, JR.
Clyde Park, Mont.

Speaker Man

. . . How about an article on speaker enclosures—types, sizes, design characteristics, theory and cross-over networks. I feel both of these areas are sadly neglected.

PETER FROSIO

New York

• *We're working on it.—Ed.*

Relay Info

Please send me 'literature on Latching Relays, as shown in ELECTRONIC TECHNICIAN, June 1964, page 69.

J. B. WINTERS, PRESIDENT
INCAR Corp.

Cleveland, Ohio

• *Your letter has been forwarded to the equipment manufacturer.—Ed.*

Needs TEKFAV Volumes

I would like to find out if I may have a request published. I need volumes 101, 102 and 103 of Circuit Digest's (TEKFAV). I would like to hear from readers who have these books and no longer need or desire to keep them.

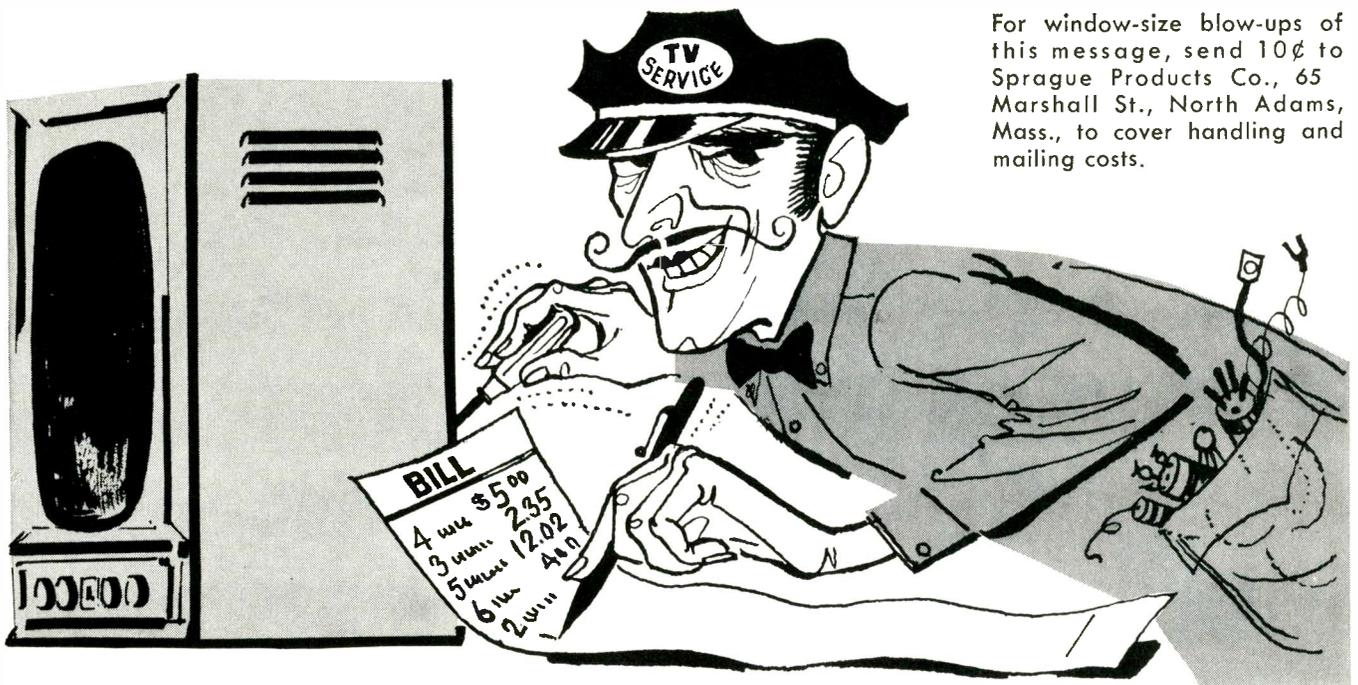
J. F. WHITE

Pensacola, Fla.

• *If you can help this fellow-reader let me know.—Ed.*

CRT Implosions

Perhaps you can furnish me with some information. The CRT in a portable TV under our service has imploded in a customer's home.



For window-size blow-ups of this message, send 10¢ to Sprague Products Co., 65 Marshall St., North Adams, Mass., to cover handling and mailing costs.

ARE TV SERVICE DEALERS GYPS?

Every so often, some magazine or newspaper sounds off about TV-radio service shops.

"Service technicians are a bunch of gyps," is the general theme. "They'll clip you if you don't watch out."

They might just as well write the same thing about doctors, lawyers, storekeepers, auto mechanics—or anyone else. There are gyps in every line of business. Actually the percentage in TV-radio is lower than in most.

The average service technician is a hard-working, straight-shooting individual. Rather than gyp customers, he is far more likely to spend more time on a job than he knows he will be paid for—simply as a matter of personal pride in doing things right.

We recently heard about someone's TV set going bad. A service technician called for it with his truck and returned it in good working condition within 48 hours. His bill came to \$10 for service plus \$2.68 for replacement parts.

The set owner argued that this was too much—yet he would never dream of complaining to the medical specialist who charged him \$10 for a 15-minute office visit; the lawyer whose bill for writing a simple will was \$75; or the garage man who laughingly admits that he charges \$5 for "just raising the hood" of a car.

In one of our very large cities, the Better Business Bureau received fewer than 500 complaints about serv-

ice in a year. Most of the complaints came from folks who expected first-class reception in doubtful fringe areas; who tried to operate their sets without suitable antennas; or who had bought sets "wholesale" at ridiculously low prices from cut-rate dealers who could offer little or no service.

Actually, it takes almost as long to become a good service technician as it does to train for any other profession. Beyond this, it calls for regular study to keep up with the constant stream of new developments. Also, it requires a surprisingly big investment in test instruments, manuals, and other shop equipment. The modern TV or radio receiver is by far the most intricate piece of equipment the average person ever owns or uses.

Service technicians are not fly-by-night businessmen—99 out of 100 run their businesses properly. The other one per cent—the gyps—can usually be spotted a mile away. Nine times out of ten, they are the shops that feature "bargain" prices and ridiculously liberal service contracts. And their victims are generally set owners who expect to beat the game by "getting something for nothing."

Good television sets or good TV service are not things to be bought on a "bargain counter" basis. Set owners who recognize this aren't likely to get gyped.

Instead, they'll find that they get more real value for their television entertainment dollars than for any other dollars they spend!

THIS MESSAGE WAS PREPARED BY SPRAGUE PRODUCTS COMPANY,
DISTRIBUTORS' SUPPLY SUBSIDIARY OF SPRAGUE ELECTRIC COMPANY, NORTH ADAMS, MASSACHUSETTS, FOR . . .

YOUR INDEPENDENT TV-RADIO SERVICE DEALER

LETTERS

TO THE EDITOR

The set was not in operation, having been turned off for four hours, and was unattended at the time. The implosion shattered the plastic safety glass and scattered remnants about the room. We were thinking about the possibility of sonic "boom" as the cause. Do you have

any information on this?

BOB KAHN

Brooklyn, N. Y.

• *We have searched our files but have been unable to locate a case of CRT implosion caused by external influences other than a direct heavy mechanical blow on the face plate or bell area. We have no record of implosion caused by sonic resonance. This, of course, is possible if the sonic frequency is favorable and has sufficient amplitude. Most implosions that take place under circumstances you describe,*

are caused by imperceptible, undetected imperfections in the glass bulb.—Ed.

Wanted . . .

Here at Chicago's Tower Radio Service, Inc. we have been "readers and listeners" to ELECTRONIC TECHNICIAN for several years. I must say, at this point, that many well-written articles have come our way as a result of your efforts, and we want to express our thanks for your help.

We have a suggestion that we think will help many technicians and service-dealers. May we suggest a means where service technicians may list a situation wanted, and service organizations and/or dealers may list a help wanted ad.

We can always use good, informed radio, television, and Hi Fi men, and we feel that people who read publications such as yours would be the logical men to interview.

Maybe you will want to elaborate or re-write, however, the basic idea is a means of communication between service technicians in all parts of our country that might want to re-locate.

Thank you again for your help to the industry.

CHARLES H. GAMBILL
Chicago, Ill.

Slips That Pass . . .

Would you please clarify the reference contained in a "News-of-the-Industry" item on page 85, July, 1964, ELECTRONIC TECHNICIAN, titled "New 2-Way Organization," which calls attention to radios designed for 25-54 Mc operation?

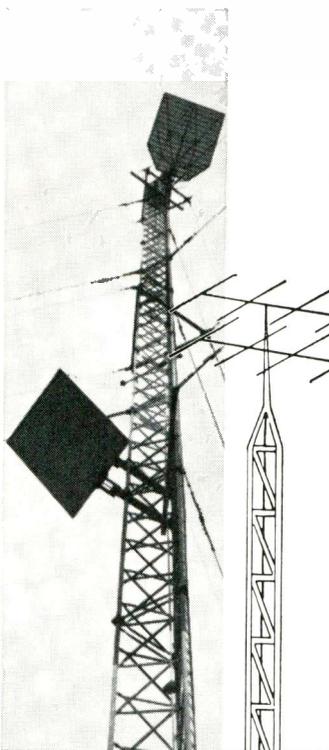
GORDON SERGI
Utica, N. Y.

• *That's what the news release said, but it slipped by us. It obviously should read 25-50 Mc.—Ed.*

High Power

I just recently received a copy of your January 1964 ELECTRONIC TECHNICIAN Magazine. I have really enjoyed your magazine, especially the TEKFAK circuit diagrams. How about some circuit diagrams of high power amplifiers?

ALEX LEE
Davao City, Philippines



The most Famous Name in
TOWERS of ALL KINDS!

Here are the advantages you get when you insist on ROHN TOWERS

LARGEST FULL RANGE OF TOWERS—you can get anything from home TV and amateur radio towers to heavy-duty communication and micro-wave towers. Included are 500 foot self-supporting towers, 1,000 foot guyed towers, "fold-over" and crank-up towers. Regardless of your needs, ROHN can supply it.

UNQUESTIONED LEADERSHIP IN DESIGN AND MANUFACTURE—you get the latest in advanced tower engineering. All communication towers are engineered to EIA specifications, and are proved by thousands of installations. No other manufacturer can surpass the quality and fine reputation of ROHN.

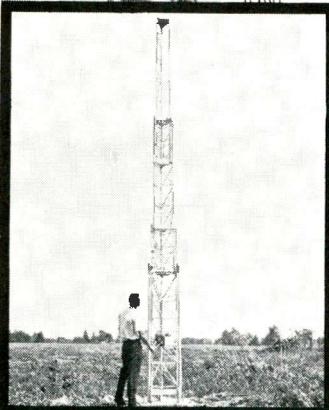
QUALITY MATERIALS AND WORKMANSHIP—Only highest quality steel is used which fully meets the specifications for the job. ROHN towers are hot-dipped galvanized **after fabrication**—a feature ROHN pioneered!

SERVICE WHEREVER YOU WANT IT—ROHN representatives are world-wide. Complete erection service for communication systems, broadcasting, micro-wave, and other needs is available; also competent engineering service to help you.

Settle for the BEST in TOWERS—ROHN—today the world's largest, exclusive manufacturer of towers of all kinds!

Also available: Rohn Lighting Kits, Microwave Passive Reflectors, Tower Installation Service and Engineering Assistance. Representatives World-Wide to Serve You.

For your needs, contact your local ROHN salesman, distributor or dealer; or write direct for information.



SEND THE HANDY COUPON INDICATING YOUR NEEDS

ROHN
Manufacturing
Co.
BOX 2000
PEORIA, ILLINOIS

Send me complete literature on the following ROHN Products:

- | | |
|---|--|
| <input type="checkbox"/> Home TV Towers | <input type="checkbox"/> Amateur Towers |
| <input type="checkbox"/> Communication Towers | <input type="checkbox"/> AM-FM Broadcasting Towers |
| <input type="checkbox"/> Micro-Wave Towers | <input type="checkbox"/> Government |

Name _____

Firm _____

Address _____

City _____ State _____

"World's Largest EXCLUSIVE Manufacturer of Towers; designers, engineers, and installers of complete communication tower systems."

--- for more details circle 43 on post card



JUST TRY AND MAKE US

...buy any indoor antennas but Channel Master!

The line that moves in new directions. Once you discover it you'll never give it up, either.

As the gentlemen above have learned, Channel Master indoor antennas are worth fighting for. Worth holding onto. Worth featuring BIG.

Because Channel Master really blazes new trails. It's the most complete, most effective, most beautiful, most profit-packed line in the world.

It offers the best series of step-up choices in the business: 14* all told... one for every purpose and price. The customer chooses from either UHF/VHF all-channel/FM Stereo,

or VHF/FM Stereo models; all of them great for color.

Know what you'll particularly like about most of the "all-channel 82's"—besides their looks and price? The **outdoor**-type elements. **Yagis. Stacked Bow-Tie.** Really revolutionary for indoor antennas.

And each model is truly 2 antennas in 1—made with 2 separate and distinct UHF and VHF transmission lines. The VHF models? Time and again, they've proved their claim to be called best.

Honestly—wouldn't it be a crime to buy anything but Channel Master? Write for our full-line catalogue: *New Directions in Indoor Antennas.*

CHANNEL MASTER

hands you
the keys
to the city...



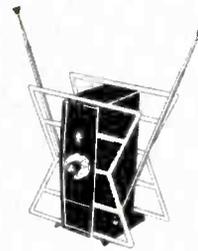
New! Canaveral-82, Model 4006.
All-channel and FM. VHF Dipole; plus more UHF gain than stacked dipole. \$10.95*



Canaveral, Model 3720.
VHF/FM Stereo. Best-seller at \$9.95*



New! Gamma, Model 3723.
VHF/FM Stereo. \$5.95*



VU-82, Model 4000.
All-channel and FM. Exclusive Beam-Reversing Circuit \$14.95*



Transistor-Amplified Apollo, VHF only.
Model 3721. World's lowest noise level amplified indoor antenna. \$29.95*



Transistor-Amplified FM/Stereo.
Top stereo reception. Model 3731. \$19.95*



...plus eight other models from \$4.98* up. Including: In main photo above, extreme right, **Aurora-82**, \$5.95*. Second from right, **Gamma-82** with 3-element UHF yagi, Model 4007, \$6.95*. Second from left, **Alpha**, VHF/FM Model 3722, \$7.95*. Left, **Gamma**.*

... for more details circle 18 on post card

CHANNEL MASTER • ELLENVILLE, N.Y.

*Fair-traded

RELAYS 300

This 12-page, easy-reference catalog describes two hundred most widely used relays available for industrial, commercial and military service. Sigma.

TAPES 301

This 16-page catalog describes a complete line of pressure sensitive

and silicone tapes. It contains a tape selection guide in addition to illustrations, typical applications, specifications, sizes and packaging for each product shown. Porter.

CC-TV 302

A 36-page booklet, "Equipment Guide for Classroom Television," discusses closed circuit camera equipment and describes a variety of applications ranging from teacher-operated single camera systems to professional studio operations. Sylvania Electric.

ELECTROLYTICS 303

A 96-page electrolytic capacitor reference is designed to solve the major problems facing service technicians with electrolytic replacement. Cornell-Dubilier.

ELECTRON TUBES 304

Electron tubes for general purpose applications, pulse modulation, high voltage switching, high voltage rectification, and TV camera use are described in a 28-page catalog. Matchlett.

PHONO PRODUCTS 305

A 16-page catalog illustrates, in detail, a complete line of ceramic and crystal cartridges, replacement needles, tonearms, ceramic microphones (including low-impedance types) and learning lab headset/-microphone units. It also lists speakers and speaker enclosures. Sonotone.

HI FI SPEAKERS 306

A six-page, two-color brochure "MY", provides complete specifications and prices on a series of rugged, die-cast alloy housed high fidelity 8 and 12 in. unitary loudspeakers. Jensen Mfg.

ELECTROLYTIC MANUAL 307

An updated edition of a popular electrolytic capacitor replacement manual covers 291 different manufacturers from Acme to Zephyr, including TV sets as well as home, auto, and portable radios manufactured from 1947 up to April, 1964. Sprague.

SPEAKERS 308

Speaker system additions, as well as design innovations are fully described in two new catalogs. Argos Products.

ANTENNA DATA SHEETS 309

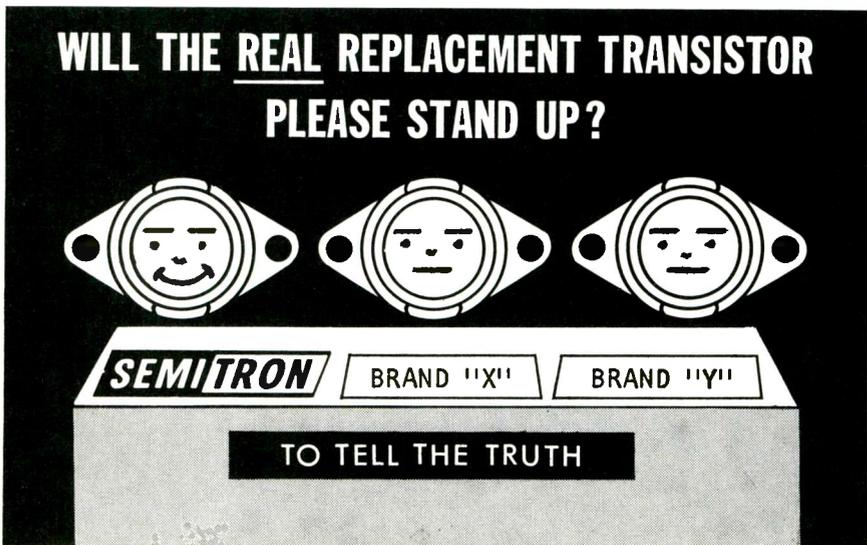
Catalog supplements CB antenna listings and confidential price lists. Antenna Specialists.

INVERTER 310

Brochure describes and lists specs on a transistorized 150-200 w inverter. Merit.

WIRE & CABLE 311

Catalog No. 864 lists a wide range of control cables FEP Teflon cables, paired cables and quads. Belden.



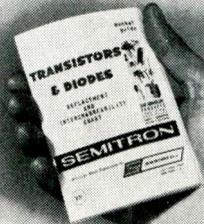
Semitron transistors "stand up" because they are service-engineered to the specifications and safety ratings of the transistors they replace.

To "tell the truth," Semitron is the only professional line for the Service Technician. For the businessman who works professionally and can't afford to experiment, only Semitron guarantees instant replacement.

- 40 Semitron transistors and diodes replace over 3000 semiconductors, "entertainment" or other. This includes any germanium transistor in any type of equipment (auto ignition, portable TV, hi-fi, CB, power supply) from any part of the world (U. S., Europe, Japan).
- Performance-proven, guaranteed, American-made line. No doubtful substitutions. Only first-quality semiconductors, service-engineered to the ratings of the originals they replace.
- Guaranteed instant availability. Your next replacement is now "on-the-shelf" of 1200 local distributors coast to coast — as near to you as your phone. All you need is to check the type number on the Semitron 1964 Transistor & Diode Replacement & Interchangeability Guide. Get a free Pocket Edition from your distributor, or send us 25¢ with your name and address.
- Rely on Semitron — the 5-year pioneer in semiconductor replacement. You'll see for yourself why 60,000 professional service technicians acknowledge Semitron as the only complete program for the professional.



Semitronics Corp.
265 Canal Street
New York, N. Y. 10013



Please send me the 1964 Semitron Transistor & Diode Replacement and Interchangeability Guide, (Pocket Edition). I enclose 25¢ for postage and handling.

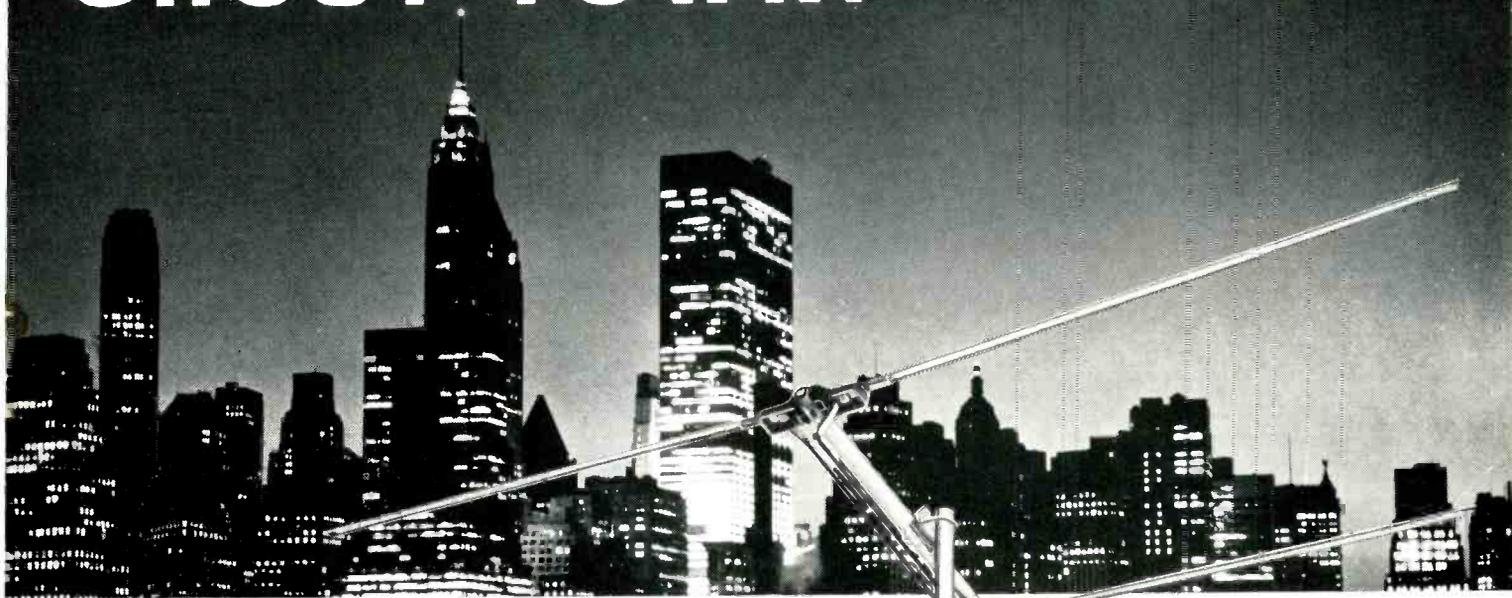
Name.....

Address.....

City or Town.....State.....Zip Code.....

--- for more details circle 45 on post card

GHOST TOWN!



Clean it up...take it over... with this unique new Channel Master antenna

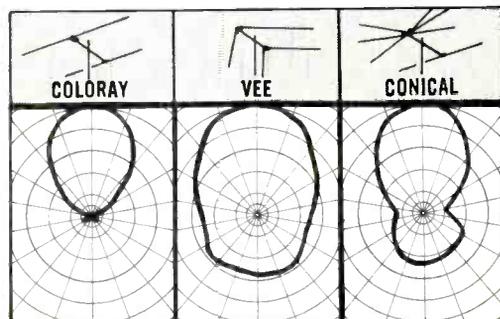
The Coloray. A new kind of antenna **GUARANTEED** to make city (and suburban) TV sets give up the ghost, knock out interference. And has proved it time after time. Right out there in the field—among the tall buildings that cause 80% of the city's TV troubles.

The Coloray is so effective, in fact, that we dare guarantee it to do a better ghost-killing job than any other antenna on the market . . . regardless of size, type, or price . . . or your money back! It is the only antenna in the world backed by such a guarantee.

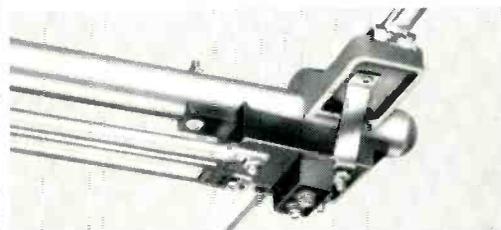
Enjoy Fringe-Area-Type Profits! No longer are you forced to sell metropolitan antennas on a low price, low profit basis. No longer need you envy fringe-area dealers their high profits on expensive antennas.

The Coloray gives you a real **performance** advantage . . . that means big new profits from a waiting market willing to pay a little more for it. Model 3110-G. Includes E.P.C. protective "Golden Overcoat." Also available in kit form, Models 3115-G, 3116-G.

Higher Front-To-Back Ratio Than
a 10-Element Single-Channel Yagi.



Compare polar pattern of Coloray with those of most commonly used city antennas.



The secret! A transposed phasing harness with an impedance balancing Power Equalizer Circuit that is really unique.

CHANNEL MASTER COLORAY*

hands you the key to the ghost city

--- for more details circle 19 on post card

CHANNEL MASTER • ELLENVILLE, N.Y. *Patent Pending

I. F. & R. F. COILS

30,000 O.E.M. Replacement Parts in our Catalog No.164
 Even non-listed items receive our same day service
 Just send us model no., part no. or defective unit

across the nation
 it's
J. W. MILLER
J. W. MILLER COMPANY
 Factory: 5917 S. Main Street Los Angeles 3, Calif U.S.A. Phone ADams 3-4294—FAX No. XCM

--- for more details circle 37 on post card

EDITORS' MEMO

Antenna Season?

This is hurricane, tornado and just plain "twister" season along the eastern seaboard, the gulf coast and in many inland areas we could poke a finger at on the map. And many technicians have grown to feel that it's antenna season, too. But it is and it isn't, depending on how you look at it. Actually, this is another one of those "pearls of wisdom" that cultured itself on a grain of truth.

Every day in the year is antenna season throughout a large section of the country and for at least 7 or 8 months a year in northern areas—for alert service-dealers and technicians, that is.

From now until old-man winter clamps icy fingers on roof tops across more than half the nation, many of you will have an overflow of antenna business. And this winter some of you will be postponing or even turning down urgent requests for antennas in zero or sub-zero weather. Most of the antennas that fall apart in winter were already defective last summer—and they are wrecks right now. All they need is a puff of wind or a little icing to put them totally out of commission.

Yes, this is antenna season. But so was last summer when your business was slow and last spring when it was just beginning to pick up a little.

If you want to stop losing antenna business in winter, or stop competing for business under winter working conditions, then make autumn, spring and summer your antenna season. It takes a little get-up-and-go but you can show most TV viewers right now why they'll be crying for a winter antenna job later. And you can show others the same thing in spring and still others in the balmy summer when your TV repair business is normally slow.

If other service-dealers and technicians can sell antennas the year 'round, so can you. And if you don't know how it's done, then read a few of the articles in this issue. All of these articles were

Continued on page 79



MAKE EXTRA PROFITS WITH THIS NEW HEATHKIT® FM STEREO GENERATOR

ONLY \$9900

- Everything you need for fast, simple servicing & alignment
- Produces all signals required for mono & stereo FM servicing

Enter the profitable field of mono & stereo FM servicing now! This new Heathkit FM stereo generator offers complete facilities for every alignment and trouble-shooting need. Signals generated by the IG-112 include audio or composite stereo signals for tuner, receiver and multiplex adapter adjustments . . . phase test for accurate alignment of subcarrier transformers . . . special SCA frequencies (65 & 67 kc) for aligning even the most advanced-design tuners . . . a crystal-controlled 19 kc (± 2 cps) pilot signal, adjustable from 0 to 10% to check the lock-in range of stereo receivers . . . sweep function with built-in markers for overall IF & RF alignment . . . a 100 mc RF carrier (adjustable ± 2 mc) mono or stereo modulated . . . and many more! Balanced 300 ohm RF output permits direct connection to the antenna terminals of unit under test without complicated matching networks! Complete with test leads and detailed stereo alignment instructions. Order your Heathkit IG-112 now for faster, easier servicing and extra profits in this greatly expanding field of stereo FM!

Kit IG-112 . . . 10 lbs. . . \$10 dn., \$9 mo. \$99.00
 Export model available for 115/230 VAC, 50-60 cps; write for prices.





FREE CATALOG

Over 250 exciting Heathkits available in easy-to-build kit form. Save 50% or more by doing the easy assembly yourself! Send for your free catalog today!

HEATH COMPANY, Dept. 24-9-1
 Benton Harbor, Michigan 49023

Name _____ (Please Print)

Address _____

City _____ State _____ Zip _____

Prices & specifications subject to change without notice.

TE-130R

--- for more details circle 30 on post card

SNOW COUNTRY!



Clean it up...take it over...with **CHANNEL MASTER CROSSFIRES**

The world's most powerful TV/FM antennas. Way-out farm country is snow country. Real weak signal. Without the right antenna, there's a good chance viewers are seeing "spots" on their TV screen. Near fringes and often suburbia are also weak signal. Smart watchers know what to do about this problem in all these areas. They get the right Crossfire.

Top snow removal team! The revolutionary Golden Crossfire alone works on the principle of Proportional Energy Absorption. Meaning? There are more driven elements working with greater efficiency on the Crossfire than in any other antenna. It actually delivers the highest antenna gain of all time. Cleanest, too. The unique transposed feed line cancels rear pick-up beautifully. Perfect for color. And exclusive E.P.C. "Golden Overcoat" protects against every type of corrosion.

8 rugged, handsome Crossfire models are available... 1 for every area and budget. Feature them and you've got the snow country, the near fringes, and the commuter belt... right where you want 'em! In your money belt. Shown above: 28-element Crossfire for deep-fringes. Model 3600.

**Now! Channel Master
Reduces Booster Prices
Up to \$10.**

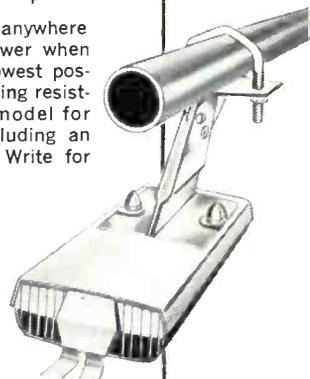
World's most effective antenna amplifiers.

... Because no boosters anywhere give you more extra signal power when and where you need it. Plus lowest possible noise figure. Built-in lightning resistance. Complete line covers model for every purpose and area... including an all-in-one rotator-TV amplifier. Write for catalog.

WAS \$39.95

NOW! \$29⁹⁵

Transistorized Telstar TV/FM,
with 4-set coupler. Model 0023B.



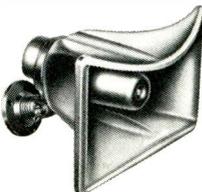
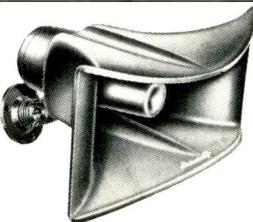
Model 3604, 11-element
Crossfire Suburban
... for high gain and
top directivity.

CHANNEL MASTER hands you the keys to the snow country

ELLENVILLE, N. Y.

--- for more details circle 20 on post card

Plan your paging/talk-back speaker installations around University ...the most complete line.

APPLICATION	REQUIREMENT	RECOMMENDED SPEAKER	SPECIFICATIONS
Complete coverage for small areas with low ambient noise levels. Spot coverage to assure uniform sound volume in large systems.	Wide dispersion. Good frequency response. Weatherproof. Compact size. *OLB	 UNIVERSITY MODEL MIL-A	7.5 watts 350-13,000 cps 120° dispersion 7 ¹³ / ₁₆ " dia. 6 ⁷ / ₈ " deep In 4, 8, and 45 ohm impedances.
Same as above and where overhead obstructions are encountered.	Same as above but with greater control of dispersion pattern, reducing reverberation and spill over. *OLB	 UNIVERSITY MODEL CMIL-A	7.5 watts 350-13,000 cps 120° x 60° dispersion 6 ¹ / ₄ " high, 9 ¹ / ₂ " wide, 8 ¹ / ₂ " deep In 4, 8, and 45 ohm impedances.
Coverage of sizeable areas with moderate ambient noise level. Amusement parks, warehouses, loading docks, portable P.A. systems.	High power handling capacity, high efficiency, greater low frequency response. Utmost reliability. Weatherproof. *OLB	 UNIVERSITY MODEL IB-A	25 watts 250-13,000 cps 90° dispersion 10 ¹ / ₄ " dia., 9" deep In 4, 8, and 45 ohm impedances.
Same as above and where overhead obstructions are encountered.	All of the above, but with exclusive University Wide Angle horn for reducing reverberation. *OLB	 UNIVERSITY MODEL CIB-A	25 watts 250-13,000 cps 120° x 60° dispersion 7 ³ / ₈ " high, 14" wide, 12" deep In 4, 8, and 45 ohm impedances.
Ceiling suspension of speakers to cover wide area. Using minimum number of units. Factories, department stores, depots.	Uniform 360° sound dispersion. Built-in driver. High power handling capacity. *OLB	 UNIVERSITY MODEL IBR-A	25 watts 300-10,000 cps 360° dispersion 13" dia., 10 ¹ / ₄ " deep In 4, 8, and 45 ohm impedances.

*OLB - Patented University Omni-Lok Bracket directs and locks speaker in any plane with a twist of the wrist.

University paging/talk-back speakers offer high microphone sensitivity for reliable talk-back communications. Their rugged construction assures lifelong dependable operation. Above all, University "High A" (High Audibility) engineering assures a degree of intelligibility that has never been matched in speakers of this type. For free catalog, write desk ET-9, LTV UNIVERSITY DIVISION, Oklahoma City, Oklahoma.

LTV UNIVERSITY
A DIVISION OF LING-TEMCO-VOUGHT, INC.
9500 West Reno, Oklahoma City, Oklahoma

- - - for more details circle 58 on post card

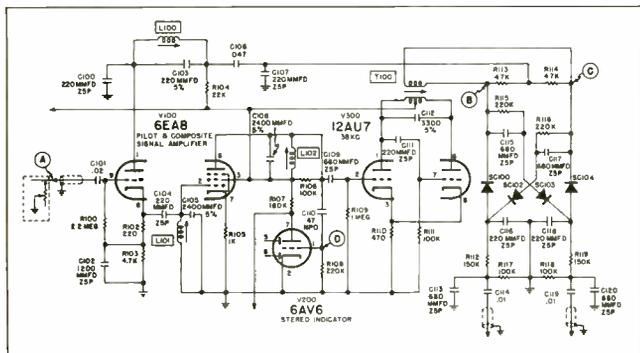
ELECTRONIC TECHNICIAN

TECHNICAL DIGEST

ADMIRAL

Schematics for TV Chassis C21A1-1A, C21A1-1E and C21A10-1C
Stamped Run and Run 11—Component Listing Corrections

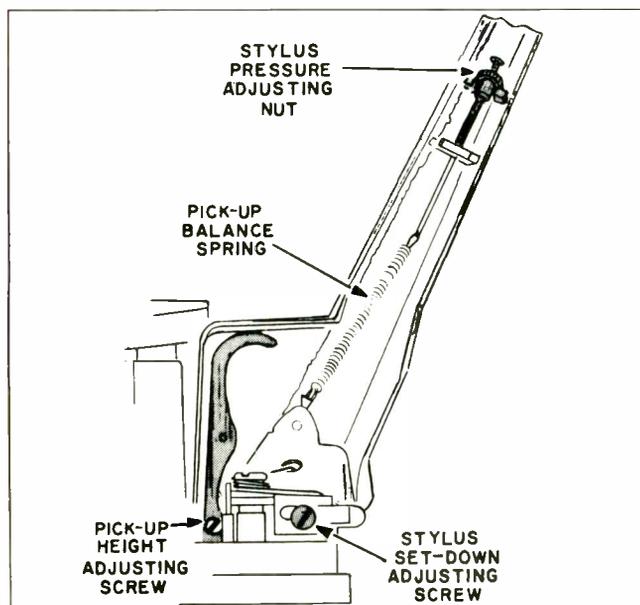
Run 10 and 11 are identical. Resistor R413 should be listed as 470,000 Ω , instead of 680,000 Ω . Vertical hold control should be 750,000 Ω , instead of



1.2 M Ω . Resistor R436 should be 150,000 Ω , instead of 47,000 Ω . Capacitor C405 should be 470 pf, instead of 20 pf. Capacitor C408 should be 560 pf, instead of 1200 pf. Pin numbering for V405 (1X2B tube) is incorrect. Should be 2 and 9 instead of 4 and 8.

DUMONT

Stereo AM/FM Hi Fi Phonograph Record Changer
819206—Adjustment Settings

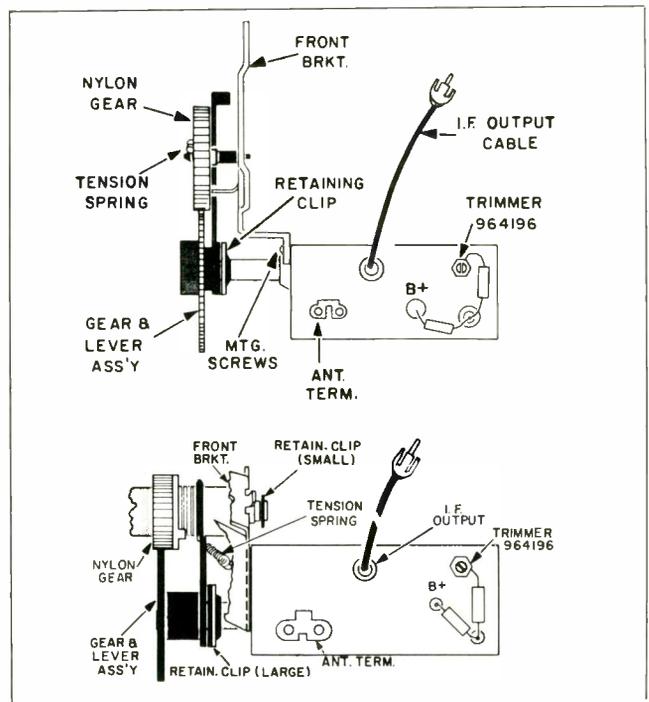


Stylus Set-Down: Raise pick-up arm and adjust screw indicated for proper set-down on the lead-in groove of a 10-in. record. When correctly adjusted for a 10-in. record, the set-down point for 7-in. and 12-in. records should also be correct. **Pick-Up Height:** Adjust screw indicated (accessible through hole in top of pick-up arm) until stylus point is approximately $\frac{7}{8}$ -in. above the turntable mat as the pick-up arm returns to the rest post. **Stylus Pressure:** Adjust stylus pressure by turning the stylus pressure adjusting nut until the correct stylus pressure of 5 to 7 g is obtained.

EMERSON

TV Chassis 120744G/753J—UHF Tuner Field Alignment

UHF Tuner alignment is factory pre-set and should not require any additional adjustments. Should it become necessary to change the oscillator transistor



try several, choosing the one which most closely resembles the original with regard to sensitivity and calibration.

UHF tuner 471532 is supplied with gear and lever assembly, nylon gear and front bracket. UHF tuner 471541 is supplied with gear and lever assembly, tuning shaft assembly and front bracket. Therefore, if

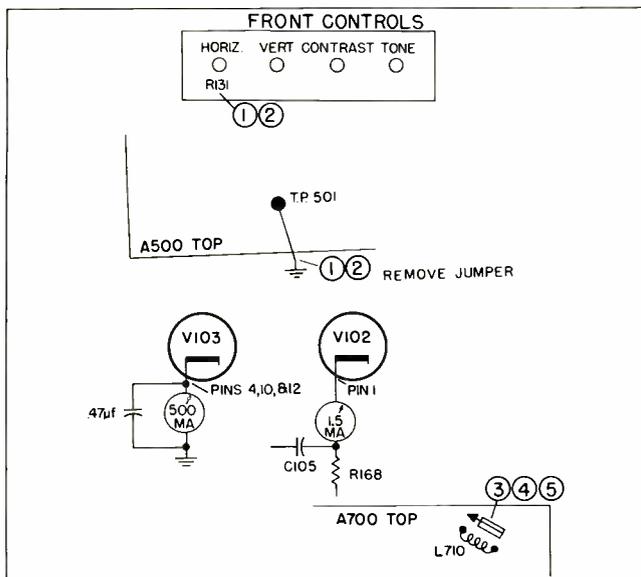
TECHNICAL DIGEST

returning one of these units for service or replacement, it should be shipped complete with IF output cable and all of the aforementioned items. Only the antenna lead-in wire should be removed.

GENERAL ELECTRIC

TV FY Chassis—Horizontal Deflection Alignment

Tune the receiver to a signal and synchronize the picture; open jumper (see diagrams) and insert a 0-500 ma meter between tube socket terminals 4,



10, 12 (cathode) of V103 (horizontal output) and ground. Bypass meter with a $0.47 \mu\text{f}$ capacitor; connect a 0-1.5 ma meter in series with cathode lead of V102 shunt regulator by opening jumper between the cathode of V102 and the junction of C105 and R168; connect a VTVM through a high voltage anode lead with high voltage probe at CRT.

1. Short jumper from TP501 to ground. Adjust horizontal hold control, R131, to center of its range.
2. Adjust L501 slug until picture drifts very

slowly and sides are vertical. Remove TP501 jumper. Check R131 at both ends of its range.

3. Adjust L710 (horizontal efficiency coil) for current of 210 ma. (Current should not exceed 220 ma.)

4. Adjust R105 for 24.5 kv. Check current on milliammeter. Current must not be less than 1.5 ma with minimum brightness. Try to attain as close to 1.5 ma as possible while turning L710 core no more than $\frac{1}{2}$ turn clockwise and checking to see that horizontal output tube current does not exceed 220 ma.

5. If foldover occurs after adjusting R105, re-adjust L710 (horizontal efficiency coil) clockwise to eliminate the foldover. Be sure that current milliammeter does not exceed 220 ma. Adjust focus, height, and vertical linearity controls for proper focus and vertical size. Don't forget to replace jumpers when milliammeters are removed.

PHILCO

Color TV Chassis 14M91—No Color, Sound OK

If no color, insufficient brightness and adjustment of brightness control has practically no effect, trouble is probably in the chroma section. Check at the common color difference amplifier cathodes. If no signal is present, check at the blanker cathode. If a high dc voltage is found here, check for an open 820Ω resistor (R708), connected from the bandpass amplifier and blanker cathodes to ground. An open resistor in the common blanker, bandpass amplifier circuit, not only cuts-off the bandpass amplifier but removes dc restoration by disabling the blanker stage. Replacement of the open resistor restores color and proper CRT grid bias.

TRUETONE

TV Chassis 2DC3417B—Focus

The picture tube is electrostatically focused by means of a focus electrode in the gun assembly. If poor focus is obtained with normal operation of the receiver, check the focus connection strip located on the circuit breaker mounting bracket. Connect the lead (orange) of the picture tube focus electrode to points 1, 2 or 3 as shown on the schematic diagram for best focus.

SUBSCRIPTION SERVICE CHANGE OF ADDRESS

Please include your ELECTRONIC TECHNICIAN address label to insure prompt service whenever you write us about your subscription.

Mail to: ELECTRONIC TECHNICIAN Subscription Service Dept.
Ojibway Building, Duluth, Minnesota 55802.

To subscribe: mail this form with your payment, and check:
() new subscription () Renew my present subscription

Subscription rates: in the United States:
1 year, \$5.00, 2 years, \$8.00; 3 years, \$10.00.
Subscription rates for all other countries available on request.

ATTACH LABEL HERE

If you're moving, please let us know five weeks before changing your address. Place your magazine address label here, print your new address below. If you have a question about your subscription, place your magazine address label here and clip this form to your letter.

name _____

your job title or position _____

address _____

city _____ state _____ zip code _____

NEW... FROM THE JFD CHAMPAIGN, ILLINOIS LABORATORIES

JFD LPV-VU LOG PERIODIC

—the world's first all-channel VHF/UHF/FM antenna with single down-lead!



TAME
Television Antenna Manufacturers' Association
KEEP TV FREE

model LPV-VU15 15 active cells for
 VHF—up to 150 miles,
 UHF—up to 90 miles,
 FM—up to 60 miles

space-age engineered for finest COLOR and B/W TV . . . FM/STEREO reception!

Two years ago, JFD made history with the revolutionary new Log Periodic LPV antenna for VHF/TV and FM.

Now, the totally new JFD LPV-VU Log Periodic—the world's first VHF/UHF/FM antenna—will make new history for JFD dealers and distributors!

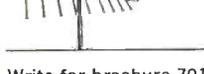
Engineered by the JFD R & D Laboratories, the LPV-VU is today's most advanced application of the patented log periodic concept of the Antenna Research Laboratories of the University of Illinois because:

1. The JFD LPV-VU is the first and only truly all-channel antenna to receive all FCC authorized VHF and UHF TV channels 2 to 83, plus all FM/Stereo frequencies.
2. Frequency independent log periodic design provides an unprecedented combination of remarkable gain... flat, full bandwidth response... sharp directivity... high front-to-back ratios... matched impedance and low VSWR on all TV and FM bands.
3. Only one downlead is required (a JFD AC80 splitter is included so lead-ins can be run to VHF, UHF and FM set terminals).
4. Unique low-impedance twin crossarms (in place of usual crossed feeder harness) help effect maximum distribution of all VHF/UHF TV and FM signals without variance.

The JFD LPV-VU offers a host of new mechanical advances, too, such as the twin square aluminum crossarms, stainless steel terminals, oversized unbreakable Celanese "Fortiflex A" insulators, solid aluminum bus bar transformers—plus handsome, electrically-conductive gold alodizing.

Get the JFD LPV-VU from your local distributor today.

Why sell today's VHF/UHF/FM markets with yesterday's antennas? Rely on the JFD LPV-VU Log Periodic to make the sales others can't—in color, black and white, and FM stereo!

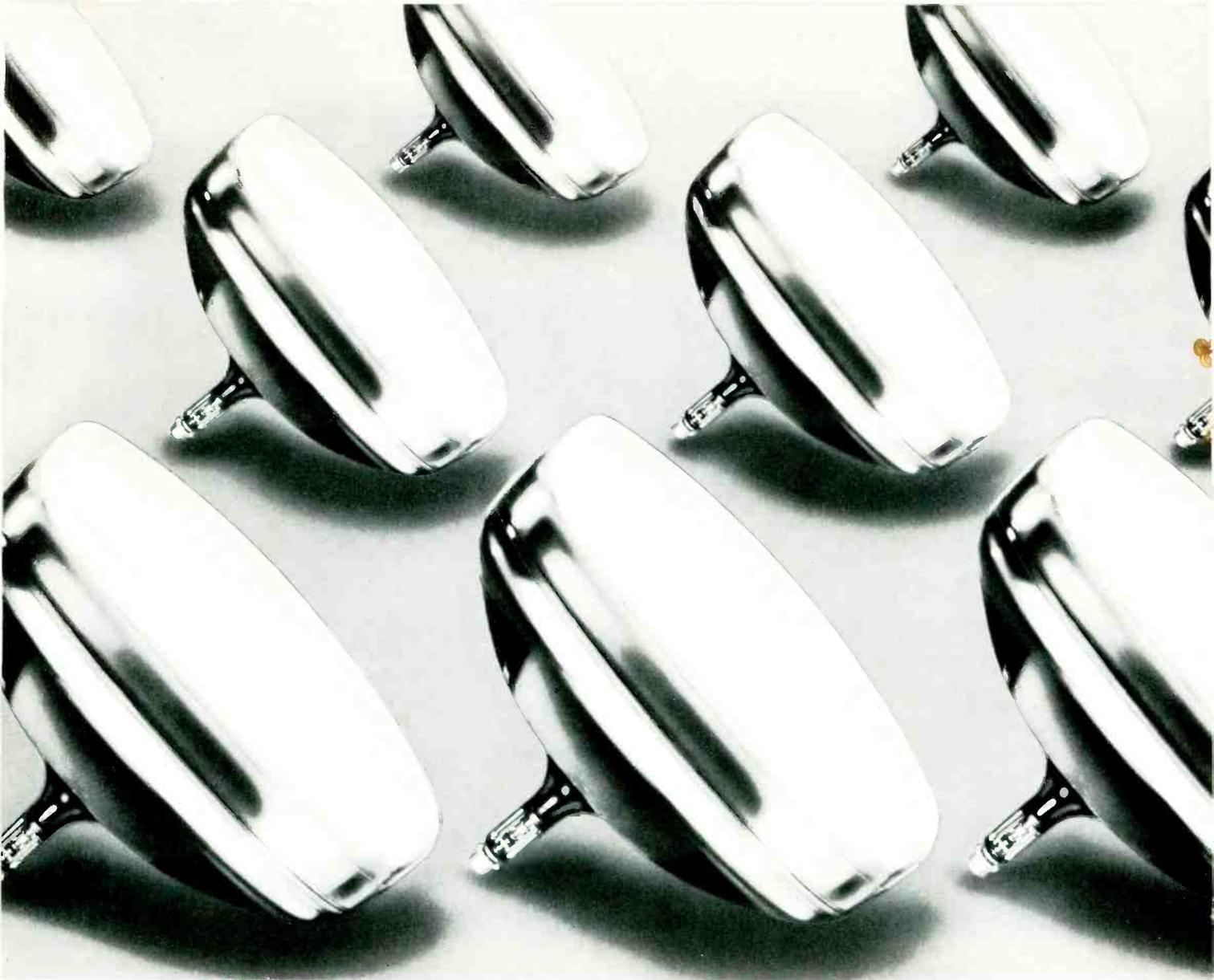
Model	Description	List
 LPV-VU18	18 Active Cells VHF—up to 175 miles UHF—up to 90 miles FM—up to 75 miles	69.95
 LPV-VU15	15 Active Cells VHF—up to 150 miles UHF—up to 90 miles FM—up to 60 miles	59.95
 LPV-VU12	12 Active Cells VHF—up to 125 miles UHF—up to 65 miles FM—up to 50 miles	49.95
 LPV-VU9	9 Active Cells VHF—up to 100 miles UHF—up to 40 miles FM—up to 40 miles	39.95

Write for brochure 701 for details regarding FREE N. Y. World's Fair trips for JFD Log Periodic dealers.

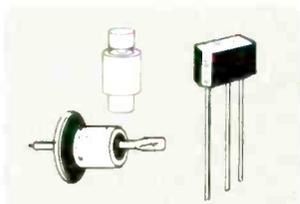
Whether the location calls for VHF...or UHF...or FM...or VHF/UHF/FM—there is a JFD Log Periodic antenna to suit your installation needs—perfectly.

JFD **JFD ELECTRONICS CORPORATION**
 15th Avenue at 62nd Street, Brooklyn, N. Y. 11219
 JFD Electronics-Southern Inc., Oxford, North Carolina
 JFD International, 64-14 Woodside Ave., Woodside 77, N. Y.
 JFD Canada, Ltd., 51 McCormack Street, Toronto, Ontario, Can.
 Copyright JFD Electronics Corp. 1964

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



THE QUALITY OF YOUR SERVICE DEPENDS ON THE PARTS YOU USE...DEPEND



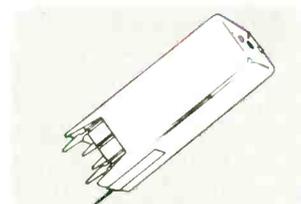
Diodes, Rectifiers, Condensers and Resistors

Complete variety for all makes and models.



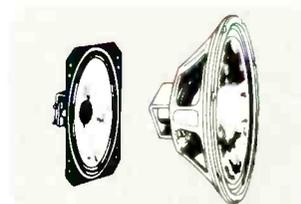
Universal Controls

With or without on-off switch. Standard taper, 3 inch shaft, half flat. 1 meg, 2 meg, 500 K. Complete selection. Fit Philco and other makes.



I.F. Transformers

For printed circuits, 4 lug, 5 lug or 6 lug types . . . to fit Philco or other makes. Dependable Philco Quality.



Replacement Speakers

All sizes, round, oval or rectangular types. 3.2, 8, 16, 20 ohms. From tiny 1 3/4" to giant 15" sizes.



Philco Receiving Tubes

To fit any make, any model TV or radio, manufactured to exact Philco standards, thoroughly inspected. Original factory cartons.



Rotary Switch Antenna

High gain type with 6 position switch for best possible signal selectivity. 3 section brass dipoles. Padded cast iron base.



Contact Cleaner

Philco TV and Radio Contact and Control Cleaner, Lubricant in self spray can, complete with protective cap and spray nozzle.



Philco TV Yoke

Genuine Philco TV yokes, made to original factory specifications. Accurately wound and inspected. Packed in individual boxes, ready to install.

There's a Philco Fully Stocked Parts Center Near You!

IF YOU NEED A PHILCO PART...YOU CAN GET IT FAST...HERE'S WHY

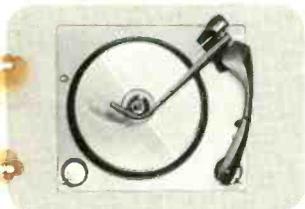
1. Philco has a nationwide network of Parts distributors—THERE'S one in your area.
2. Philco distributors are backed up by Parts Warehouses with millions of dollars in Parts inventory.
3. NEW Parts for NEW Philco models are shipped automatically along with the NEW products.
4. All Parts orders are handled by experienced Parts specialists.
5. ALL EMERGENCY orders are transmitted over the nation's largest industrial communications system and processed within 24 hours.

Whatever you need—whenever you need it—if it's a Philco Part just dial your Philco distributor. He has thousands of Philco Parts right now on his shelves. If the item you need is temporarily out of stock—he can get it for you FAST. You may DEPEND on your Philco Parts distributor.

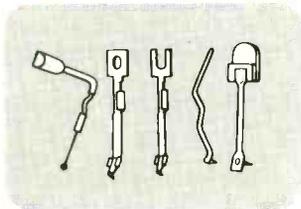
Customer Confidence Begins When You Use Genuine Philco Star Bright 20/20 Picture Tubes

Every CR Tube you replace represents a high-dollar service sale for you . . . and your customer. Play it safe with a brand that's known for Quality . . . PHILCO. All material and parts used in the manufacture of Philco Star Bright 20/20 Picture Tubes are new except for the envelope, which prior to reuse, has been inspected and tested to the same standards as new envelopes.

ON YOUR PHILCO DISTRIBUTOR FOR ALL YOUR PARTS AND ACCESSORIES



M62A 4-speed Record Changer
Intermixes all size records. Light-weight tone arm with retractable scratch protection assembly and famous Euphonics U8 cartridge. Changer ideal for built-in installations or "modernizing" record playing equipment. Template and instructions included.



Philco Phono Needles
A complete selection of types and numbers for Philco and most all other makes. Carefully made, attractively packaged. ALL TIP TYPES and sizes, including Diamond. Special now available—"THE BIG 18 KIT." This attractive compact metal case contains 18 of the industry's fastest selling needles.

Your Philco Distributor Features These Famous Makes

PHILCO • PHILCO-Bendix • CROSLEY • EVEREADY Batteries and Flashlights • CAROL Cables • GOODRICH V-Belts • GC Products • AUDIOTEX • WALSCO Products • COLORMAGIC Antennas • PRECISION Test Equipment • SPRAGUE Capacitors

Philco Parts are Available Through a nationwide network of Parts Distributors. Mail the Coupon Today for the Name of the One Nearest You.



PARTS AND SERVICE OPERATIONS

PHILCO

A SUBSIDIARY OF *Ford Motor Company*

--- for more details circle 42 on post card

Philco Parts & Service Operations
C & Tioga Streets, Phila. 34, Pa.

I am interested in receiving information about special Philco Parts offers, prices and facts. Please send me the name of the nearest Parts distributor.

Name _____

Address _____

City _____ Zone _____ State _____

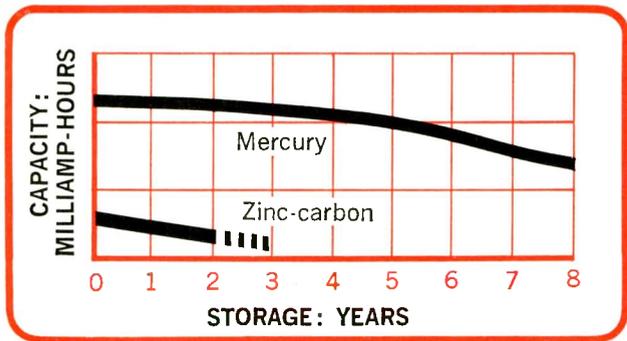
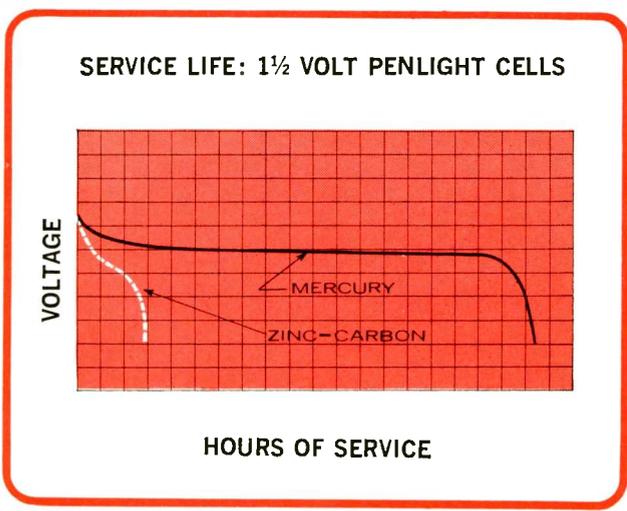
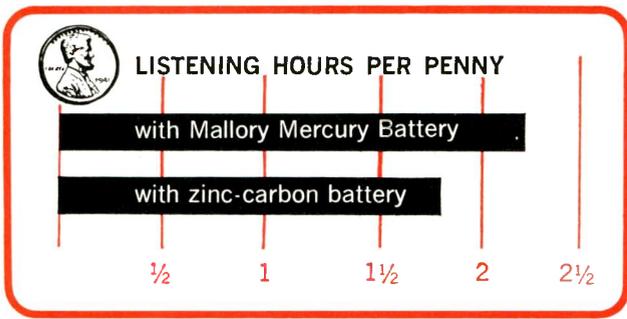


MALLORY

Tips for Technicians

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

Why Mallory Mercury Batteries work better in transistor radios



There are a lot of good reasons why more and more people are using mercury batteries in their transistor radios. And the reasons boil down to this—they're a better value, and they give better performance.

To get a comparison between mercury batteries and ordinary zinc-carbon batteries, let's look at a typical transistor radio. This radio uses size "AA" penlight batteries and has a current drain of 15 milliamperes. The Mallory Mercury Battery is the ZM9 and the zinc-carbon type would be the NEDA type 815. The ZM9 retails for 75¢ versus 20¢ for the 815. Got the picture?

Here's where the fun begins. The ZM9 will operate the radio for 165 hours versus only 35 hours for the zinc-carbon battery. This means that for one penny you'll get 2.2 hours of listening pleasure using the ZM9 versus 1.75 hours for the zinc-carbon battery. In other words, it costs you 0.57 cents per hour to use the zinc-carbon compared to only 0.45 cents for the mercury battery.

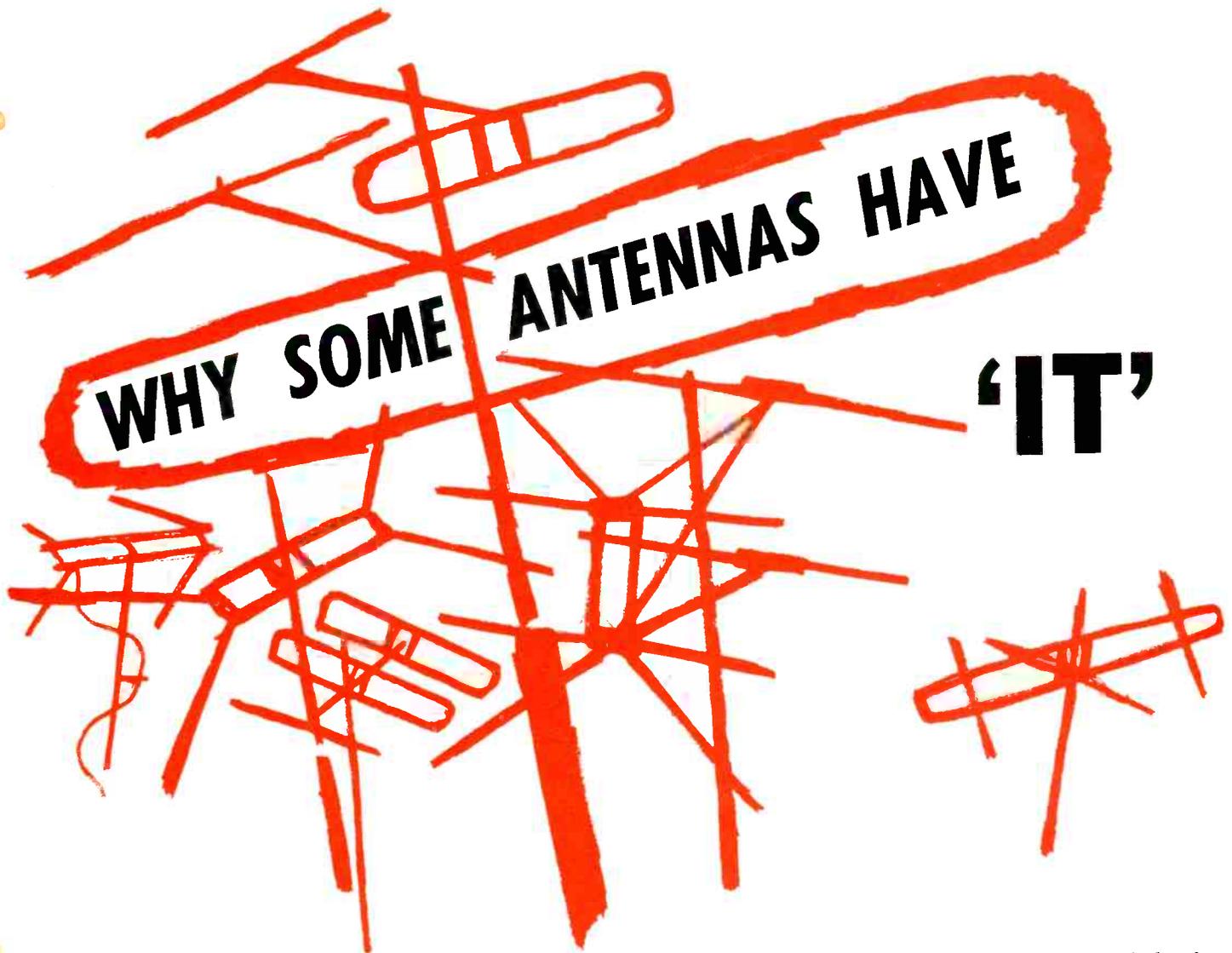
We're not through yet. Let's get back to *listening pleasure*. The mercury battery has essentially a flat discharge curve. This means that it presents a more constant voltage to the transistors. Result: you don't have to keep turning the volume control up while you're listening AND the radio *sounds* better because there's far less distortion.

Had enough? There's one more important point. Suppose you put the batteries in the radio and use it only slightly. Those 20¢ zinc-carbon batteries go "dead" in a few months whether you use them or not. But the mercury batteries can be stored 2 to 3 years and still deliver dependable power. Plus the fact that Mallory Mercury Batteries are guaranteed* against leakage in your transistor radio.

We've used this "Tip" to illustrate the superiority of Mallory Mercury Batteries in transistor radios. But this superiority extends to *thousands* of other applications. So whether you're building test equipment, heart-pacers, or satellites, see your Mallory Distributor. He has a Mallory Mercury Battery that will do exactly the job you want done.

*We guarantee to repair the radio and replace the batteries, free of charge, if Mallory Mercury Batteries should ever leak and damage a radio set. Send radio with batteries to Mallory Battery Company, Tarrytown, New York.

--- for more details circle 36 on post card
 ELECTRONIC TECHNICIAN



You can't 'palm-off'
second-rate installations today
at top prices

by *Keith Peterson*
Chief Engineer
GC Electronics

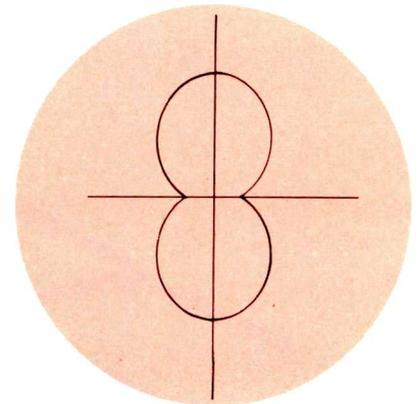
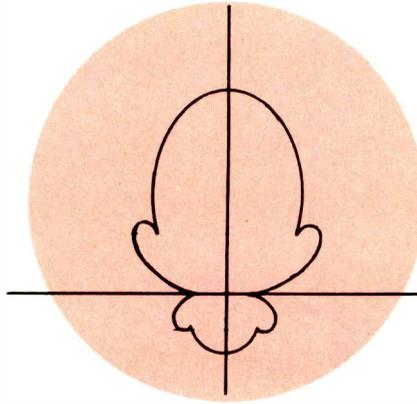
■ Important questions are now arising in the minds of many TV-radio service-dealers and technicians. All are anxious to plot a course toward a successful antenna selling and installation campaign when the boom begins soon. And the foremost question is "why do some antennas have "It"? Why do some antennas have satisfied customers and others don't? This question is easily answered but not easily learned.

People Are More Discriminating

U. S. consumers today have a "dollar-value" awareness. It's very difficult today to "con-off" second-rate materials and workmanship—15-dollar-value antenna installations at 40 dollars. And the consumer is interested in more than how well a particular installation works. Today's TV-viewer wants to know if the installation will cost him *less in the long run* through longer use-life and reduced maintenance! This is something you can't afford to forget. Your constant awareness of this fact, or lack of it, will determine the extent

WHY SOME ANTENNAS HAVE 'IT'

Continued



of your success in the service business for weeks and months and even years to come. But you need to have a technical awareness," too.

Understand Technical Characteristics

You need to understand the technical characteristics of the products you sell and service and install. You must know the product and its capabilities. This is your only "in" toward a successful business relationship with TV-viewers. A basic technical knowledge of antennas and accessory products can place you in the best position to advise your customers what antenna can best meet each of their particular needs. Moreover, if you obtain this "technical awareness" you can look forward to fewer service problems, fewer call-backs and *more* satisfied customers—that is, if you employ this technical awareness to guide your customers' purchases wisely. But let's find out how to get this "technical awareness."

Antenna Design

Before you can have the technical awareness necessary to effectively advise a customer which antenna will do the job, you must carefully consider several things. The first thing is antenna design.

Every knowledgeable technician knows what a Yagi antenna is, for example. It has high gain (depending on the number of elements), has a high degree of resolution (directivity) and a good front-to-back ratio. But it's no good for all channel TV reception—in some

cases even single channel reception—because of its low characteristic impedance and narrow-band response. It has to be modified to increase its characteristic impedance and bandwidth.

In recent years some methods have been developed to modify the Yagi sufficiently to broaden its response. But some of these methods were not very successful.

The method found that did an optimum job used driven elements—one resonating at the low end of the low band and the other resonating at the low end of the high band. The two driven elements were phased 180 degrees apart to reduce interaction. It was found that the arrangement worked best when the impedance of the driven elements were higher than the feeder impedance. This is true because the parasitic elements tend to lower the impedance when tuned for the best possible reception. But the Yagi director system made it almost impossible to receive both high and low band frequencies because the low frequency single director acted as a reflector on the Hi-band frequencies.

This problem was solved when a dipole director was developed that resonated on the fundamental harmonic of the low band frequencies and also on the second harmonic of the high band frequencies. This feature brought about an effective broad-banded Yagi type antenna. Still, one drawback remained with this element: the second and third harmonic operation of the element in the high band frequencies tended

to scatter the signal more than fundamental operation.

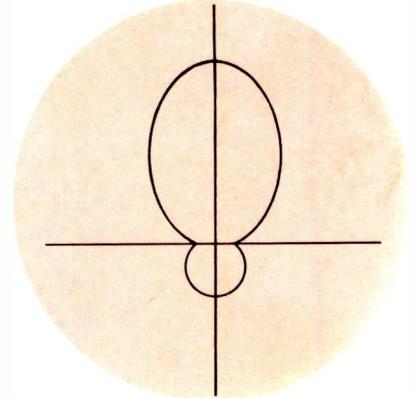
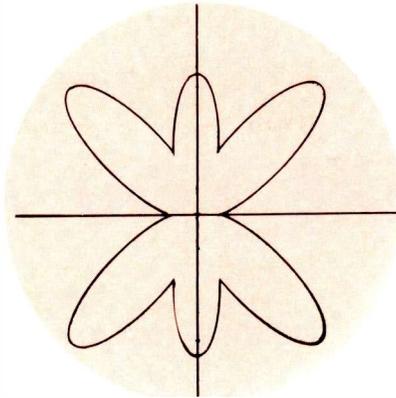
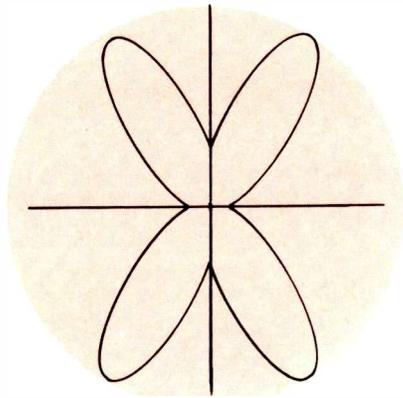
One approach to solving this problem requires a resonant parasitic element on the fundamental harmonic on both high and low band frequencies—with single high band directors placed between these dipole directors and tuned to direct the signal back to the driven elements. This appears to be superior to the average second harmonic TV element by producing a tight, "laser-linked" signal directivity and high gain.

Antenna Performance

How a particular antenna is designed will determine its performance. And the dimensions of almost all outdoor TV antennas are fixed—determined by wave length, amount of gain desired and the front-to-back ratio.

Three determining factors must be considered to evaluate performance (especially for color reception). They are VSWR (voltage standing wave ratio), the antenna's polar pattern, and a good flat gain vs frequency response curve. The antenna's VSWR determines the amount of signal, compared to the noise, introduced at the TV receiver. If the antenna has a very poor VSWR, color reception will smear. If the antenna's polar pattern has side lobes with the major front lobe, these may cause signal delay—creating ghosts and color mis-match on the TV screen.

The higher the front-to-back ratio with one major front lobe, the less your customer will be bothered with



co-channel interference and the video will be better.

If the antenna has too much gain for the area in which it is used, the set will overload—causing too much contrast and image distortion. The receiver's AGC can be adjusted to compensate for this action, however, in most cases. The proper antenna should be selected for a given televiewing area.

If peaks or valleys appear in the frequency response curve (Chart I), near the color burst frequency (3.5 Mc), edging will appear on the human faces and around lettering telecast in the color picture.

The performance of the antenna you select is important. But the performance may be short-lived if you have not considered how the antenna is manufactured. This includes construction, component quality, and the built-in protection against adverse weather conditions. True, some consumers may be limited in the amount of money they are able (or care to) spend for a TV antenna. But this has no bearing on the antenna's quality.

Construction

How the antenna is constructed should be rated high on the list which determines your technical awareness. Performance, design and weather-protection won't mean a thing if a gust of wind blows it off the roof this autumn, winter or spring—if modest winter icing snaps the elements off one by one like dead, brittle tree branches.

Where basics are concerned, it is generally known that a tear-drop-

shaped form offers the least wind resistance. "But what's this got to do with antennas?" you ask. Listen. . . .

When air or any fluid passes over the teardrop shape, it offers the least resistance because it has no sharp edges that tend to catch the fluid or air. Since there is little turbulence—it's turbulence that rips objects apart—the teardrop form remains undisturbed.

The next best form that offers least wind resistance is a cylindrical shaped object. That's why expansion bridges, subjected to extremely

high winds, employ cylindrical forms.

The form with the highest resistance to air or fluid is flat or square. It's in these areas that multiple edges catch the air or liquid and set up great turbulences behind the object; in many cases literally shaking antennas apart. This is the reason most TV antennas manufactured today are constructed with tubular or cylindrical shapes, especially if the antenna is large.

The rivet joints in antennas are also vulnerable to stress and strain

Continued on page 96

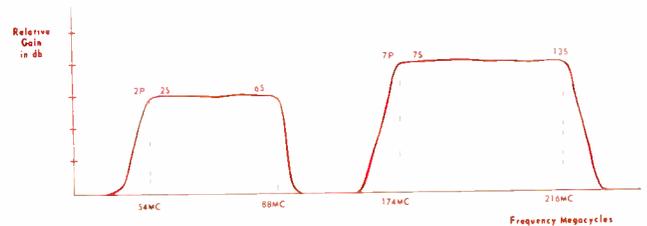
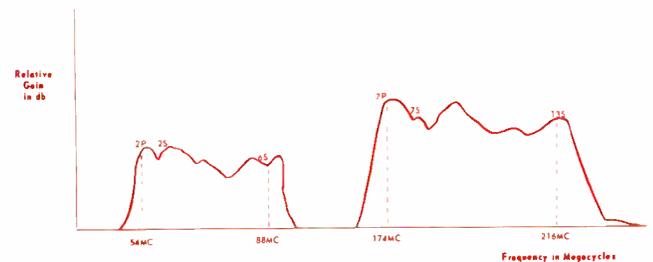


CHART I

Ideal frequency vs gain response curve (top), and poor response (bottom).

Frequency VS. Gain Response Curve Showing Ideal Flat Response For Color TV Reception of an Antenna



Frequency VS. Gain Curve Showing Peak and Valleys which Cause Very Poor Color Reception

ARE YOU MISSING THE

You are--if you are not doing a profitable business in TV and FM antennas and accessories

■ Whether you are grossing \$15,000 or \$50,000 annually, you can do better if you promote antenna installations. Many in the industry have been bemoaning the slim profits in low priced service calls. If these service-dealers and technicians would simply give greater attention to the untapped sources of antenna installation business immediately around them, as others have done, they would be profitably surprised.

Know Your Markets

Let's take a look at our immediate surroundings. For example, let's look at:

Color Television. In 1964, 1½ million color sets are expected to be sold. Can you give one good reason why a new antenna can't be installed with each one? A new color TV set owner is a gilt-edged prospect for an efficient outdoor TV antenna that will give him:

1. Flat response across the 6 Mc bandwidth of each channel.
2. High signal-to-noise ratio for realistic color reproduction.
3. Sharp directivity to eliminate ghosts.
4. 300Ω impedance match to insure low VSWR—so necessary for good color registry.

It's easy to sell a color-designed antenna to a color TV set owner or prospect. "After all," the customer or prospect reasons, "it's worth an additional small investment to get top-grade performance?" Why should you let a color TV owner

hook into a decrepit, under-powered, played-out TV antenna? Call it "salesmanship" or whatever you wish but you are obligated to give your customers and prospects the benefit of your years of technical experience and know-how.

Most likely his present antenna is ready to be junked anyway. And don't worry about the customer balking at the "extra" cost of a new color-designed outdoor antenna. On the contrary, he will be grateful for the wonderful reception—and you will gain a happy customer, an upgraded local image and a "bonus" profit.

Replacement Antennas. Some experts say that every year 12 million worn-out antennas become ready for retirement. Most antennas five years old have "had it". Naturally, if you let the problem ride so will the prospect—until the antenna falls completely apart this autumn or winter or next spring. The deterioration of picture quality is so gradual that the viewer never really notices that his reception could become spectacularly sharp and bright again with the moderate investment of a new TV antenna.

I met a technician in Champaign, Illinois who was reputed to be one of the busiest installers in town. Naturally, being curious about his success, I asked if he would tell me his secret. He nodded cheerfully and asked me to accompany him to his "Econoline" service wagon where he pointed to a 10 ft mast bolted to a swivel mount assembled flat along the van's roof.



by James C. Sarayiotos

JFD Electronics Corp.

"Watch," he smiled, and grabbed a preassembled antenna (with downlead already attached), U-bolted it to the end of the mast, and swung it up into receiving position over the roof of the truck. "That's all there is to it," he added, and then proceeded to outline the simple details involved in racking up all those sales.

If he spotted a broken outdoor antenna, or serviced a set having a weak antenna signal, he would ask the TV owner's permission to demonstrate the big difference in reception a new TV antenna would make. He would then swing up his antenna, run the lead-in into the nearest window and attach it in place of the old antenna downlead.

Needless to say, the eye-opening demonstration sold antennas. Total selling time, he said, was usually ten minutes!

This is one of many methods you can put to work to drive home the difference in reception a new antenna makes.

UHF Television. Authorities estimate that 55 to 60 million new all-channel television receivers will be sold by 1974. As you know,

'SKY' BOAT?

UHF signals are more susceptible to losses and distortions than VHF signals.

UHF signals are more easily absorbed. Buildings and trees and hills can cause severe signal loss. More signal loss will accrue in the feedline too. And if the lead is wet or dirty or cracked from age, this loss can soar to 600 percent.

This problem, of course, calls for UHF-engineered antennas and twin lead that provide the gain necessary on UHF bands. This equipment must be mounted on existing VHF antenna masts or as new installations.

But what happens if more new UHF stations become available in your area? It's obviously impractical to continue adding more UHF antennas. Your particular situation may call for a new all-channel VHF/UHF/FM antenna and a rotor—an almost universal need for *any* reception requirement. Sound interesting? It *does* make sense to most TV owners!

TV-radio service-dealers and technicians should not concentrate entirely on just selling UHF antennas to pick up newly opened channels. There's more here than meets the eye at first glance. The benefits of an all-new UHF antenna, powerful enough to receive local UHF channels and new UHF stations that may be going on the air in neighboring counties and towns should be considered. This will insure customer satisfaction with the installation and more reasonable profit for the installer.

In areas where VHF is received, technicians should not be content with adding a UHF antenna to existing VHF antenna installations. TV owners should be told how they can enjoy the all-channel advantages of a powerful modern new UHF/VHF antenna for a moderate additional sum. The dealer can



Motorized antenna elevated in receiving position on truck front

Are You Missing the 'Sky' Boat?

Continued

point out the sensible reasons why a single antenna with a single down-lead is mechanically stronger and more desirable esthetically. Electrically, an all-channel antenna will perform better than an installation where a new UHF antenna is added to an old, weathered VHF antenna that has lost a good part of its signal-gathering ability.

FM Stereo. Over 300 FM/stereo stations are now on the air. Close to 400 are expected to be broadcasting by the end of 1964.

Here's another golden opportunity to capitalize on a *need* for antennas.

A properly designed outdoor FM antenna is essential in FM stereo reception—in primary as well as fringe areas. Rabbit ears, line cord antennas or pieces of twin lead cannot do the job because they are not capable of responding fully to the 19 kc pilot signal broadcast by the FM stereo station. This 19 kc signal is necessary for decoding stereo information at the receiver. If it is not picked up properly, phase or frequency distortion will result and cause poor stereo performance.

Stereo-engineered FM antennas are scientifically designed to provide the additional gain necessary to overcome the power loss of the suppressed carrier and subcarrier of the stereo signal.

Existing FM antenna systems that give acceptable monophonic results often fail to produce satisfactory stereo signals. They lack the directivity and sensitivity of specially designed antennas that capture the low-level stereo signals and relay them to the receiving system without loss of strength or distortion of phase.

Accessories. Don't stop at antennas. UHF converters, amplifiers, couplers, distribution systems, rotors, lightning arresters, wire and similar corollary items can produce

extra profits—at mouth-watering margins. The accessory business has grown up. The advent of UHF, the growing number of multi-set TV and FM families, the desire for better reception in troublesome signal areas all add up to a mushrooming demand for devices to do the jobs.

How to Set Your Sights

Once you know your markets the next step is to plan your work by:

1. Deciding on a definite antenna advertising and sales promotion program with attainable realistic goals.
2. Organizing the selling tools you will need for the campaign.
3. Executing the program according to a pre-set schedule—without deviations.

Now is the time and your distributor can provide you with sales aids you need. All manufacturers make these aids available through your distributor.

You can count on the antenna manufacturer to have a complete assortment of sales helps ready. Prepared by experts for service-dealers and technicians, they beat the drums hard for new antenna business with compelling "reasons why" that result in sales.

A Pocket-Sized Advertising Campaign

Here is a quick run-down on how to get going. Let's begin from the inside of the store and work our way out to the hinterlands. It's easy and inexpensive.

1. Set up an antenna display inside your store.

2. Streamers, decals and banners on your walls or inside your window or showcases stating that you are an antenna specialist are also good silent salesmen. Change them every six months to keep them crisp and fresh-looking.

3. Doorknob hangers are effective and economical business-promoters. Keep a stack of them in each service truck. Whenever you spot a home with a weather-beaten antenna, stop and drop one of these "painless" reminders over the front doorknob. It's *sure* to be seen—perhaps saved—maybe acted on. Your cost: approximately 20 sec in time—and a fraction of a cent for the imprinted doorknob hanger.

4. Newspaper advertising mats, run in local county or shopper's weeklies, are also a fine source of new business. Include an offer of a \$3 or \$5 discount on the installation by making it a summer or spring special deal. Offer a free demonstration. Your ads can be small in size—but big in imagination and appeal. Your distributor and his suppliers can work out such a campaign tailored to your budget needs—and perhaps chip in to defray part of the cost, too.

5. Mailing lists could be one of your strongest lifelines to antenna prosperity. (See article *Update Your Mailing List*, August, 1963 *ELECTRONIC TECHNICIAN*.) You have your choice of a wide assortment of direct mail literature that antenna manufacturers make available to your distributor. Take advantage of them!

Keep a list of your customers, past and present. Get copies of voters lists from your county or town hall. Rent lists from your local agencies. Where there is a will, there is a way. And you cannot beat direct mail for personal impact, timing and completeness of sales message.

To Sum Up

1. Be aware of your antenna markets and their potentials.

2. Plan your work. Formulate a simple but positive plan for converting these opportunities into profits.

3. Work your plan. Get going—now! Use the few ideas here as "openers" for the hardest-hitting antenna business drive you have ever undertaken. Make a *real* effort.

And your investment will pay off in the pleasant tinkling of extra cash in the till. ■

ROTORS

Sweep The Horizon

Equip your own demonstrator antenna
with a convenient rotator

■ Antenna rotors, or rotators, are a necessity in many areas for good reception. They may be used to pick up stations in more than one direction from the TV or FM receiver location. By employing a modern high-gain, broadbanded Yagi-type antenna, expensive and elaborate multiple-type antenna systems are seldom required when a rotor is used. The single antenna system also reduces the possibility of interference pickup.

And in deep-fringe areas, a rotor is frequently a great help in improving reception because it allows the TV viewer to orient his receiving antenna in a direction to obtain the strongest signal. Viewers are more firmly convinced of optimum reception when they can "tune" the antenna to the best reception point themselves. In many areas, the strongest signals arrive indirectly from the transmitting station—reflected from hillsides, buildings, gas storage tanks, water tanks and from mountain sides. Additionally, the effects of co-channel "over-ride" can be minimized when the two stations are located in different directions from the receiver. Even if the two stations are located in the same direction, the undesired station is sometimes weaker than the other and a slight shift in the antenna's frontal lobe will reduce the weaker station's signal well below the noise level—leaving the stronger signal displayed clearly on the screen.

Rotors are also helpful in "tuning out" additional forms of interference when high-gain antennas are em-

ployed, including adjacent channel and cross modulation interference. And what is frequently a two-man job—adjusting the antenna to minimize multi-path ghosts—becomes a simple task of pushing a button or turning a dial on the rotor's control box.

As more UHF TV and Stereo/Multiplex FM stations are established, service-dealers and technicians will find an increasing number of antenna installations that will require rotors for improved reception and increased station coverage.

At The Survey

When you make a preinstallation survey at the antenna site, keep constantly in mind how the overall reception can be improved, or how a particular reception problem can be solved by addition of a rotor to the installation. If you have a fixed or telescoping mast type demonstrator antenna mounted on a truck or trailer, by all means have it equipped with a rotor. It will save you a lot of work and wasted time moving the truck or the mast around to orient the antenna for best reception from stations in various directions. And when your demonstrator is equipped with a rotor, it's a lot easier to demonstrate to a prospective customer that he *needs* a rotor in his installation.

Rotor manufacturers cooperate closely with service-dealers and technicians by furnishing full information on rotors, including installation tips, troubleshooting and repair techniques. ■

—Illustration credit: Alliance Mfg. Co.





Get Aboard the

You're the engineer,



The proper antenna and booster combination can extend UHF reception into deep-fringe zones.

by Robert McDonald
Gavin Instruments, Inc.

■ UHF is an aerial gravy train with a full head of steam. And it's standing here waiting for you to get aboard.

In 1963, 1,076,284 UHF antennas were *already* installed and this figure should easily triple with the recent FCC all-channel law.

Add to this the 60,000,000 existing TV sets that require complete UHF conversion—including antennas, boosters, and converters. Keep adding—and get a big sheet of paper—because more than 7,000,000 all-channel TV sets will be manufactured this year. **UHF ANTENNAS ARE BIG BUSINESS!**

There are already 120 UHF stations broadcasting and many more are opening up every month. Once a limited market, UHF has suddenly become a mass medium and sales of UHF antennas and boosters are on the increase across the nation.

Who's the Key Man?

Since consumers know little about

UHF in a technical sense, they turn to trained experts for equipment, installation and service. So the key man to unlock this market is you, the TV technician. You're the engineer, the fireman and the conductor of this 'aerial' gravy train.

Here are a few tips to help you choose antenna equipment more wisely, reduce installation time and eliminate headaches too. Most of all, you need to know how to ride the UHF gravy train non-stop—and know how and where you're going when you hop aboard.

Know Your Territory

No single antenna can meet every UHF need. Instead, UHF is divided into four major installation zones: metropolitan, suburban, near-fringe and deep fringe. Each zone has its special requirements and limitations. And the best UHF antennas are specially engineered to fit specific area needs.

The metropolitan zone is right in the heart of the UHF signal area—

close to the transmitting station. In some cases, indoor antennas provide adequate reception. But single bay outdoor antennas are frequently required to assure ideal reception. These antennas are small, inexpensive and easy to install.

The suburban zone requires higher gain antennas. Here double bay broad-banded yagis and comparable types will usually do the job.

For near fringe reception the four bay antenna is a good bet.

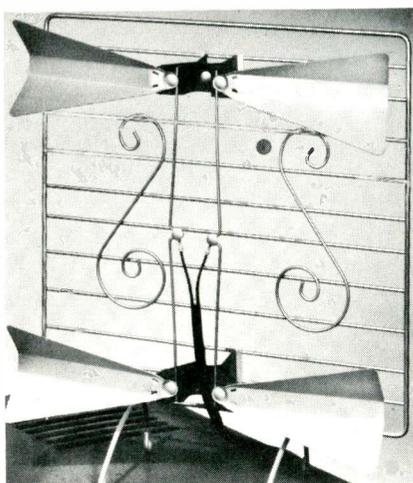
Is the deep-fringe viewer a prospect for UHF? Most assuredly so, if you select the proper antenna and booster combination. Remember, major UHF antenna manufacturers design their boosters to match their antennas. And antenna match is critical in UHF.

Reliable UHF reception is sometimes a bit "tricky" because of the signal's higher frequency, particularly with low-power transmitting stations.

1. Probe over and around the building to determine the strongest

UHF 'Aerial' Gravy Train!

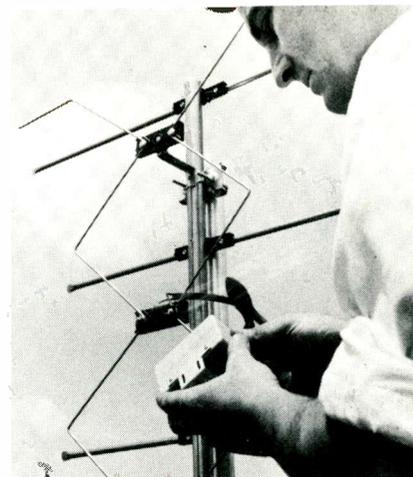
the fireman and the conductor



Under certain conditions, indoor UHF antennas may provide adequate reception in some metropolitan-zone areas.



In some densely-populated areas it's getting more difficult to find a good spot to mount another UHF antenna.



As a trained technician and TV expert, you are very much in demand by UHF-minded consumers.

signal location and mount the antenna there.

2. Try various heights and try aiming the antenna skyward and groundward to determine maximum gain position. This is sometimes necessary in difficult locations.

3. If the antenna must be located in the "shadow" of a natural or a man-made obstruction, the antenna can be aimed to pick up a reflected signal from a building, mountain, or a "mirror" located on a suitable hill or building. This "mirror" can be made of close-weave fencing or wire screen material. It can be as small as 4 x 6 ft, or several times larger. It will reflect available signal to a facing antenna, the way a mirror will reflect a beam of light.

4. Lowest loss transmission line should be used from the antenna to the set, particularly if the distance is more than 50 ft.

Hop Aboard

If the UHF gravy train has a station in your area, now is the

time to hop aboard and man the throttle. New stations are opening everywhere, virtually every week. If your area has no UHF programming at present, you can expect a time-table soon.

You should begin the job of educating your customers well in advance of a new station opening. Tell them what UHF is and what it will mean to them as TV viewers. Make use of available UHF equipment manufacturers' aids: UHF program guides, equipment and market fact reports, mail pieces, stuffers, streamers, point of sale displays, technical data studies, consumer attitude surveys and newspaper advertising mats. These are available through your local distributor.

Uncle Sam also helps make the UHF picture clear to your customers. For free booklets on "What you should know about UHF-TV," write to the FCC, c/o Electronic Industries Association, 1721 DeSales St. N.W., Washington, D.C.

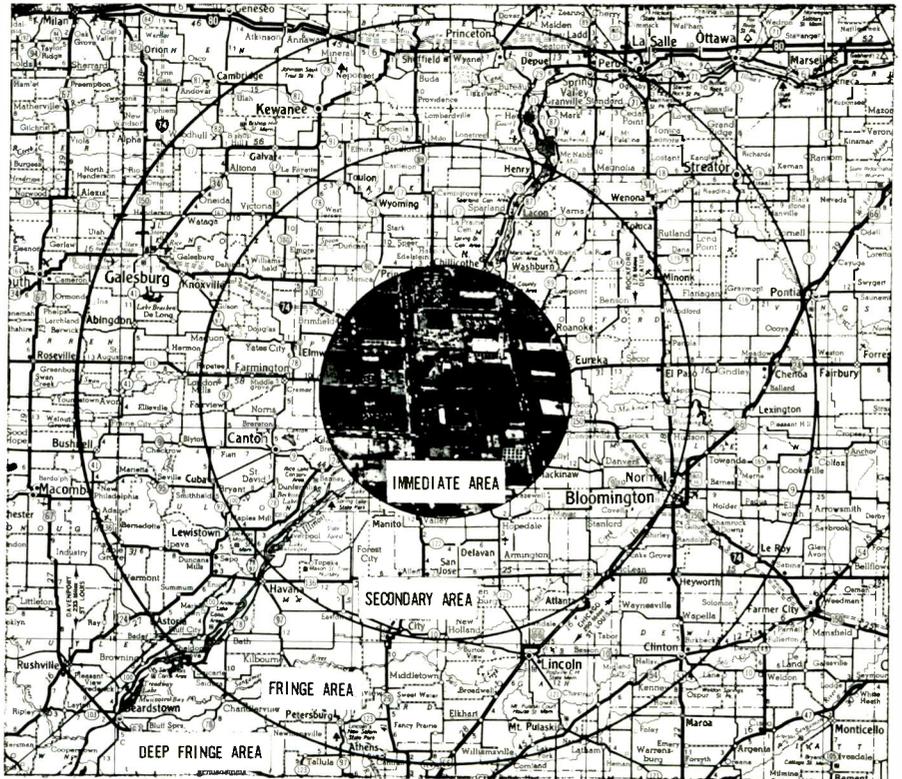
Tie-In Sales Are Simple

So far, you have seen the giant, growing market for UHF among existing set owners and among new set owners with all-channel TV. Remember, as of April 30, 1964, there were more than 60,000,000 TV sets not equipped for UHF reception. It is possible to sell not only UHF antennas, but profitable converters and boosters too.

Retail lists, including installation, can range from about \$25 to \$75 for the complete sale. Do not sacrifice quality for price. Sell the installation which provides the best possible UHF reception in your locality. The TV owner wants a clear picture, do not undersell the antenna system.

As a trained TV technician you can write your own ticket. As a TV expert, you are in demand by UHF-minded consumers. All you need to do is step aboard the UHF aerial gravy train and open the throttle wide. ■

Chicago-Area map.



DETECT...

A vast potential VHF/UHF antenna market awaits technicians who

■ A decided increase in consumer demand for both UHF and VHF antennas has recently taken place. This has been stimulated by the present emphasis on all-channel TV receivers and the growing market for color TV. The demand is for better reception. But this is only part of the story. . . . It is conservatively estimated that 75 percent of all outdoor antennas need replacing *NOW*. When this fact "syncs in", we begin to visualize the vast antenna market potential directly around us.

Check All Factors

Final and conclusive selection of the correct antenna for a given area is possible after an actual on-the-spot check is made. And a number of factors must be considered: transmitting and receiving antenna height, effective radiated power of the transmitting antenna, placement and sensitivity of the TV receiver; hills, buildings, weather, foliage and even seasonal changes.

Signal "bounce" frequently acts in a peculiar manner and occasionally will force an odd installation position. A field strength meter will, in most instances, save time and effort by pinpointing the strongest signal area. Sometimes, the addition of a booster will enable antennas used in the secondary area to also be applicable for the fringe area and antennas used in the fringe area to also be applicable for the deep fringe area. Boosters should not be used where a strong FM or TV transmitter is in the immediate area since serious overload problems may arise. UHF reception in fringe areas becomes acceptable or greatly improved by the proper use and selection of lead in, wire dress and stand off insulators.

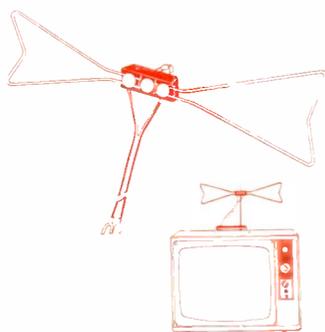
As we already know UHF radiation assumes some of the characteristics of light. That is, it tends to travel in straight lines, thus sharp bends, excessive loops and kinks in lead-ins should be avoided. UHF antennas also, because of their in-

herently high gain, are extremely directional and require proper positioning for optimum results.

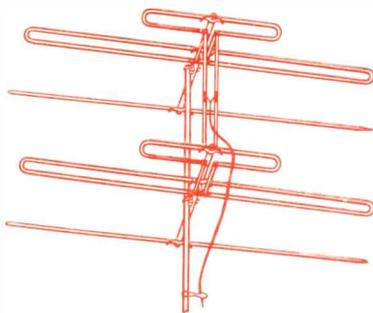
Although broader in area coverage than UHF, VHF is more sensitive to noise—car ignition systems, electrical storms and even the effects of turning a light switch ON or OFF. But a good antenna, properly installed and grounded, will usually eliminate the bulk of these troubles.

Area-Antenna Selecting

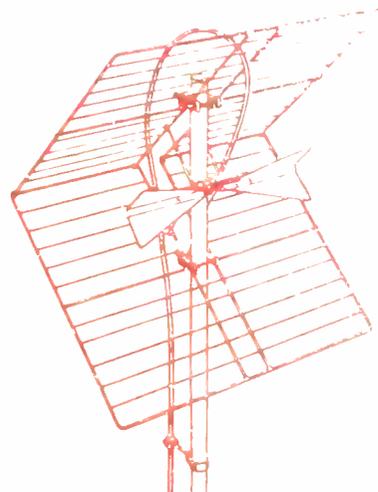
As shown on the Chicago-area map, four primary reception areas are designated as *immediate*, *secondary*, *fringe* and *deep fringe*. In the immediate or metropolitan area, where a strong signal is available, it is not uncommon to find that excellent B/W and color reception can be obtained with a "rabbit ear" type antenna. Some TV sets have built-in antennas and dipoles, which you simply "pull-up" when in use and "push-out-of-sight" when not. These perform equally well.



Universal snap-on bow tie indoor antenna for VHF.



Stacked in-line VHF antennas provide high gain for deep fringe areas.



All-channel UHF corner reflector.

SELECT... INSTALL

*know their reception areas and the array
to pick for the particular job*

It is recommended that a separate, outside antenna be used for FM Stereo, even if an attenuator is necessary. The outside antenna will reduce variable multi path distortion which is very objectionable.

In the secondary area, we must realize that we are moving out of the area where strong signals exist and into an area where we will begin to experience occasional reception difficulties. Here the buildings, signal "bounce," height of the transmitting tower and the receiving antenna and a host of other factors begin to affect reception. In these areas you can expect to install outside antennas. You are still in the UHF range, and UHF/VHF antennas can be used. As you move deeper into the secondary area, you will experience continuing signal loss until a point is reached when separate UHF and VHF antennas will be required. A corner reflector is excellent for UHF in this area. Antennas should be sturdily built to resist strong winds, ice loading

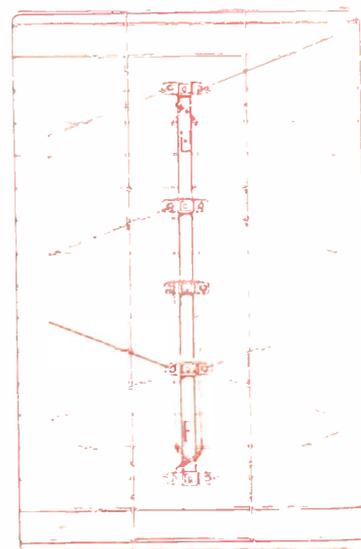
by J.E. Bayne

National Service Division
Admiral Corp.

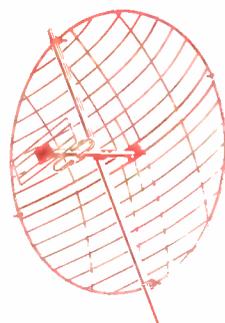
and general weather conditions.

We now come to the fringe area. Antenna installations here become more expensive and more elaborate masting and mounting problems arise. Since both UHF and VHF signals tend to flow in a straight line from the transmitter and do not follow the curvature of the

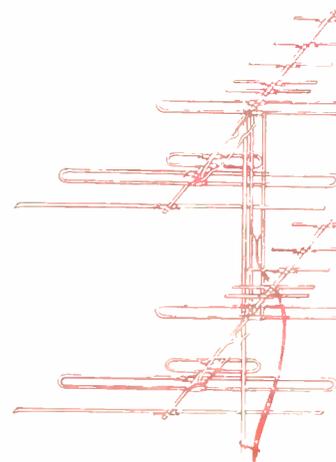
Continued on page 62



A 4-bay UHF bow tie antenna



49551



Stacked, broad-banded Yagi type antennas give high gain in fringe and deep fringe areas.

Single dipole parabolic antennas have low loss and high gain for UHF fringe reception.

VERTICAL LINES

(Conclusion)

In the beginning was the 'spook' . . .

by Joseph Hayes

■ "Scoot!"

"Yes, boss."

Bob glanced up abruptly from a schematic, startled by Scoot's unconventional response.

"I'm sorry about last Saturday," Bob said, "that pile of color sets got us in a bind."

"OK, I understand," Scoot said good naturedly.

"The 'Spook' line," Bob resumed, "always appears at the extreme left side of the raster. In fact, if it weren't for the CRT mask we would

be bothered by it more. Since the line is dark it tends to be wider on a raster than when a picture is on the screen. And both edges of the line are ragged. In cases where the 'spook' interference is weak, or when the incoming TV signals are strong, the line becomes very narrow and if you inspect it closely you'll see it is composed of short diagonal lines which seem to be in motion."

"Sounds like another case of the tuner picking up the signal since it

tends to disappear with a stronger signal. Is the 'spook' more prevalent on one channel than on another?"

"Yes it is. It's just the opposite of Barkhausen; the 'spook' gives more trouble on the low band channels. Spook signals result from damper circuit high frequency harmonic radiations.

"It's easy to see why the spook line is always at the left. It takes place simultaneously with the sharp damper conduction rise. Signals radiated include frequencies through video, up through VHF channels. Depending on spook signal strength, they can be picked up by almost any TV circuit, including the sync circuits.

"Other things being normal, most spook interference doesn't cause poor TV set operation. In most cases, the condition can be quickly remedied by simply increasing the picture size until the spook is hidden by the mask. If the spook line causes interference to sync circuits, the signal can usually be filtered with a small choke and a mica-type capacitor. Before you try anything, Scoot, adjust the linearity coil to proper resonance. In many cases this will kill the oscillation. Less frequently, changing the damper tube will correct the problem.

"If the choke-capacitor treatment becomes necessary, connect a 2 μ h choke in series with the damper plate or cathode—depending on which is nearest the B+ supply. If this helps, but doesn't kill the oscillation, you can connect an 80 pf or so capacitor from the choke to ground. This 'L' filter network keeps the signal out of the B+ line where it can be picked up by other sections of the set. If the problem persists, connect a choke in series with each of the other elements on the damper tube, including the filaments.

"Be sure too, that the high voltage cage is properly grounded and that the top is securely fastened. Remember, since the problem is basically one of radiation, you also have to be careful of lead dress. Sets with indoor antennas are more susceptible. That's another reason why you don't see much spook interference around here."

Other Vertical Lines

"I've told you a lot more than I intended when I started this talk—I guess I might as well round it out now with a few other horizontal section troubles."

"I thought we had covered everything—don't tell me there's more!"

"Yes. And the damper circuit is one of the main causes. If, as an example, you find dark and light bars down the left side of the picture the linearity coil may be ringing. If this is a problem, try shunting an 8.2 to 12K Ω carbon resistor across the linearity coil. That usually cures the trouble.

"In some sets you'll also see a ringing that's very similar to yoke ringing, also caused by linearity coil problems. Don't let it throw you. Most of the time, however, an open linearity coil causes very dark vertical bars and in most cases pretty bad foldover along with the bars.

Sometimes, in the same circuit, you'll find an anti-ringing network. It usually consists of a resistor, a capacitor and a coil all in parallel and in series with the damper tube. When one of the elements in this network changes value or fails, the symptoms are very similar to yoke ringing. You can usually tell the difference though, by examining the vertical lines carefully. Remember that yoke lines are almost always heavier at the top and bottom of the line. This is peculiar to yoke problems and I don't think you'll ever see it anywhere else."

"Bob, you sound more like a 'factory rep' without the commercial every time you give me one of these lectures."

"Sorry, but I'm not through yet! Overdriving the horizontal output tube is another common source of the vertical line. This type of line is always near the center of the screen and is lighter than the raster background. The line can also be more easily seen on a raster than when a picture is present on the screen. The first thing to do is check the drive control. If you can't get rid of the line by adjustment, you'll have to make some other checks. Overdrive means just that. Too much signal for the out-

put tube control grid. The first thing to do is scope the input to the grid and make sure the signal there is normal. A flat topped waveform at the input will also give the symptoms of overdrive."

"It looks like the overdrive symptom is always caused by the oscillator or the input circuit of the horizontal output. Right?"

"Wrong! In fact, one of the biggest causes is low screen voltage. A bad screen resistor, screen filter, or a B+ fault can cause this. Sometimes you can see other symptoms present when this is the case, though. For instance, if the screen voltage is low, you may not only have an overdrive line, but the width may be insufficient and the brightness may be lower than normal.

"Still another white-line malfunction that occurs on the right side of the screen is caused by parasitics. If you think this is the trouble, put a 100 Ω resistor in series with the output tube control and screen grids. This should kill the oscillations."

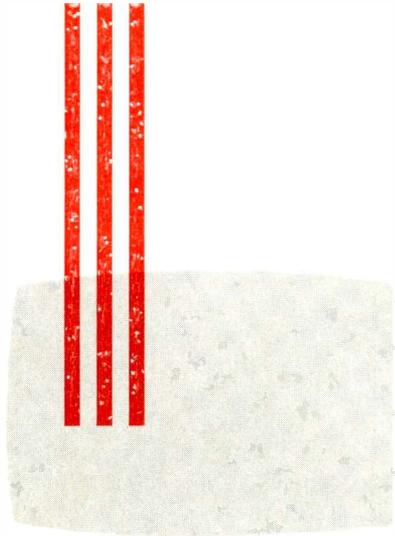
When It's Not Horizontal

"Bob, a while ago you said that vertical lines are *almost* always caused by a problem in the horizontal output. You showed me how drive lines could be caused by the oscillator. Are there any other sections that can cause vertical lines in the picture or raster?"

"There sure are, Scoot, and we could stay here all night discussing every possibility. But I'll show you some of the things that can cause vertical lines and are, strictly speaking, not caused by faults in the horizontal section.

"First, the vertical section can cause vertical lines." Bob pointed to a schematic spread out on the bench. "Look at this capacitor across the secondary of the output transformer secondary. If that capacitor opens on some sets, the symptoms will be very similar to horizontal yoke ringing. Also, the vertical windings can slip and cause pickup from the horizontal yoke. This signal can be fed back through the vertical retrace blanking system and intensity modulate the CRT beam. By the way, this can also cause vertical jitter.

VERTICAL LINES



Continued

“Another thing you should never overlook is the power supply. It’s not infrequent at all for an open filter to cause a very wide and dark bar in the picture. Depending on which filter fails, there may only be one bar or there may be two. This is one that’s easy to overlook since it is actually caused by loading at the horizontal frequency.

“AGC filters can cause similar symptoms except there’s usually no picture on the light part of the screen. Bridging the filter will usually show up this symptom.

“Several smaller dark bars can also be caused by an open mica bypass in the power supply of some receivers. These bars are usually no more than half an inch wide

■ Hum is defined as a 60 or 120 cps tone, or some harmonic thereof, heard in the output of audio amplifiers. It can come from three different sources:

1. Inadequately filtered power supplies.
2. Nearby ac power line circuits.
3. Ac tube-heater supply.

Power Supply Hum

Hum caused by inadequate dc power supply filtering is probably the easiest to eliminate. Once the source is determined, it can be eliminated by rearranging the supply’s components. This includes the rectifier itself because it develops a magnetic field which may extend far enough to be picked up by other components. For this reason it should be kept well away from low level input stages. This problem does not arise, however, in properly designed equipment.

Amplifiers employing push-pull output circuits are generally not as severely affected because ripple

voltage is cancelled by the phase relationship. For other output circuits, a hum-bucking coil placed in series with the loudspeaker voice coil tends to neutralize hum in the output.

Inductive and Capacitive Coupling

Hum from these sources is somewhat more difficult to locate. It arises from the magnetic fields created by ac transformers, chokes, heater wires and power lines.

Stray fields from transformers and chokes may be reduced considerably if these components are properly spaced and oriented on the chassis. And power transformer replacements should be mounted above the chassis if possible. The chassis tends to extend magnetic fields in flush mounted transformers.

Well shielded transformers and chokes have low leakage flux (small air gap in the core), but are considerably more expensive and not likely to be found in moderately priced equipment. If hum

is encountered because of shielding difficulties, try wrapping a shield around the transformer or choke.

Lead Dress

Grid and plate leads should be dressed away from heater leads, power line leads, chokes and power transformers. Dress tube grid, plate, resistor and capacitor leads close to the chassis. Grid leads of all stages should be shielded and kept short.

Ground Loops

Too many ground points may cause a ground loop condition—producing hum through circulating ground current IR drops. For example, if the coaxial cable shield used as a cartridge ground return accidentally shorts to a separately grounded chassis, then two ground paths are provided for the cartridge.

The chassis shouldn’t be used as a ground return because magnetically induced hum currents circulating through the chassis may

and are darkest at the left, fading gradually toward the center. You often see these little mica jobs tied right over the filter cans in the power supply. The trouble is always most noticeable on a blank raster.

"Ghosts are another frequent cause of vertical lines. It is, in most cases, a little more obvious what the trouble is. Actually, the dark bar you see is the horizontal blanking bar. On a weak ghost, the picture may not be visible, even though the blanking bar is quite visible. Familiarize yourself with the appearance of the horizontal blanking bar.

"The video amplifier may also pick up horizontal sync pulse there-

by causing vertical lines. Usually, poor lead dress is the cause and close lead inspection and repositioning will not only serve to correct this fault but will act as a check to make sure that lead dress is the problem.

"I know we haven't covered everything, but there's one last symptom I'd like to tell you about. The TV transmitter can also cause a vertical line symptom. The line is found on the left side of the raster and will be present only on one channel. The line will be thin and with ragged edges. You should be able to move the line by adjusting the horizontal hold control. If you run into such a symptom, call the TV station and tell them about

it. They should be only too happy to correct the problem.

"Now are there any questions?"

Just one, Bob. How can you afford to take so much time to tell me everything you know? Do you realize that you have cost yourself about \$15 in wages and no telling how much profit? You gave me a lecture once on money and I'm not likely to forget it."

"You've hit home Scoot. I should restrict your education time to coffee breaks. But if you remember everything I've told you today I'll be a very happy teacher, and it'll be worth every penny of it. If you apply all I taught you about vertical lines my investment in time will be returned tenfold." ■

Eliminating Hum in Audio Amplifiers

*Dress grid and plate leads away from heater
and power line leads, chokes and power transformers*

by Robert E. Batchelder

be coupled to the low level audio signal. A preferred method is a common ground point, soldered to the chassis near the input tube grid.

High Impedance Ground Paths

Hum is also prevalent in amplifier circuits which present a high impedance path to ground. This is most noticeable in grid circuits of low signal level input stages. Because this hum voltage appears at the grid, it is amplified by the tube. This voltage is proportional to the impedance of the electrostatic currents flowing to ground through the grid circuit. To help reduce hum

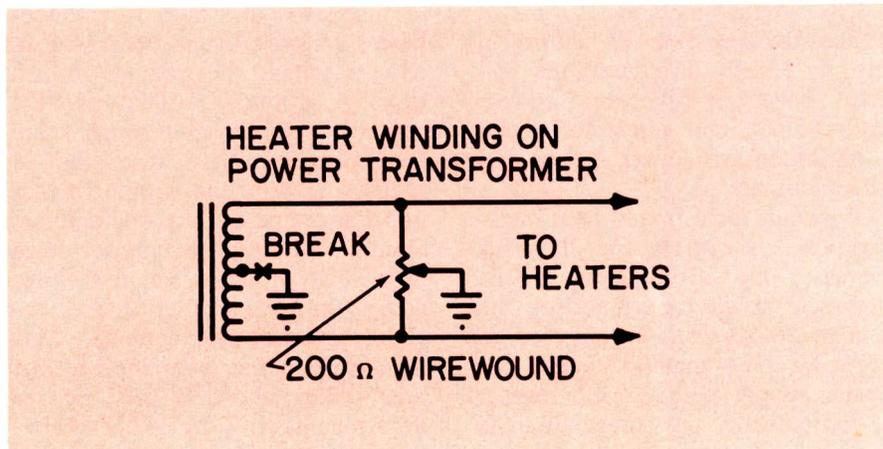


Fig. 1—Simple hum-bucking pot.

caused by electrostatic fields, circuit impedances should be kept to a minimum, and the tubes and grid leads well shielded.

Tube Filaments

Ac is just as good for heating cathodes as dc. But ac presents certain problems to both service technicians and tube designers. The ac field surrounding the heater wires is quite intense, and unless these leads are twisted and properly routed they may cause hum problems.

Directly heated cathode and filament-type tubes are the worst offenders because a direct connection exists between the heater supply and the rest of the circuit.

The hum problem with indirectly heated cathodes arises from the magnetic field set up by the heater. Leakage occurs occasionally between the heater and cathode, allowing a small voltage to appear at the tube grid. Generally, grounding one side of the heater supply will help, although better results are frequently obtained by grounding the filament transformer center tap.

Hum-Bucking Pot

The simplest method is to install a hum-bucking pot, as shown in Fig. 1. Merely disconnect the filament transformer's center tap, install the pot, and adjust for a null—minimum hum level in the amplifier output.

A circuit for a biased hum-bucking pot is shown in Fig. 1. This increases the effectiveness of the previous circuit by connecting the arm to 20-50 v of B+ instead of ground. This method makes the heater supply positive with respect to the cathode, thus preventing the flow of ac between the heater and cathode.

As shown in Fig. 3A and 3B, the grid and plate returns are connected to the filament transformer center tap. This provides an equal and opposite voltage to both sides of the filament. The balance is never perfect, however, and some hum will still be present.

The dc filament supply shown in Fig. 4 makes selection of an input tube and lead dress less critical. This circuit can be adjusted for either 6.3 or 12.6 v tube heater requirements.

Input Tube Shield

A significant reduction of first-stage hum can be obtained by soldering a metal shield to the center pin at the bottom of the tube socket. This is done as shown in Fig. 5. The shield is particularly effective with ac heated tubes.

Electron Tube Hum

Several hum causes are associated with electron tubes. They are: Cathode-heater leakage, grid hum, plate hum, induction hum, magnetic hum and emission from heater ends.

Cathode-Heater Leakage

Probably the most common cause of amplifier tube hum is cathode-heater leakage. It is generated in circuits where the cathode is not directly grounded. That is, the cathode is grounded through some impedance. In this case, the ac path is between the cathode-heater impedance and the external cathode circuit. When the filament voltage divides, it produces an ac voltage across the cathode impedance, between the grid and cathode. This ac voltage is then amplified by the tube. This situation may be relieved somewhat by properly bypassing the cathode resistor and by using a hum-bucking pot. The pot

is not too effective, however, because of the rich harmonic content of the leakage voltage. Generally, if shorting the cathode resistor decreases hum level, cathode-heater leakage may be assumed.

Grid and Plate Hum

Grid hum is provided by the voltage divider which consists of the impedance between filament and grid, in series with the external grid resistance, and acting on the heater supply. Here, a tube with low filament-to-grid capacity and good insulation resistance, helps reduce the hum level. A hum-bucking pot will also further reduce this level.

Plate hum is produced in the tube's plate circuit and is similar to grid hum, except it may not be as objectionable because it is not amplified by the tube. The ac path is now the impedance between filament and plate. Since this hum voltage is not amplified by the tube, it may be observed separately by cutting off the tube with a high negative grid bias. A hum-bucking pot will reduce the electrostatic plate hum.

Induction and Magnetic Hum

Induction hum is caused by induction between heater leads and other elements which produces a 90 deg out-of-phase voltage between them. The hum generated here is amplified by the tube, and internal tube grid and cathode leads become critical. The hum-bucking pot has no effect here because the hum is produced by a magnetic field from the heater supply. The problem is solved in tube design—where proper lead spacing and length are considerations.

Magnetic hum in a tube is generated by the magnetic field of the heater. The resultant voltage causes

ELIMINATING HUM

Continued

plate current modulation at twice the heater current frequency. Here again, the hum-bucking pot is useless, but tube manufacturers design helix- or spiral-shaped heaters to reduce magnetic hum.

Heater-End Emission

If the insulation coating is insufficient on heater ends inside the tube, hum may be produced. The electron path is either to the cathode, causing its voltage to vary with the heater supply; to the grid, when the heater voltage is negative with respect to it; or to the plate, when the grid voltage is just above the heater voltage. The resulting waveform is rich in harmonics, and the hum-bucking pot has some effect on the level as the voltage at the heater ends varies with respect to the cathode. To eliminate hum from this source it is necessary to keep the heater more positive than the grid.

Troubleshooting

By temporarily short-circuiting the grid of each tube to ground, starting with the output amplifier, the stage that is causing the hum can usually be located.

Generally, when a particular stage is short-circuited, and considerable hum reduction is noted, it means the source is from the preceding stage—although it may be originating in the short-circuited grid circuit. If shorting a grid does not decrease the hum level, the problem is originating either in the plate of that tube or the grid of the next one.

Aside from wiring errors, a defective tube, or inadequate plate supply filtering, objectionable hum usually originates in the first stage of the amplifier, hence, it may be better to check this stage first. ■

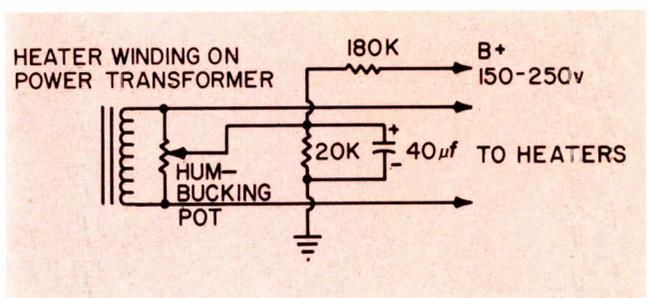


Fig. 2—Biased hum-bucking pot. The 40 µf capacitor is used for ac groundings.

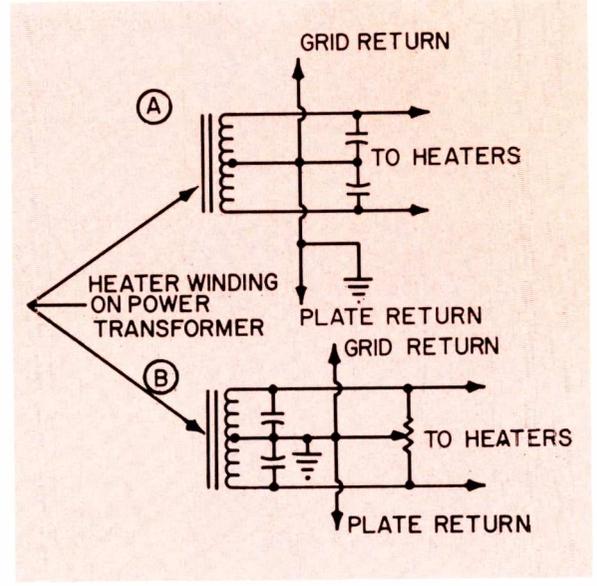


Fig. 3 — Filament center-tapping methods used with directly heated tubes.

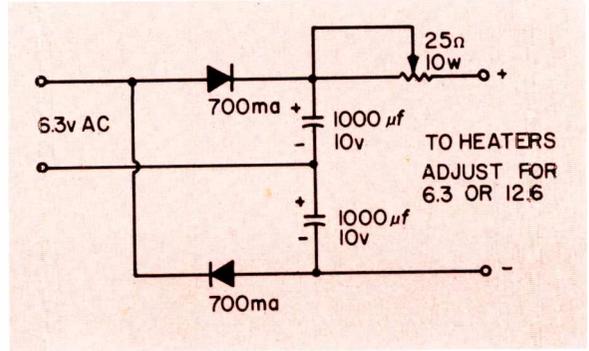


Fig. 4—Circuit for converting a 6.3 vac heater supply to dc. Rectifiers are rated at 18 v.

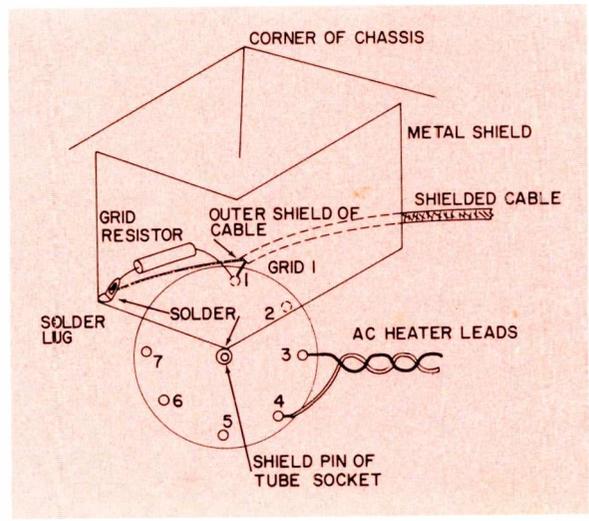


Fig. 5—Method of shielding input tube grid.

Another Approach to FM Stereo Demodulation

Operation of FM multiplex balanced peak detection system analyzed

by Milton N. Lanford and James W. Azbell

Bell Sound Division, Thompson Ramo Woolldridge, Inc.

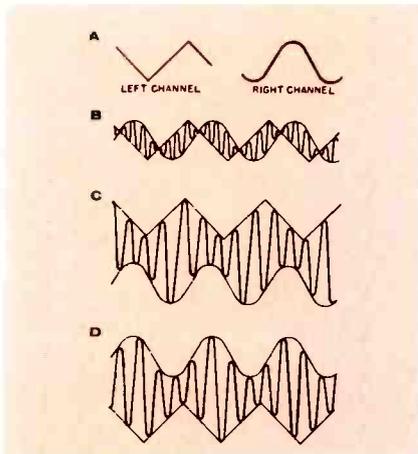


Fig. 1 (A)—Left and right audio modulation. (B)—Composite transmitted signal. (C)—In phase 38 kc insertion. (D)—Out-of-phase 38 kc insertion.

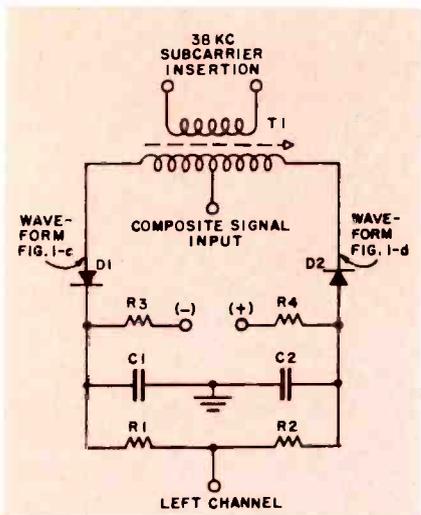


Fig. 2—Left channel circuit of the balanced detector system.

■ Three significant FM/stereo detection methods are available today: switching; filtering L-R modulation, detecting and matrixing; and envelope detection.

In envelope detection, the subcarrier is added in correct phase to the composite signal—the top of the envelope is the left channel, while the bottom is the right channel.

Subcarrier regeneration signal is eliminated from the audio output signal to prevent beats during tape

recordings by a balanced detector which cancels the undesired signal, as well as even order harmonics. A number of other systems use LC filters.

This subcarrier regeneration can be accomplished in a variety of ways. In any case, the 19 kc pilot must be separated from the composite signal and deliver a 38 kc signal to the detector. The fidelity and stability of this subcarrier determines the degree of separation achieved.

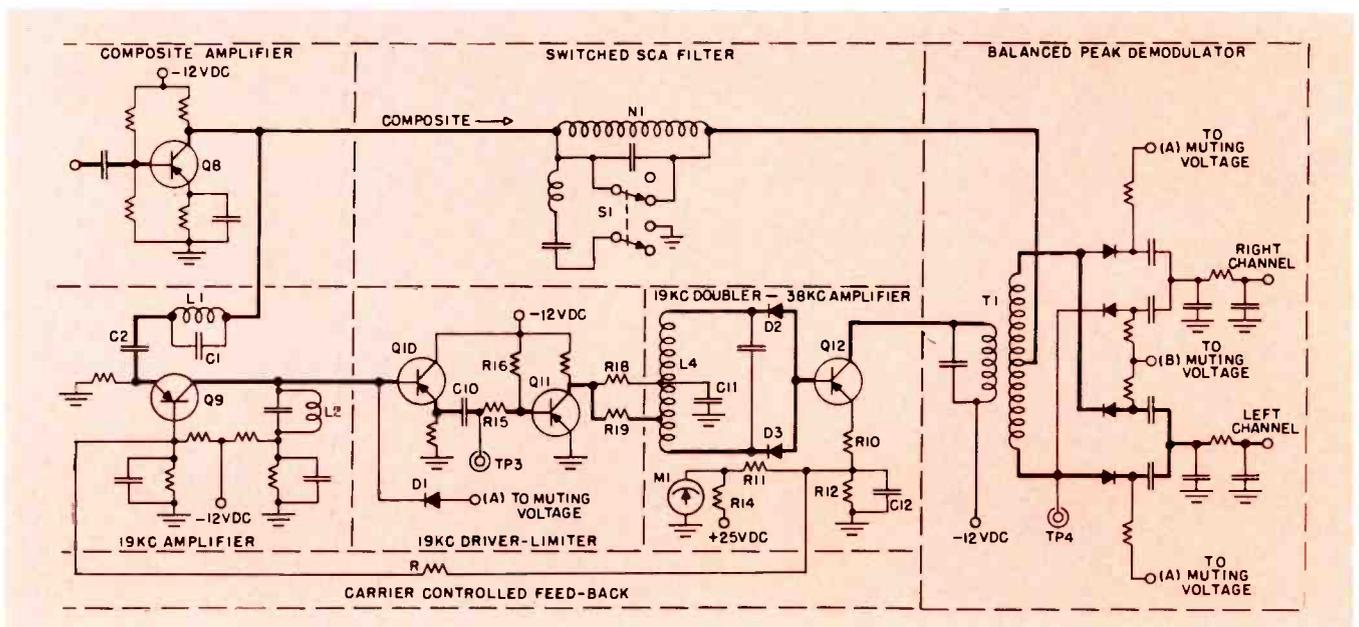


Fig. 3—Schematic of complete demodulator.

Balanced Peak Detection

The multiplex signal structure is shown in Fig. 1. Left and right channels are shown in Fig. 1A and the composite signal less the pilot signal is shown in Fig. 1B. If an in-phase 38 kc subcarrier is added to the composite, the left and right channels will be separated, as shown in Fig. 1C. An out-of-phase 38 kc subcarrier added to the composite results in left and right channel separation, as shown in Fig. 1D.

The balanced detector uses the signal forms, 1C and 1D, for its operation. A schematic of the subcarrier insertion and the balanced detecting system of the left channel is shown in Fig. 2.

The 38 kc subcarrier phase is inserted so diode D1 receives the waveform of Fig. 1C. The other side of the transformer's (T1) secondary winding has a 180 deg phase reversal and presents the out-of-phase waveform to diode D2 (Fig. 1D). Diodes D1 and D2 are connected to conduct the top of the waveform shown in Fig. 1C, and the bottom of that shown in Fig. 1D. Capacitors C1 and C2 form a peak detector, and resistors R1 and R2 combine the detected waveforms.

Since the 38 kc signal through D1 is 180 deg out-of-phase with the 38 kc signal through D2, and the audio is not, the circuit cancels the 38 kc signal. The combined audio signals remain at the left channel output.

Resistors R3 and R4 forward-bias the detector diodes and the diodes conduct a monophonic (monaural) audio signal from the composite amplifier to the left and right outputs. The forward biasing

potential for the diodes is derived from a squelch circuit, which, in the muted mode, reverse biases the diodes to accomplish inter-station noise muting.

The subcarrier regeneration circuit uses the 19 kc signal to generate 38 kc. In the absence of the 19 kc pilot signal, which represents a monophonic transmission, no 38 kc will be present at the detector. Automatic switching from mono to stereo is then accomplished by the forward bias of the diodes and absence of the 38 kc subcarrier.

Circuit Analysis

Referring to Fig. 3, the complete demodulator, Q8, is the composite amplifier which has a frequency response from 20 cps to 100 kc. The output of this amplifier is 3 v at maximum modulation of the FM carrier which corresponds to an input signal of 100 mv from the FM detector.

The composite signal is then connected direct to the balanced detector with switch S1 in the position shown. Band-stop filter N1 can be switched into the circuit to attenuate frequencies from 53 kc to 74 kc, the SCA subcarrier frequency. S1 is necessary since there is some stereo separation degradation when the filter is on.

A scope waveform of a multiplex signal with pilot as it appears at the collector of Q8, with Q9 removed from its socket, is shown in Fig. 4. The composite signal is supplied from a multiplex generator being modulated by two different sine waves for the left and right channels.

The 19 kc selective amplifier is composed of L1, C1, C2, L2 and Q9. The 38 kc signal is attenuated

by resonance of L1 and C1, and the series resonance of L1 and C2 couples maximum 19 kc signal to amplifier Q9.

Q10 is an emitter follower stage used to drive the limiter Q11. Under monophonic signal conditions Q11 is saturated by R16 and the collector voltage is low. When a 1-v 19 kc signal appears at the emitter of Q10, the limiter transistor is switched from saturation to cut-off at the 19 kc rate.

The 19 kc sine wave pilot signal may be observed at test point 3, the junction of C10 and R15. And coils L1 and L2 can be aligned for maximum 19 kc by scoping TP3.

Since Q11 is operating as a limiter, the wave form at the base will be a modified 19 kc sine wave, as shown in Fig. 5. The time constant of C10, R15 and R10 creates an approximate 12 v P-P 19 kc rectangular wave which can be observed at the collector of Q11. This wave form is shown in Fig. 6. This controlling time constant lessens the possibility of random noise pulses turning on the limiter.

The doubler circuit is composed of L4, D2 and D3. Capacitor C11 serves to connect L4's center tap to ac ground. The dc component of the collector voltage from Q11 to Q12 is parallel-coupled by R18 and R19.

The ac signal is coupled to L4 by R19 since it is connected to L4's off-center electrical point. Coil L4 is tuned to 19 kc, while diodes D2 and D3 double the signal frequency and couple the dc voltage as well as the 38 kc signal from Q11's collector to Q12's base.

Since the voltage on the collector of Q11 is low, under no signal

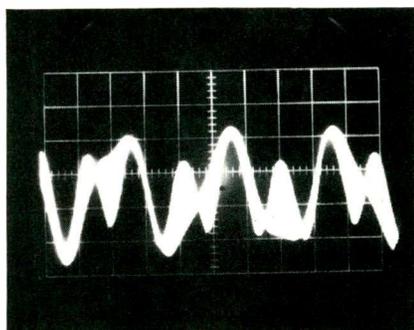


Fig. 4—Composite signal at the collector of Q8.

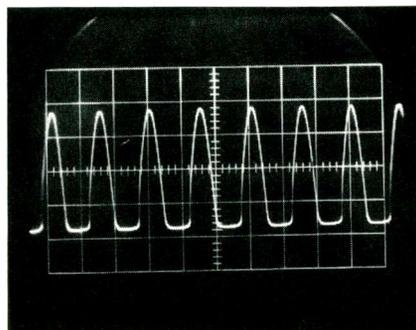


Fig. 5—Modified 19 kc wave form at the base of Q11.

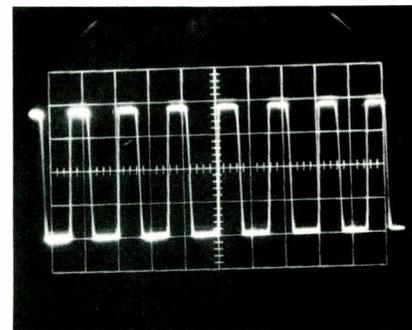


Fig. 6—The 12 v P-P 19 kc rectangular wave observed at the collector of Q11.

FM Stereo Demodulation

Continued

conditions, the emitter dc voltage of Q12 is also low. When a signal is present, the potential becomes about -4 v. This is used as a stereo indication function since it is controlled by the 19 kc pilot signal.

The carrier-controlled voltage at Q12's emitter serves an additional function. The gain of Q9 is relatively low with no 19 kc signal because of its bias. When a weak 19 kc signal is present for a certain time period, Q12's emitter voltage increases negatively as subcarrier turn-on begins. This is fed back to the base of Q9, increasing its gain—in turn making Q12's emitter voltage more negative. The carrier controlled positive feedback gates the system to a positive turn-on of a usable stereo station and reduces the gain of the system to random noise or fluttering stereo signals.

The 38 kc waveform at the base of Q12 is essentially a sine wave since L4 is tuned to 19 kc and its filtering effect modifies the square wave output of Q11. The final 38 kc subcarrier is coupled to the balanced detector through T1. The

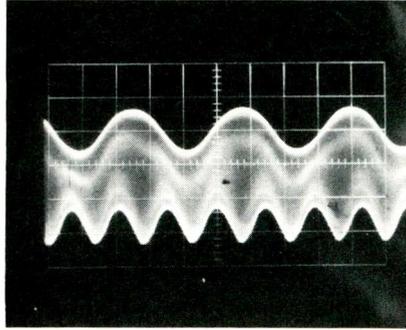


Fig. 7—Separated left and right signals observed at TP4.

primary of T1, tuned to 38 kc, removes distortion from the regenerated sine wave subcarrier.

The separated multiplex signal is observed at TP4. With a multiplex generator providing audio modulation at two different frequencies, the wave form observed at TP4 is shown in Fig. 7. Without audio modulation the regenerated 38 kc signal's amplitude can be peaked by adjusting L4 and T1. Actual program material can also be seen as a separated signal, as shown in Fig. 8.

By scoping at the left or right channel output, the separated sine wave can be observed. Filtering of the 38 kc subcarrier by the detector can be seen in Fig. 9. Cross talk appearing in the other channel is shown in Fig. 10. It can be seen that the crosstalk is an undistorted form of the desired channel. Optimum separation can be adjusted by touching up L4 and T1. ■

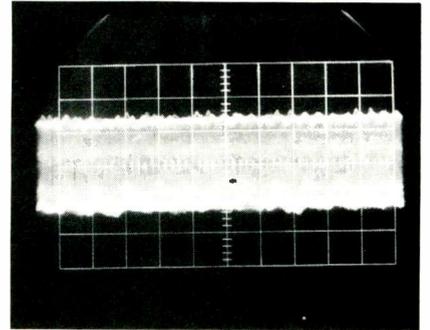


Fig. 8—Channel separation of a stereo transmission.

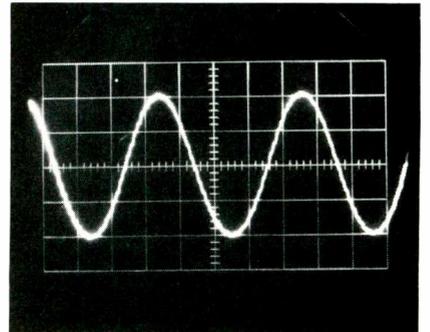


Fig. 9—Desired channel shows effective filtering.

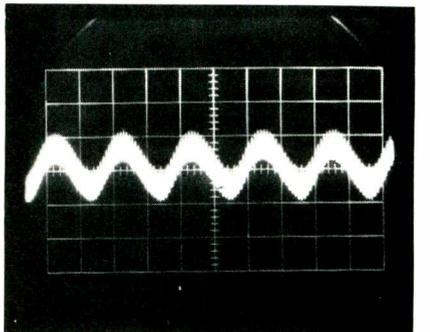


Fig. 10—Null channel attenuated 35 db.

Detect . . . Select . . . INSTALL Continued

earth, antennas in most fringe areas must be higher to be in the signal area. Consequently, this calls for higher masts, higher roof mountings and even towers.

Most VHF stations operate on sufficient power to blanket this area, thus providing snow-free pictures. UHF is something different. In some cases, location may be on the extreme edge of the signal, resulting in poor reception. In this area, and the deep fringe area, additional gain may be obtained by stacking two antennas, or by using a booster.

It is highly recommended that you employ a field strength meter so that sufficient information can be obtained to decide on the exact location and type of antenna required for the job. You may find any number of antennas suitable and convenient for stacking, including conicals, inlines and bow-ties for UHF.

And now, the deep fringe area! This is the area where signal "bounce" is most prominent. It is not uncommon to receive signals from stations several hundred miles away, only to see them fade out suddenly when atmospheric or ionospheric conditions change. Here too, is the area where you may have "over-ride" or where two co-channel stations compete for each other for a place on the TV screen. The

results are interesting but impossible to watch!

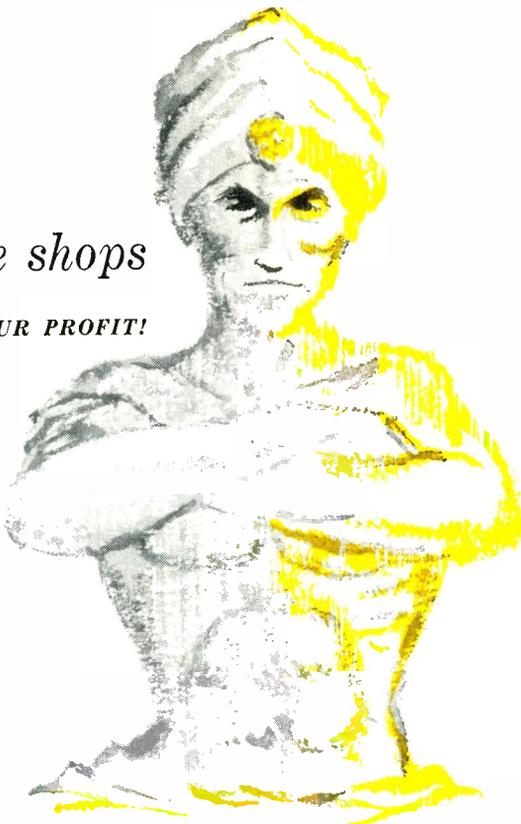
In this area, specially designed antennas are highly desirable, these include broad-banded Yagi-types for VHF and parabolics for UHF. The parabolic is especially effective since it has extreme directivity and provides maximum signal without phasing-harness loss which arises in other UHF fringe type antennas. This antenna is about $4\frac{1}{2}$ ft wide and will provide about 13 db gain over the UHF spectrum.

Let's emphasize one last point. Many areas have building codes governing an antenna installation-types. It would be wise to check with the local authorities to determine just what type of mounting is permitted, to avoid future problems. ■

MIRACLE WORKER

in professional TV service shops

PINPOINTS ANY TV TROUBLE FAST! UPS YOUR PROFIT!



DELUXE B&K

MODEL 1076 B&W and COLOR TELEVISION ANALYST

*with Crystal-Controlled Keyed Rainbow Color Display
and Highly-Stable Horizontal Oscillator Sync*

FLYING SPOT SCANNER

*transmits B&K patterns or your own
pictures onto TV screen*

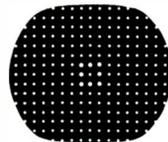
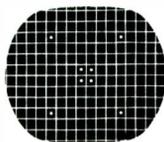
It's like having your own TV station! You can inject your own TV signals at any time, at any point—and quickly solve tough dogs, intermittents, any TV trouble, as you watch the generated test pattern on the raster. Checks any and all circuits in any stage throughout the video, audio, r.f., i.f., sync and sweep sections of the TV set. No external scope or waveform interpretation is needed. And if you wish, you can transmit your own slide-pictures.

Makes Color TV Servicing Easy, Too.

Generates white dot, crosshatch and color bar patterns for convergence. Generates crystal-controlled keyed rainbow color display to check color sync circuits, check range of hue control, align color demodulators. Demonstrates correct color values.

Saves time and work for the "pro." Makes servicing easier and faster for the beginner technician. Most valuable instrument in TV servicing.

Net, \$329.95



*Profit with a B&K Service Shop
See your B&K Distributor
or Write for Catalog AP21-T*

B & K MANUFACTURING CO.
DIVISION OF DYNASCAN CORPORATION
1801 W. BELLE PLAINE AVE. • CHICAGO, ILL. 60613
Canada: Atlas Radio Corp., 50 Wingold, Toronto 19, Ont.
Export: Empire Exporters, 123 Grand St., New York 13, U.S.A.



Difficult Service Jobs Described by Readers

Shocking Portable

A 19 in. Motorola portable TV with metal cabinet was brought into the shop. The owner complained that a "shock" was received when the set was turned off, and at times when it was turned on. I switched the set on and off several times, and let it operate for a few minutes. Sure enough, an electrical shock could be received at times when the plastic mask was touched.

My first thought was a "series" set with one side of the ac line tied to the chassis, but after removing the back it was found to be a power-transformer chassis. I then checked for faulty filtering components on the primary side of the power transformer, but found none. Further inspection showed that B— was at chassis ground and also the metal cabinet was well grounded to the chassis.

The possibility of "shock" being produced by either ac or dc voltages was soon eliminated. This left only the CRT and associated circuitry as the source. I immediately checked for a good ground between the aquadag coating of the CRT and chassis, adding additional grounding straps, and satisfying myself that a good ground return existed between these two points. Still, a shock could be received when the set was turned off.

Closer checks revealed that the shock was received only when touching the plastic mask on front of the set and not when touching the metal cabinet. Not fully understanding why a charge would build up on the plastic, I tried to "drain" it off by making sure there was a direct path from the mask to the chassis by connecting grounding straps between the two. With this proving to be unsuccessful I then checked for excessive RF from the high voltage circuit, but found everything OK.

I now had a real puzzler but worked from the theory that if I could "drain" the charge to B-, I could eliminate the problem.

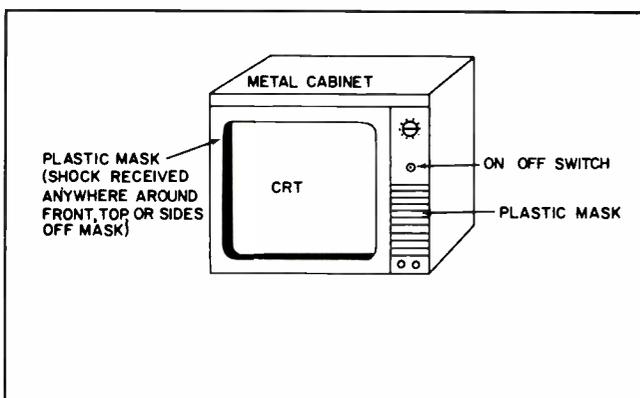
Next I removed the CRT, and placed a grounding strap around the inside of the mask, securing the strap to the mask with masking tape, and bringing it out to a good ground. The shock could still be received. I then took tinfoil and secured it to the back side of the mask and grounded it. The shock remained.

Confused and at a loss how to eliminate the trouble, I consulted several technicians in my area, but no one could come up with an answer to the dilemma.

Since the charge existed only on the outer surface of the mask, I toyed with the idea that it just might

be possible that the paint used on the mask contained substances capable of storing a charge. Of course, this idea was "far-fetched," but anything was worth a try at this point. I then took a screwdriver and scraped it across a small area on top of the mask, scratching the surface. A close examination revealed that the scratched portion looked more like grime and dirt than paint. Scraping a little more, I was convinced that it was grime.

It then began to get through to me! The owner had used furniture polish on the set which had hardened into a very thin oily waxy film all around the exterior of the mask upon which dust particles had settled and dried in with the polish, being very unnoticeable unless given a thorough inspection. The cause of the charge was now apparent. The entire mask had taken on the properties of a capacitor, the plastic or painted surface acting as one plate, the oily waxy film as the dielectric material, and the dust particles as the other plate. Each time the set was turned on this capacitor would receive a charge and often retain it for sometime after the set was turned off. It was not being discharged because no connection existed between the outer surface of the mask and B-. A good scrub-down with a brush and cleaning powder solved the problem.—*Joe R. Sport, Patsburg, Alabama.*



Alternate layers of grime and furniture wax made this set a shocker.

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, Ojibway Bldg., Duluth, Minnesota 55802.

you profit 4 ways

- 1— Test tubes faster, more accurately
- 2— Sell more tubes per customer
- 3— Save call-backs
- 4— Satisfy more customers



basic for the professional service shop



**Model 700
DYNA-QUIK**

Dynamic Mutual Conductance Tube Tester

Multiple-Socket Speed with Gm Accuracy plus obsolescence protection

TESTS All TV and Radio Tubes, Old and New

TESTS Nuvistors and Novars

TESTS 10-Pin Tubes

TESTS 12-Pin Compactrons

TESTS European Hi-Fi Tubes, Voltage Regulators, and Most Industrial Types

Everyday use by thousands of professional servicemen has proved its speed . . . its accuracy . . . its efficiency.

You can quickly check all the tubes in the set, detect hard-to-locate weak tubes that need replacement . . . and sell more tubes. Provides multiple-socket section to quick-check most of the TV and radio tube types the *true dynamic mutual conductance way*—plus simplified switch section to check new tube types in Dyna-Quik emission circuit. Also includes provision for future new sockets.

Makes test under set-operating conditions. Checks each section of multi-section tubes separately. Checks for *all* shorts, grid emission, leakage, and gas. Makes quick "life" test. Exclusive adjustable grid emission test provides sensitivity to over 100 megohms. *Insures your reputation. Quickly pays for itself.* Net \$179.95.

See your B&K Distributor or Write for Catalog AP21-T

Time-Saving, Money-Making Instruments Used by Professional Servicemen Everywhere



Model 960 Transistor
Radio Analyst



Model 1074
Television Analyst



Model 1076
Television Analyst



Model 850
Color Generator



Model 445 CRT
Rejuvenator Tester

NEW TUBE INFORMATION SERVICE

Available every 3 months, on subscription, for all B&K Dyna-Quik Tube Testers



B&K MANUFACTURING CO.

DIVISION OF DYNASCAN CORPORATION

1801 W. BELLE PLAINE AVE. • CHICAGO 13, ILL.
Canada: Atlas Radio Corp., 50 Wingold, Toronto 19, Ont.
Export: Empire Exporters, 253 Broadway, New York 7, U.S.A.

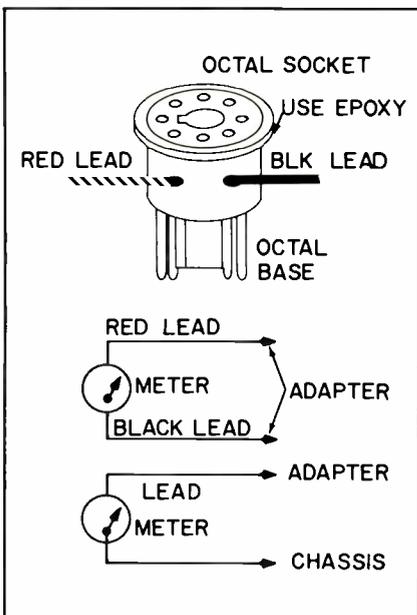
— for more details circle 15 on post card

SHOP HINTS

TIPS FOR HOME AND BENCH SERVICE

Time & Work Savers

When checking tube current of HV regulator (6BK4) and HOT (6DQ5) in color sets, it is usually necessary to remove the chassis and unsolder connections. I have made up two adapters using two standard octal sockets, two bases from octal tubes (like 6SN7) and three 2-ft insulated leads. Sockets are mounted inside bases with 2-ft wires running out through a hole in the base (for 6DQ5 adapter) and two wires running out of two holes in the base (for 6BK4 adapter). For the 6DQ5 adapter, terminals 1, 2, 4, 5, 7 and 8 of the socket are soldered to the base pins inside the base. Terminals 3 & 6 are tied together and a 2-ft lead is connected to pins 3 & 6 inside the tube base and brought out through a hole in the side. For the 6BK4 adapter, a 2-ft lead is soldered to terminal 1 of the octal socket and terminals 2, 5 and 7 are soldered to the pins of the octal base on the inside of the base. Another 2-ft lead is soldered to pin 1 on the inside of the octal base. (See drawings). Use



Two adapters made from octal sockets and bases from old octal tubes will save considerable time when making current measurements in color set HV regulator and horizontal output tube circuits.

red wire for + and black for -. Current can be read with meter simply by plugging the adapters into the set's proper tube socket inserting tube in adapter and by using one lead or two leads as the case may be. Use epoxy to hold sockets solidly in octal bases. — Leonard Blechman, Coatsville, Pa.

Feed Line Aid

Our extension ladders have tubular magnesium rungs, with a flattened tread for more comfortable standing. When it is desirable to install an antenna with lead-in attached, we slip a two foot length of $\frac{1}{2}$ or $\frac{3}{4}$ in. pipe through the spool, and stick the rest of the pipe into one of the ladder rungs. An elbow or almost any pipe fitting screwed onto the outside end of the pipe will prevent the spool from falling off the ladder. This leaves the spool free-running as we mount the ladder, and with a light hand on the spool it will not unwind more wire than is needed. Thousand foot spools are handled with ease.— G. E. McClaskey, Fairmont, W. Va.

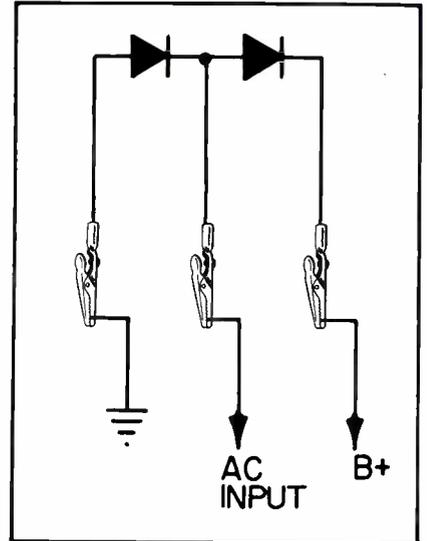
Renewed Screw Holes

When screwholes in the rear cover of a TV or in a radio cabinet get so large you can't anchor the screws, just dab a small amount of service cement in the holes and pack them with fine steel wool. Should the screws be removed later, the steel wool won't come out since the cement will anchor it firmly.— H. Josephs, Gardenville, Pa.

Rectifier Substitution

Two silicon rectifiers of 500 ma connected in series are a useful addition to your test equipment. Connect a lead from each end of the string and one from the junction and provide them with insulated alligator clips.

After disconnecting the ground and output leads of the original pair, insertion of the test unit will quickly reveal their condition. Too low a



Two 500 ma silicon rectifiers connected in series are a must addition to standard test equipment.

voltage with the test unit in operation may indicate faulty filter capacitors.—John Little, San Angelo, Texas.

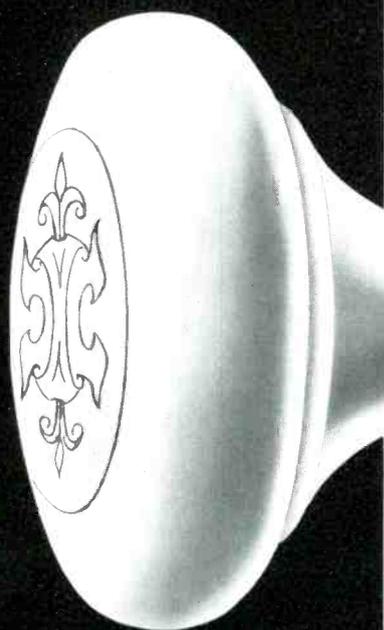
Skid-Proofing Meters

Our test and worktable tops are covered with $\frac{1}{4}$ -in. thick plastic and it's very easy for an expensive test meter to be pulled off a bench to the floor.

An effective way to prevent such damage is to make the meters skid-proof by criss-crossing a few strips of adhesive tape on the slick bottoms of the meter cases.—S. Clark, East Bradenton, Fla.

SHOP HINTS WANTED

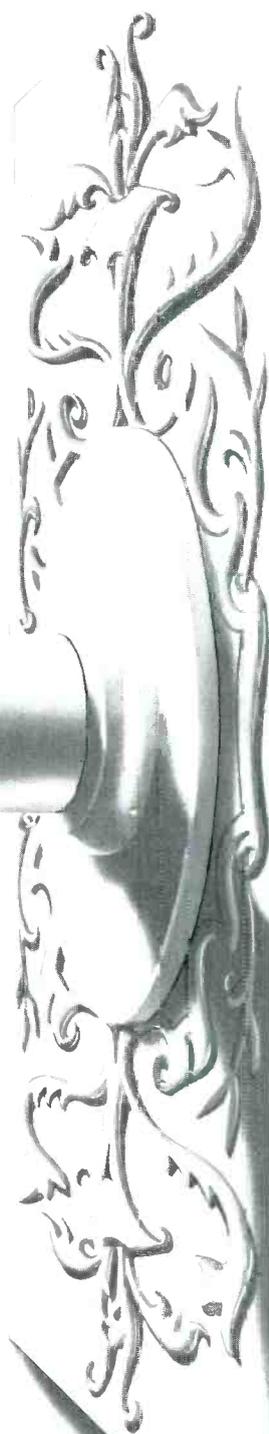
\$3 to \$10 for acceptable items. Use drawings to illustrate whenever necessary. A rough sketch will do. Unacceptable items will be returned if accompanied by a stamped envelope. Send your entries to Shop Hints Editor, ELECTRONIC TECHNICIAN, Ojibway Building, Duluth, Minn. 55802. The hints published in this column have not necessarily been tried by ELECTRONIC TECHNICIAN editors and are the ideas of the individual writers.



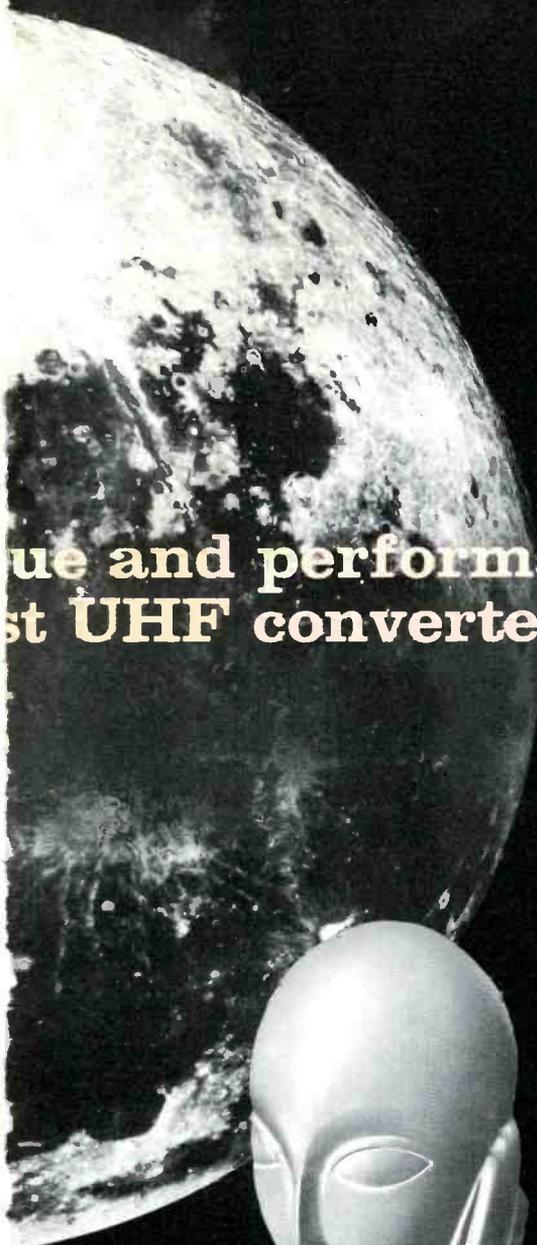
for 1965...



opens a new
world of TV
performance



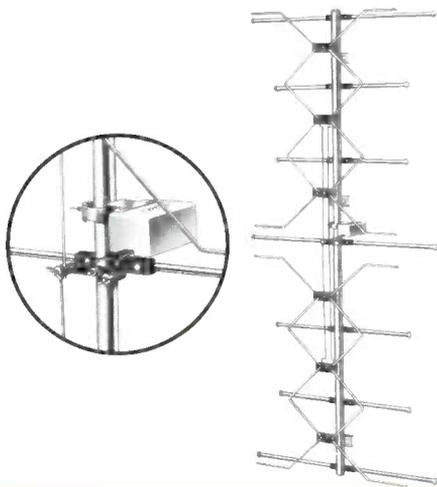
ue and performance
st UHF' converter



NEW ZONE CENTERED ANTENNAS
for custom-tailored UHF reception

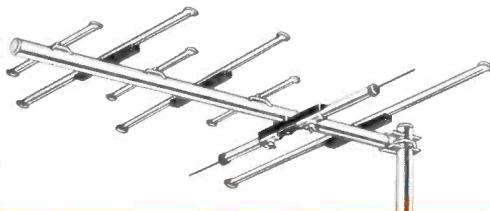
DEEP FRINGE
TWIN IMPERIAL
BOOSTER/ANTENNA
COMBINATION

Improves all UHF-TV sets and converters. Factory integrated and mounted 2 transistor UHF pre-amplifier guarantees trouble-free installation. Complete with safe AC power supply.
MODEL TW-10 (CHANNELS 14-70)
MODEL TW-11 (CHANNELS 70-83)



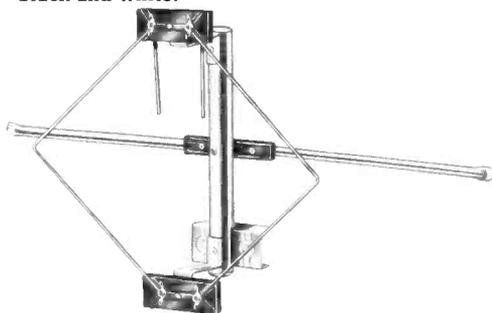
NEAR FRINGE
JAVELIN ALL CHANNEL
UHF "YAGI"

The power-performance of the "yagi" design, leader in VHF, now assures ghost-free UHF reception. Unsurpassed gain and match.



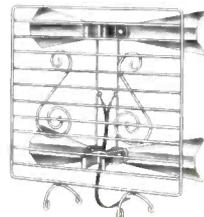
SUBURBAN
"CAVALIER"
UHF-TV ANTENNA

Now at last—a small, low priced outdoor UHF antenna with every big performance feature. Factory assembled. Guaranteed for color and black and white.



METROPOLITAN
"CORONET" INDOOR
UHF-TV ANTENNA

The finest antenna in its class, designed for performance and compliments. Ideal where outdoor antenna installation is impossible or inconvenient.



ALL GAVIN ANTENNAS
IN LIFETIME
DURA GOLD FINISH



Gavin

® opens a new world of value
with the world's finest



GAVIN "SATURN" UHF CONVERTER

Warm, mellow walnut is featured in this fashion-right converter... yet only the look is expensive! Saturn converts any VHF set into exciting all channel reception. Same fine features as Venus converter, with powerful new solid state circuit designed for metropolitan locations. Model 502.



GAVIN "JUPITER" ECONOMY CONVERTER

Look... dramatic brass in the new shape of TV sophistication. Clear, bright all-channel reception. The price? New and nice. Model 501.

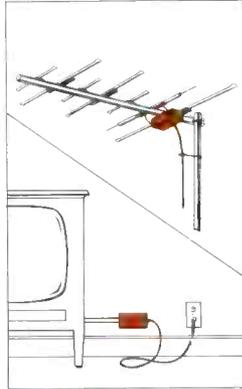
ALL GAVIN CONVERTERS ARE CERTIFIED TO BE IN COMPLIANCE WITH FCC REGULATION PART 15 SUB PART C.

GAVIN "VENUS" DELUXE UHF CONVERTER

The ultimate in style and performance. Handsomely styled decorator cabinet is accented in soft, subtle gold. Enhances every decor. Inside, high gain built-in amplifier and years-ahead Gavin transistor circuitry assure peak all-channel reception in every area. Exclusive Ultrascopes® fine tuning with "Luminaires" dial insures easy channel selection. For all areas, including deepest fringe, specify Model 503.



a world apart in quality



More power for less cost... from antenna to living room. Signal amplified at antenna for snow-free picture and maximum gain. Power supply mounts at TV set.

GAVIN UHF AND VHF-TV BOOSTERS

Now bring in sharp, clear pictures—even in the deepest fringe areas. Gavin boosters increase the range and performance of any TV set. No tuning needed. Compact, easily installed booster features world's most advanced solid state pre-amplifier. Complete with safe AC power supply.

- MODEL GBV (CHANNELS 2-13)
- MODEL GB-10 (CHANNELS 14-70)
- MODEL GB-11 (CHANNELS 70-83)



6 METER MAVERICK

Again in 1965, only Gavin offers the filter designed especially for 6 meters. No reflections, no transmitter loading problems. Exclusive composite filter combines 5 complete filter stages in one unit. Matched tuning assures maximum power. (Output power indicator optional).



TUNABLE BAND-PASS FILTER

Trust Gavin leadership to eliminate TV interference problems. Designed exclusively for 2 meter transmitters, the BP-144 with tunable input and output stages, assures optimum match for greater power.



TUNABLE CB FILTER

Now Gavin brings you more power at your antenna—with no more TV interference. CB-T multi-section filter circuit suppresses unwanted second harmonics. Adjustable tuning trimmers provide peak output and reception.

Insist on genuine Gavin factory replacement equipment in electronic transmission lines...color TV yokes...patch cords. Each bears the famous Gavin guaranty of quality.



...new look for the leader

This new Gavin trademark symbolizes a new era in UHF-VHF engineering: Now Gavin research opens a wonderful new world of TV enjoyment... backed by new, ultramodern testing and manufacturing facilities... new, decorator styling by internationally famous Banka-Mango... plus an enviable reputation for integrity and workmanship unsurpassed in the industry.

GAVIN INSTRUMENTS, INC.
General Offices:
Somerville, New Jersey

This brochure is available to you with your imprint. Write to Gavin, Dealer Aid Division.

INDUSTRIAL ELECTRONICS

SECTION

CONTENTS

Troubleshooting! 72

S. P. Fairchild, Jr. gives six simple rules for troubleshooting electronic equipment

What About Potting and Encapsulation? 76

Jim Hawkins takes the 'highbrow' varnish off potting and encapsulation materials

New Products 79

SEPTEMBER • 1964 • VOL. 80 • NO. 3

TROUBLESHOOTING!

Follow six simple rules for troubleshooting and become worthy of the title, 'Professional Technician'

by S. P. Fairchild, Jr.

Electronics Engineer
Federal Aviation Agency



'... now relax for a minute and study your equipment and understand how it works.'—Illustration: courtesy Bell Labs.

■ The ability to troubleshoot electronic equipment is an important basic qualification for electronics technicians. Yet, of the hundreds of "technicians" I've known, it amazes me that very few were good troubleshooters. This is especially true of technicians who do daily routine maintenance but little emergency troubleshooting.

How can we improve our troubleshooting techniques? Well, we can improve our engineering and technical knowledge. We can all increase our storehouse of basic electronics know-how.

Some technicians went to technical school twenty years ago and now feel that's enough. But they couldn't be more wrong!

Other technicians say that theory is a lot of hooley. "Give me a voltmeter and a screwdriver and I'll fix anything," they boast.

When you focus sharply on this particular character you find he's doing repetitive daily repairs by rote. I've seen men of this caliber practically crack up when a strange trouble symptom appeared. So

here's my first bit of advice—*keep studying electronics!*

My second suggestion is—*study your equipment.* Open the instruction book and read the equipment's operating theory. If the equipment uses a Schmitt trigger circuit and you do not understand Schmitt triggers study them or get a buddy to explain them. You should be able to observe a particular schematic and explain to your boss or interested co-worker how every circuit works. This knowledge comes in mighty handy when the chips are down.

What to do first?

Now, let's say you *are* fully prepared when your equipment fails. Your boss is screaming bloody murder. What should you do first?

Relax. That's right, I said *relax*. Most technicians make their biggest mistake right here — they rush around taking meaningless voltage measurements and get more rattled by the minute. Even if they compose themselves later, valuable time has been lost.

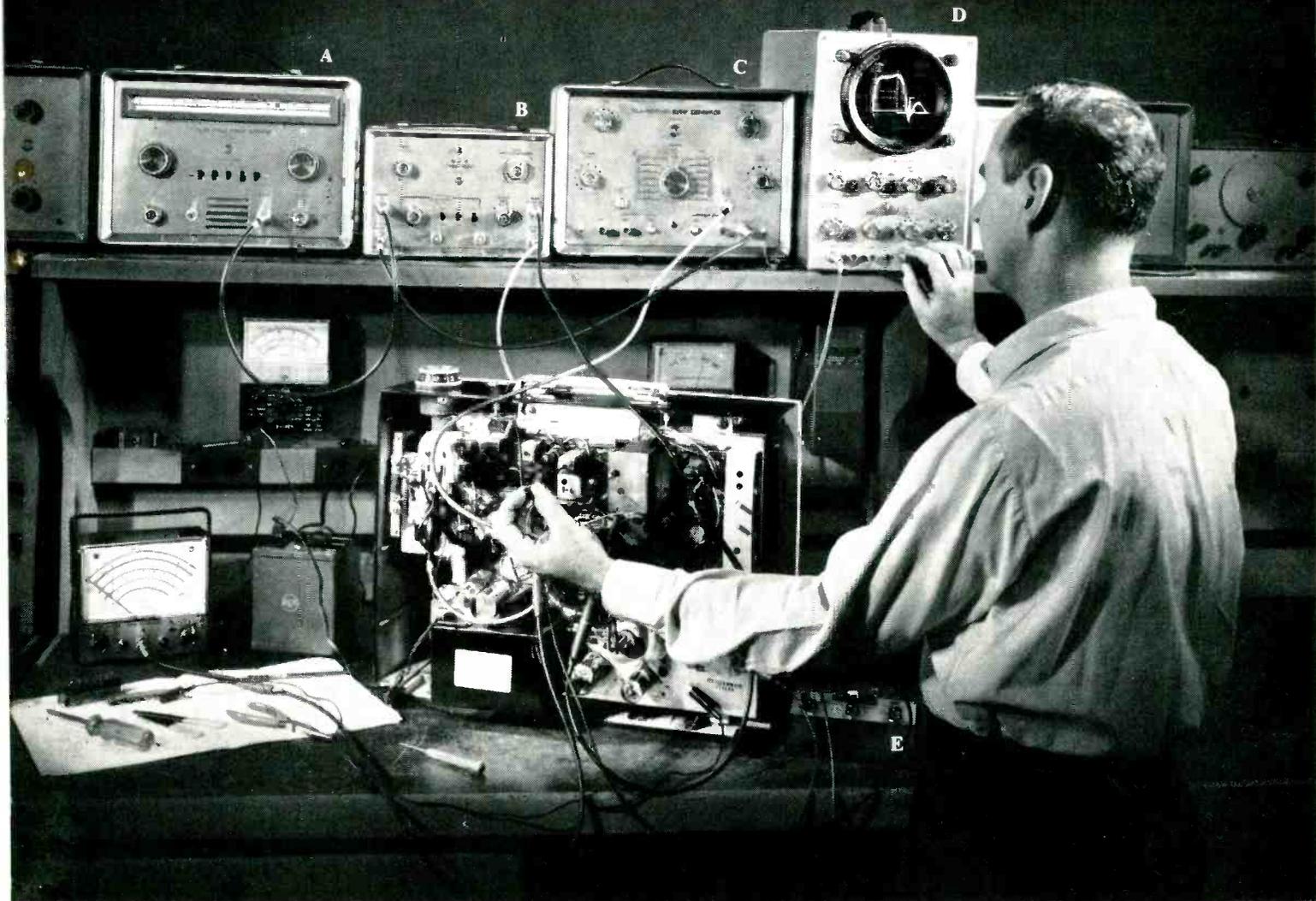
Troubleshooting can be a highly satisfying challenge. It is a break from routine meter readings and adjustments. You are going to "detect" the "clues" and "catch" the criminal. You are going to "have a ball," so why *not* relax?

Next, *use your powers of observation.* I once observed a technician working on a transmitter that had two output tubes in parallel. One tube plate was cherry red, the other was cool. Obviously, one tube was carrying most of the load. I said nothing to the technician, and I saw him look directly at the two tubes several times, but *he didn't recognize the obvious symptom!* Like wise, I have seen other technicians feverishly taking voltage readings at the wrong check points while a large charred resistor was as evident as my "schnozzle" (nothing can be more evident).

The correct procedure, of course, is to mentally list all the symptoms (the more the better) and observe obvious parts failures by using a variety of senses. (I suppose someone, somewhere, has even used their

RCA Test Instruments...

EVERYTHING YOU NEED FOR ACCURATE TV ALIGNMENT



Checking overall frequency response (RF and IF) in a portable B&W TV receiver using the test instruments indicated in the block diagram below. Pattern on oscilloscope screen is an overall response curve with dual markers: one at picture-carrier frequency and one at sound-carrier frequency.

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

Supplies a fundamental frequency RF carrier of crystal accuracy for aligning and trouble-shooting color and B&W TV receivers.

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

\$256.50* complete with output cable.

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

For use with a marker generator and a sweep generator. Used for RF, IF, and VF sweep alignment color and B&W TV receivers. In visual alignment techniques, it eliminates distortion of sweep response pattern.

\$74.50* complete with four coaxial cables.

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

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

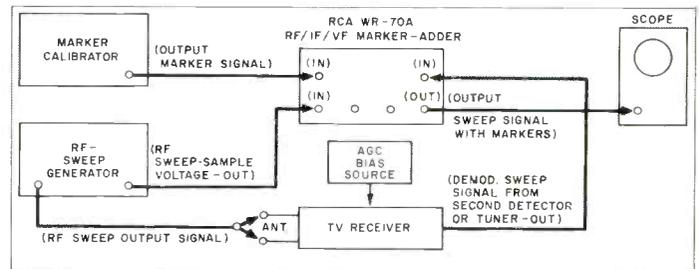
- IF/Video output frequency continuously tunable from 50 Kc to 50 Mc
- Sweep-frequency bandwidth continuously adjustable from 50 Kc to 20 Mc on IF/Video and FM; 12 Mc on TV channels

\$295.00* complete with RF output cable and IF/Video output cable.

(D) RCA WO-91A 5-INCH OSCILLOSCOPE FOR COLOR-TV

A heavy-duty, wideband precision scope, essential for TV alignment and troubleshooting.

- New 2-stage sync separator assures stable horizontal sweep lock-in on composite TV signals
- Dual bandwidth: 4.5 Mc at



0.053 volt rms/in. sensitivity; 1.5 Mc at 0.018 volt rms/in. sensitivity

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

(E) RCA WG-307B TV BIAS SUPPLY KIT

Three separate dc output voltages each adjustable from 0 to

-15 volts provide bias voltages for aligning RF, IF and other circuits of COLOR and black and white TV receivers. **\$11.95***

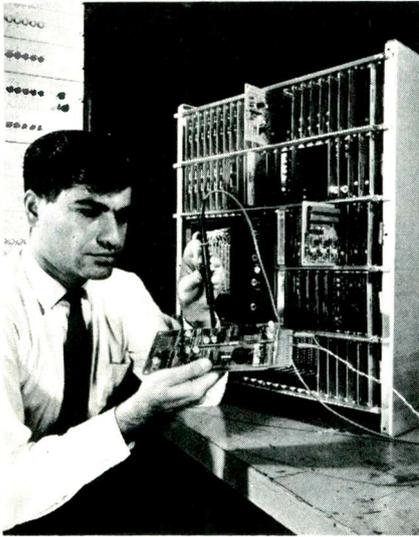
See them all at your Authorized RCA Test Equipment Distributor.

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

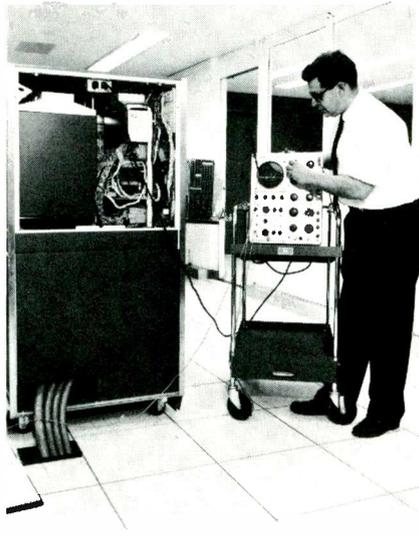
RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N. J.



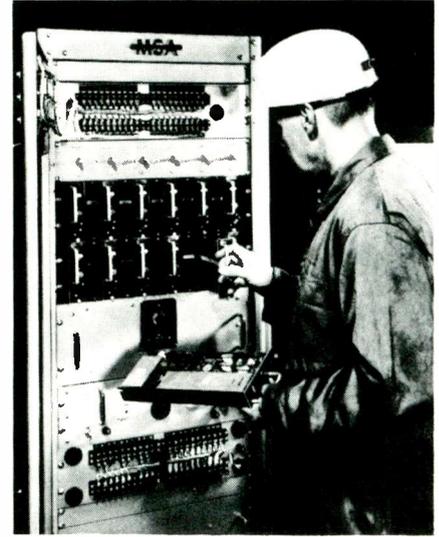
The Most Trusted Name in Electronics



'... troubleshooting can be a highly satisfying challenge.'—Illustration: courtesy RCA.



'... perhaps the trouble is so obscure that further checks and deductions will have to be made.'—Illustration: courtesy IBM.



'... you can now find out how smart your deductions were.'—Illustration: courtesy Mine Safety Appliance Co.

sense of taste.) Now relax for a moment and analyze the situation. What voltage and resistance measurements are needed to wrap up the case and corner the "crook"?

Like the cornering of a real criminal, you are now at the most exciting point in the chase. You can now find out how "smart" your deductions were. Perhaps the trouble is so obscure that further checks and deductions will have to be made. Like a physician who discovers a rare disease, you may be the first technician to troubleshoot this particular malady. If you are, you may write the factory and save somebody thousands of dollars — and rob many technicians of a challenging joy (!)—wrestling with this particular problem.

Taming "Dogs"

Sooner or later you'll get an equipment trouble you can't solve. It has happened to me, it will happen to you and to any technician who's in the troubleshooting business for a while. These "dogs," as

some people call them, usually have two causes:

1. Some troubles are obscured by factory wiring or other causes and become impossible to fix unless you're a cotton-pickin' genius. (But if we were geniuses we wouldn't be in this business in the first place.)

2. In the course of troubleshooting, your reasoning takes a wrong turn and leads you up a muddy river. Each time you "back paddle", you unconsciously make the same false turn. This is especially likely to happen if you are fatigued or under pressure to restore operations.

The best solution to this problem is to ask another technician to take over for you. Don't tell him "I checked the tubes, the resistances and the voltages and they are all OK." Let him start from scratch with a fresh outlook. Swallow your pride; perhaps you can return the favor someday.

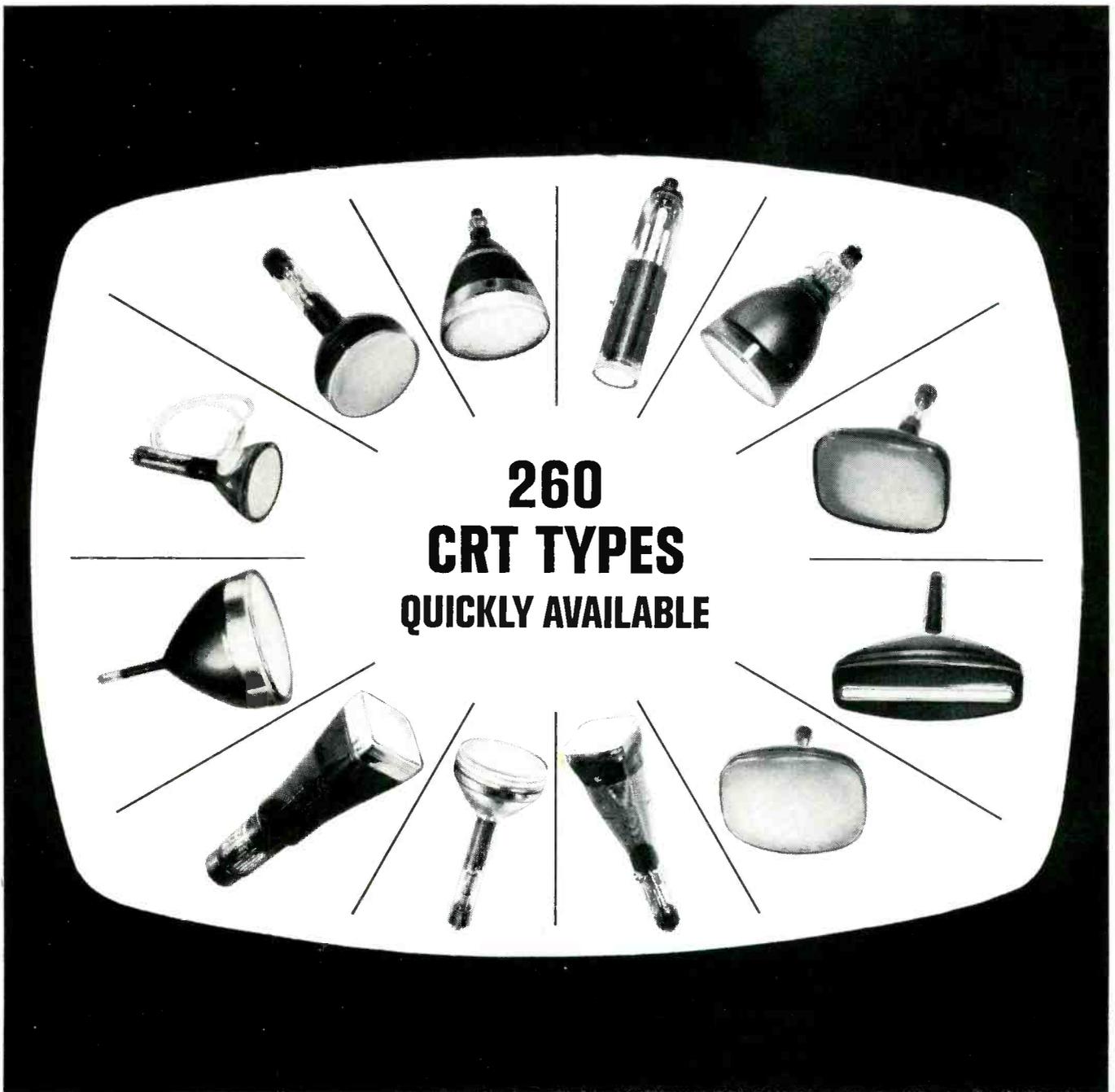
If you work alone and cannot ask for help—take a break. Get out of the shop and have a cup of

coffee or a cold beer. Stand on the corner and look after "Mary's little gams"—*anything* to get that confounded equipment problem off your mind. If time permits, sleep on it. I once gave my wife a scare when I bolted upright in bed at 2 a.m. and said, "I know what's wrong with that TV!" I did know, too. This frequently happens to many conscientious technicians and engineers.

In summary, here's the way to become a top-notch troubleshooter:

- Never stop studying electronics.
- Learn how your equipment operates.
- When a trouble occurs, *relax*.
- Before you do anything else, use your natural senses.
- If you can't find the trouble, take a breather.
- If you still can't find it, holler for help and don't be bashful.

Good troubleshooting, and may the "wolf-dogs" and microminiature "gremlins" stay away from your electronic equipment doors. ■



**260
CRT TYPES
QUICKLY AVAILABLE**

**Get the CRT you need fast
from your Sylvania Distributor**

He has tubes for 'scopes, radar indicators, video recorders, industrial monitors, TV set checkers. These tubes benefit by the latest Sylvania advances in cathode-ray tube technology: high brightness, high resolution, double deflection, multiple guns, high visibility, low heater power, high deflection sensitivity, and fiber optics.

Rely on your Sylvania Tube Distributor for anything you need in CRT's for design or replacement. If he

doesn't have exactly what you want, chances are he can get it for you—quickly.

★ ★ ★

For technical data, see new Industrial and Military CRT Catalog ET-3914 or, if you are a design engineer, Systems Designer's CRT Handbook ET-3924. Contact your Distributor or write Electronic Tube Division, Sylvania Electric Products Inc., Box 87, Buffalo, N. Y. 14209.

SYLVANIA
SUBSIDIARY OF
GENERAL TELEPHONE & ELECTRONICS



... for more details circle 53 on post card

What About Potting and Encapsulation?

Once considered strictly "highbrow," these space-age offspring are now recognized as valuable, down-to-earth maintenance aids

by James W. Hawkins

Silicone Products Department General Electric Company

■ Because the terms "potting and encapsulation" are often associated with the "far out" aerospace industry, industrial electronics engineers and technicians sometimes tend to consider the use of the terms—and in fact the materials—too exotic for solving "industrial" maintenance problems. Well, it just ain't so! An examination of some practical applications will help dispel this outdated notion.

Encapsulating

First of all, let's remove the mystery from the terms. "Encapsulate," according to Webster, means "to enclose in a capsule." For example, we "encapsulate" a coil when we dip it into a varnish and a continuous film of varnish is formed around the coil. In fact, even ordinary shellac could serve as the "capsule."

The thickness of the coating and the material used to make the "capsule" may vary according to the requirements, but the idea is the same whether shellac or a space-age coating is being used.

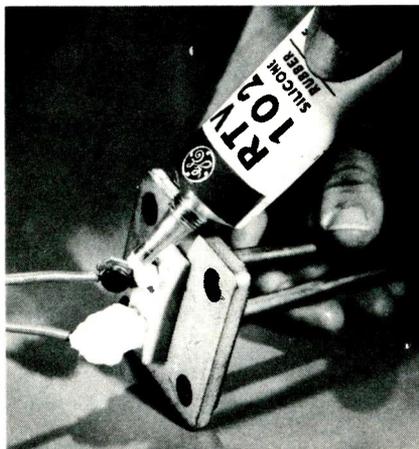
Potting

"Potting" is often erroneously considered synonymous with "encapsulation." It's strictly defined, however, as the art of "placing or preserving in a pot or can," and

this definition is quite accurate for electronic work. A coil, for example, may be placed in a can, which then is filled with a potting material (usually melted wax in the early days). When the wax has hardened, the entire assembly—can, wax and coil—has become a "potted" electronic component.

In other words, the main difference between potting and encapsulation is that in the case of potting the "pot," or "can," always becomes an integral part of the final assembly.

The need for potting and encapsulation of electronic assemblies is by no means limited to exotic



Terminals and connections can be potted for trouble-free performance by using various types of compounds, either rigid or rubber.

proved improved



This was the proved Type 545A at \$1550.

Used by more engineers than any other commercial laboratory oscilloscope, the Type 545A became the standard of the industry.

User suggestions and research innovations helped it grow and develop into the world's best known laboratory oscilloscope—through five years as the Type 545, another five years as the Type 545A.

Over the years, better circuit components and design techniques led to simpler operation and application, greater accuracy and reliability, easier maintenance and calibration.

Seventeen amplifier plug-in units were developed to provide quick adaptability for particular applications. Other features were added or improved to update performance specifications.

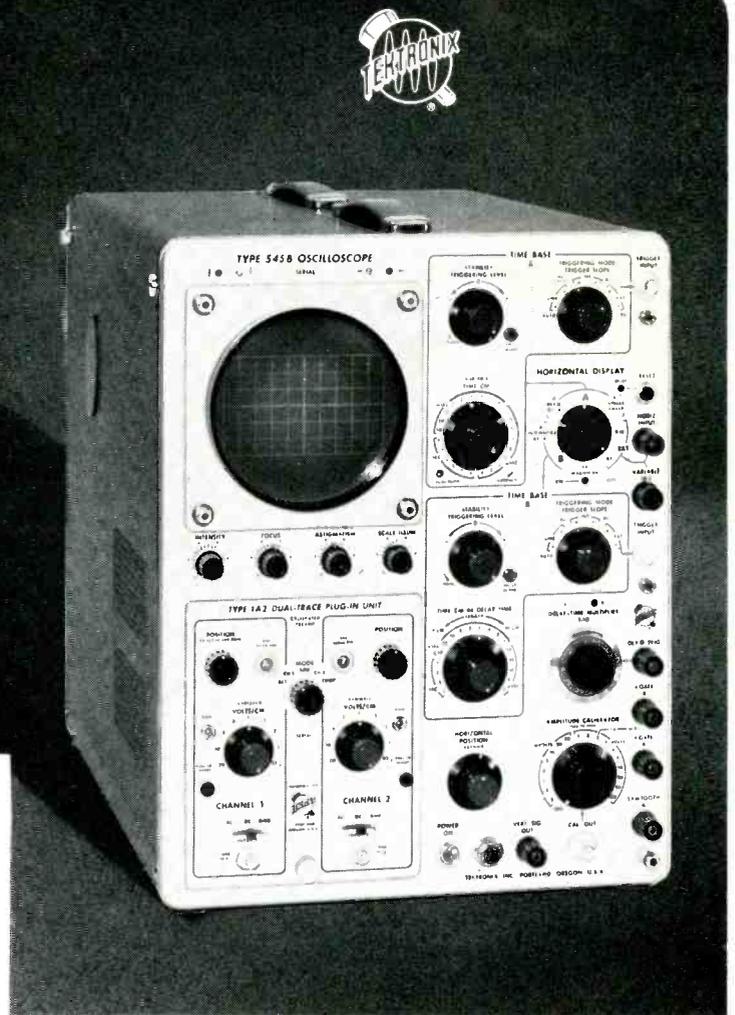
With the dual-trace unit, the Type 545A provided 50 mv/cm sensitivity for a wide range of dc-to-24 Mc applications.

Further updating of the "A" Model to implement additional improvements has resulted in a new "B" Model—as the "A" Model was developed from the early Type 545.

So, now, the Type 545A is superseded by the Type 545B. Instrument support will continue to be available for the "A" Model, however, for at least 10 years.

Tektronix, Inc.

SEPTEMBER 1964



Here is the improved Type 545B at \$1550.

Looks about like the Type 545A. But added capabilities and convenience further enhance its value.

New crt. Internal no-parallax illuminated graticule. Improved resolution, uniform focus over the full 6-cm by 10-cm (50% greater) display area. New hybrid vertical amplifier—greater stability and reliability. Fixed-tuned delay cable, prevents misadjustments. Triggering beyond 30 Mc. Sweep delay, single-sweep, other features and refinements that equal or excel those of the present "A" Model.

Use all your Tektronix Type A to Z Plug-In Units at equal or better frequency response, or the new Type 1A1 or 1A2 Dual-Trace Plug-In Units for 50 mv/cm at dc-to-33 Mc. The Type 1A1 also offers 5 mv/cm at dc-to-23 Mc dual-trace, and, by cascading the two amplifiers, approximately 500 μ v/cm at 2-cps-to-14 Mc.

Price at \$1550 is the same as the Type 545A and includes two probes. Full field-engineering services back up every instrument.

But to hear the complete story, call your Tektronix Field Engineer. He will know if a Type 545B offers the best solution to your measurement problem. If the Type 545B appears to be the answer, try it. Use it in your own application—with one of your 17 letter-series plug-ins or one of the new amplifier plug-in units.

Available throughout the world

- - - for more details circle 54 on post card

equipment. Some of the environments found in industrial plants present challenges just as difficult as those offered by satellites in orbit.

Protection from conducting particles is another problem, notable industries—food processing, paper, chemical, petroleum, etc.

Protection from conducting particles is another problem, notable examples of which are plants that work with carbon black, such as automobile tire plants, or plants where metal dust or chips are prevalent. Protection from abrasive conditions is necessary for equipment used in the cement industry, in mining and in the rock products industry.

Protection from temperature extremes is a very common requirement. In the iron and steel industries, for example, some high-temperature conditions challenge even the best insulating materials. Food processing and dairy products industries, on the other hand, regularly pose low-temperature problems.

Hammermills, coal pulverizers, mining equipment, shakers, and sorters often create some very severe vibration and shock problems.

Although these are by no means all of the hazards that might call for the additional protection of potting or encapsulation, they represent the type of problems often encountered.

Types of Compounds

The most commonly used en-

capsulation and potting materials fall into one of three general categories: rigid, resilient (rubber-like) and foams of either the rigid or resilient type. All are liquids which, after the addition of curing agents, set up to solid form at either room temperature or elevated temperature.

Considering the many types of compounds available, one might wonder how to select the right material for a particular job. Well, some of the important factors to be considered are:

- Ease of use and handling properties.
- Electrical requirements over the range of temperature and humidity.
- Resistance to mechanical hazards, shock, vibration.
- Resistance to environmental contaminants, chemicals, etc.
- Compatibility with other insulating materials.
- Need for repairability.
- Heat transfer properties required.

There is no simple way to select materials. But reliable potting material manufacturers are eager to provide data on material properties, and many engineers find it useful to obtain data on the three categories of materials previously mentioned. The best procedure is to select a manufacturer or two of each type of material—for example, an epoxy supplier; an RTV silicone, rubber supplier; and a supplier of foam material. Study the literature they provide. Organize your re-

quirements, perhaps using a check list or an outline of desired properties, and then review the product data sheets. Take particular note of such things as:

- Handling properties—Is special equipment required to handle the material? Are there any toxicity or safety problems? Are ovens required in order to cure the material?
- Do the properties of the candidate material meet your application needs on temperature, humidity and resistance to environmental hazards?
- Will the environment require the material to have resistance to chemicals, mechanical shock and vibration? If so, how will it stand up to them?
- Is good heat transfer required of the compound?
- Must the compound be repairable?

Most of these questions can be answered from a review of the literature supplied by the vendors.

Keep in mind that no single material is best on all counts. Rigid materials, for example, often rate high on chemical resistance, and resistance to mechanical shock and vibration, but they sometimes offer handling problems with regard to toxicity and generally are not repairable.

The foam materials offer light weight, good electrical properties, and good resistance to impact but generally have poor heat-transfer properties. The RTV silicone rubber materials are easy to use, non-



Open motors deliver performance similar to totally enclosed motors when the windings are encapsulated with RTV (room temperature vulcanizing) liquid silicone rubbers.



Liquid rubbers permit encapsulation of circuitry by the spray method.

Transformers are protected from shock and environment when encapsulated in rubber or plastic. Electrical and electronic units used in severe industrial environments can be made to function more reliably.



toxic and repairable, but they tend to cost more than the rigid materials.

Application Techniques

Typical techniques for using encapsulants and potting compounds range from squeezing the material from a tube or caulking cartridge, to spraying, dipping, pouring, painting or "buttering" with a spatula (like frosting a cake). ■



NEW PRODUCTS

LINEAR VOLTMETER 400

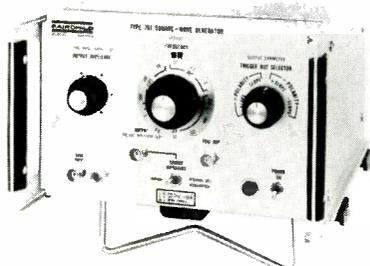
A general purpose instrument is announced for use over a wide voltage and frequency range from



10 cps to 6 Mc and features a 1 percent accuracy fsd from 40 cps to 1 Mc. Ballantine.

SQUARE WAVE GENERATOR 401

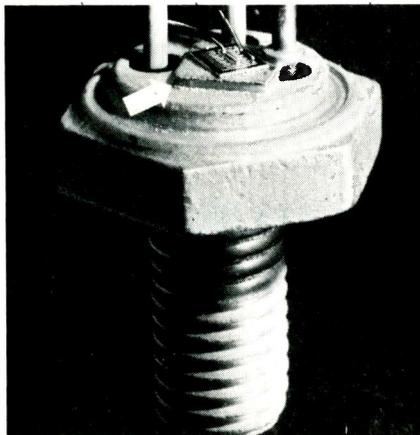
A transistorized square wave gen-



erator with nanosec rise and fall times and extremely wide operational frequency range is announced. Termed the Fairchild type 791, the solid-state generator provides performance characteristics not previously available in one instrument, the announcement revealed. Rise and fall times of the square waves are kept constant throughout all frequencies from 7 cps to 10 Mc the maker said. Fairchild.

POWER TRANSISTOR 402

A silicon planar power transistor with the collector electrically isolated from the case by a beryllium



oxide pedestal is introduced. The 5-amp transistor family has a power dissipation rating of 30 w at 100°C case temperature, the announcement said. Operating data: $BV_{CBO} = 60/100$ v; $BV_{CEO} = 40/80$ v; $BV_{EBO} = 8$ v; $h_{FE} = 20-60, 40-120, 100$ min; $V_{BE}(\text{sat}) = 2.0$ v @ 1 amp; $V_{CE}(\text{sat}) = 0.5$ v @ 1 amp; $I_{CBO} = 1$ ma @ $V_{CB} = 60$ v; $f_T = 30$ Mc, typical. Honeywell.

MINIATURE VIDEO CABLE 403

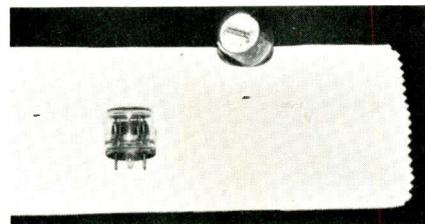
Miniature, precision video cable, 8279, is designed for broad band video and computer applications.



Construction utilizes a special compacted conductor which has the advantages of both solid and stranded conductor, the announcement indicated. Has the same OD as 59/U, it fits all RG 59/U connectors. Bel-den.

DUAL ELEMENT PHOTOCELL 404

A dual element series segmented



photoresistor is capable of detecting dark spots or blemishes on an illuminated field, it is announced. The photosensitive device was designed to meet the need for advanced quality control monitoring systems in the textile and food processing industries. In addition to monitoring for surface defects, the device also can be used to inspect transparent materials such as glass or plastic for internal flaws, the announcement said. Sylvania.

POWER CONTROLLER 405

A line of Power Controllers for proportional control of electrical loads of 100 to 1800 amp at voltages up to 600 is announced. Off-the-shelf ignitron models include



current ratings of 100, 280, 480, 800 and 1800 amp for 60, 50 or 25-cps operation. Fostoria.

... EDITOR'S MEMO

Continued from page 34

written by experts who know what they are talking about and, additionally, they meet many technicians like you while traveling in the field and they keep their fingers constantly clasped to the pulse of our industry.

Make every season of the year your antenna season — especially autumn, spring and summer!

NEW PRODUCTS

UHF CONVERTERS 200

A series of transistorized UHF converters covering channels 14 to 83 is announced. The converters are said to have a tuner noise figure of 11.5 db with a frequency drift of not more than 250kc. Has an illuminated horizontal-slide UHF channel scale for convenient tuning.



The announcement said that there are two models in the series: CR1-J for local area and suburban use and CR2-J for fringe areas. Price \$29.95 and \$39.95, respectively. JFD.

MOBILE AMPLIFIER 201

Announced is an economy-priced mobile public address amplifier. A compact 20-w transistorized unit, model BT20, is designed for general public address, fire police and Civil Defense applications it is said. It operates on 12-15 vdc, with instant warm-up, and provides optimum performance at temperatures from minus 20° to plus 65° centi-



grade the announcement said. Includes inputs for a low impedance microphone and an auxiliary tape recorder, tuner or phonograph. Price \$99.90 Bogen.

**FOR UNEXCELLED PERFORMANCE
FOR CUSTOMER SATISFACTION**

**These two will do
the best job for you!**



HALLMARK 3000

**30 WATT TRANSCEIVER FOR BUSINESS AND INDUSTRIAL SERVICE:
FCC TYPE ACCEPTED.**

A top performer for dependable, long range business communications in the 25 to 50 MC band. The compact, rugged design make best use of the features of tubes and transistors. Receiver sensitivity is 0.3 μ v for 10db S+N/N ratio. Selectivity is better than 30db. Transistorized modulator gives maximum "talk power." Power to antenna is 20 watts. Transistorized mobile power supply. Available in 115 VAC and 12 VDC models. Suggested list: \$269.50.



HALLMARK 1250

**12 CHANNEL, CRYSTAL
CONTROLLED CB DESIGNED
LIKE A 15 WATT UNIT.**

A unique hand-wired modular chassis gives a new small size that fits any vehicle. The sensational 1250 features a silicon rectifier full wave bridge, electronic switching and an improved ferrite speaker. Four rugged latches provide easy access for maintenance and to crystal sockets. Sensitivity is 0.3 μ v for 10db S+N/N ratio. Adjacent channel rejection better than 45db. Modulation exceeds 95%. RF power output is 3.4 watts or better. Dual powered. Suggested list: \$169.50.

SPECIAL OPTION: Model 1250X — Has plug-in transistorized power supply. Suggested list: \$189.50.

Write for complete information.

HALLMARK INSTRUMENTS
2620 Freewood • Dallas, Texas 75220 • FL 7-0184

- - - for more details circle 29 on post card

AUTO RADIO VIBRATOR 202

Announced is an automotive radio vibrator, series 5371A/6371A. It is said that design improvements



include a contact arrangement utilizing the combined advantages of tungsten "button" contacts and Molybdenum leaf contact members, improved magnetic circuit and driving coil, and reduced overall length to 2 $\frac{5}{8}$ in. excluding the pin base. Available for 6 and 12 v equipment. Rated for continuous duty at 6 and 4 amp respectively. Cornell-Dubilier.

HOME MIKE 203

Announced is a microphone for the home recordist, model 8000, a shock mounted cardioid dynamic.

Can you afford to guess

AT SWEEP, SYNC OR HIGH VOLTAGE TROUBLES?

WHEN IT'S SO EASY TO WALK THE TROUBLE RIGHT OUT OF THESE TIME CONSUMING CIRCUITS..... STEP BY STEP.....



SYNC. CIR. & H. SYNC. DISCRIM.	VERT. OSC.	VERT. OUTPUT	VERT. OUTPUT XFORMER	VERT. DEFLEC. YOKE
HORIZ. OSC.	HORIZ. OUTPUT	HORIZ. FLYBACK XFORMER	2nd ANODE VOLTAGE CIRCUIT	HORIZ. DEFLEC. YOKE



NEW, IMPROVED SENCORE SWEEP CIRCUIT ANALYZER MODEL SS117

PUSH BUTTON TESTING . . . for Color and Black and White

How many times do you ask, "Why do I take so long finding that sweep trouble?" How often have you wondered whether weak horizontal sync was caused by defective sync circuit, horizontal oscillator, or sync discriminator? Can you quickly isolate inadequate width or low 2nd anode voltage to the oscillator, output, flyback transformer, or yoke? How many times have you changed a good yoke by mistake?

The SS117 will pinpoint troubles like these in minutes with tried and proven signal injection, plus yoke substitution for dynamic in-circuit tests. Error proof push button testing enables you to make all tests from the top of the chassis without removal from cabinet for maximum speed and profit on every job.

Here are the checks the SS117 makes . . .

- Horizontal Oscillator: Checked by substituting 15,750 variable output universal oscillator from SS117. Signal can be injected at any spot from horizontal output grid to horizontal oscillator to determine defective component.
- Horizontal Output Stage: Checked by reliable cathode current and screen voltage checks made with adapter socket and two push buttons,
- Horizontal Output Transformer: Checked for power transfer in circuit and read as good or bad on meter.
- Horizontal Deflection Yoke: Checked by direct substitution with adjustable universal yoke on SS117.

- Vertical Oscillator: Checked by substituting 60 cycle synchronized oscillator.
- Vertical Output Transformer: By simple signal injection for full height on picture tube.
- Vertical Deflection Yoke: By signal substitution for full height on picture tube.
- Sync Stages: Checked by synchronizing triggered horizontal SS117 oscillator from any stage. If oscillator synchronizes, sync is O.K.
- 2nd Anode Voltage: A new dynamic check using simulated picture tube load. C.R.T. does not need to be operating for current tests. No interpretations—read direct from 0 to 30 KV.
- External Circuit Measurements: By applying from 0 to 1000 volts AC or DC to external meter jacks. Meter will read DC or peak-to-peak volts. 0 to 300 milliamp scale also provided for measuring horizontal fuse current.
- New features include: Large 0 to 300 microamp meter for minimum circuit loading; all-steel carrying case with full mirror in adjustable cover; two 115 volt AC outlets in cable compartment.

Size: 10¼" x 9¼" x 3½". Wt. 10 lbs.

Model SS117

Dealer Net **\$89⁵⁰**

SEE YOUR AUTHORIZED SENCORE DISTRIBUTOR

... for more details circle 47 on post card



Sencore Sam says . . . How can you miss . . .

EACH PACKAGED UNIT CONTAINS:

- An Easy to Follow Instruction Book Especially Prepared and Edited by H. W. Sams.
- A complete 33 RPM, 10 inch Permanent Record on "How to Simplify Sweep Circuit Trouble Shooting."

SENCORE
ADDISON, ILLINOIS

HANG THE COST!

Columbia Wire's Permaline television transmission cable costs a few cents more, but it's well worth it. Permaline is the only television wire available of such quality that it can be guaranteed, in writing, for 15 and 25 years.

Columbia Wire is proud to say that in ten years we have never had to replace as much as one foot of Permaline for reasons of deterioration.

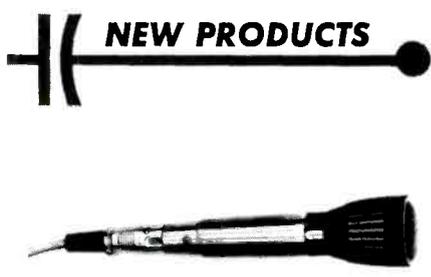
Columbia Permaline has electrical characteristics similar to those of ordinary brown polyethylene lines but the difference is, a small amount of carbon black that is added to a virgin compound to protect the transmission line from ultraviolet rays of sunlight.

Install Permaline and you will be assured of a happy customer and repeat business . . . but not for a new television cable.

Permaline is Available From Your Local Distributor. Write for samples and literature.

Columbia WIRE & SUPPLY CO.
2850 Irving Park Road • Chicago 18, Illinois

--- for more details circle 21 on post card



NEW PRODUCTS

It is said to be ideally suited also for application in churches, night-clubs, schools and location broadcasting of AM, FM and TV. Response is reported to be 70 — 15,000 cps. Price \$29.95. LTV University.

POWER PACK 204

The Tri-Pac is a device offering three distinct functions within the same case dimensions it is an-



nounced. Is available as a dc power pack, a battery charger or a transformer. As a dc power pack, it converts 120 vac to 30 vdc max, the announcemct said, for use as a battery saver on dry cell operated devices radios, clocks, etc. Electronic Components.

CB TRANCEIVER 205

A Citizens Band transceiver, the "Romper", provides eight crystal controlled transmit and receive fre-



quencies. One crystal is plugged into a socket recessed in the front panel. This arrangement allows crystals ground to any of the 23 CB frequencies to be inserted in the socket, it is said. A dual power supply allows 117 vac or 12 vdc, base station or mobile operation. Price \$124.95. Regency.

Injectorall Super 100 tuner cleaner is . . .

SAFE for nylon shafts and plastics in tuners!

SUPER 100 is a fast drying spray cleaner and lubricant that is excellent for TV tuners. It cleans contacts sparkling clean and evaporates quickly leaving a lubricated coating.

FREE! 6 oz. spray can with 6 inch steel needle a \$1.95 value . . . when you buy a 16 oz. bench size SUPER 100 with steel needle.

Cat. No. 100-16-6—\$3.60 Net

Injectorall SUPER 100 TUNER CLEANER AND LUBRICANT

You Get FREE!

1 Injectorall SUPER 100 (#100-6) 6 oz. size worth \$1.95 with the purchase of one 16 oz. SUPER 100.

Offer expires December 31, 1964.

Coupon void if taxed, prohibited or restricted by law. Cash value 1/20 of 1 cent.

INJECTORALL ELECTRONICS CORP.
BROOKLYN 14, NEW YORK

cut out coupon and take to your distributor for **FREE OFFER**

--- for more details circle 31 on post card

you get **PRODUCT PLUS** *from your Sylvania Distributor*



The value of a name Dealers have long found that SILVER SCREEN® 85 picture tubes move off the shelves fast. Why? One big reason is the tube's precision-engineered features. Another is that through the years these same features have created the guaranteed acceptance of a *name*—SILVER SCREEN 85. ■ In picture tubes no brand name approaches the assured recognition of SILVER SCREEN 85 tubes. To your customers, the name means built-in quality and long life dependability. To you, SILVER SCREEN 85 picture tubes mean sales, profits, fewer callbacks, better satisfied customers. ■ Sylvania values that acceptance and safeguards it by applying every new research and development technique for product improvement. That's why the newest SILVER SCREEN 85 picture tubes have longer life and greater product uniformity. ■ Stay with the *quality* name in TV picture tubes—SILVER SCREEN 85. See your Sylvania Distributor.

SILVER SCREEN 85 picture tubes are made only from new parts and materials except for the envelopes which, prior to reuse, are inspected and tested to the same standards as new envelopes.

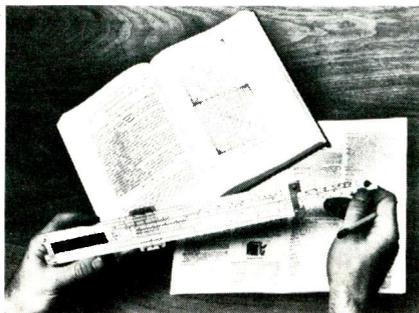
SYLVANIA
SUBSIDIARY OF
GENERAL TELEPHONE & ELECTRONICS **GTE**

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

NEW PRODUCTS

TECHNICIANS'S RULE 206

A slide rule developed exclusively for electronic engineers and technicians is announced. The instrument quickly finds correct solutions to electronic problems and its special design features enable users to read scales easily. Scales for solving reactance and resonance frequency problems are provided.



In addition, the slide rule accurately locates decimal points and provides widely used formulas and conversion factors not normally found on

other Mannerheim-type slide rules. Comes in a protective leather case to further insure long, reliable life. For handy portability, a belt loop is provided with the case. A 123-page manual is provided. Cleveland Institute of Electronics.

EXTENDED-RANGE SPEAKER 207

A two-way speaker system, the model WR-7, is announced. The compact, extended-range speaker makes effective use of a specially designed woofer, matched to a com-

CAN THIS PICTURE TUBE BE SAVED?

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

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

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

Model C-202 for duodecal base CRT's.

Model C-212 for 110° button base CRT's.

Model C-222 for 110° shell base CRT's. Net \$2.25 each.

Write for free **Britener Selector Chart**, your guide to the base type of every picture tube now in the field.

YES! Perma-Power Brightens Color Sets, Too. **Color-Brite Model C-501**, Net \$5.85 each.



Perma-Power COMPANY

5740 North Tripp Avenue • Chicago, Illinois 60646

Phone: 539-7171 (Area Code 312)

- - - for more details circle 41 on post card



compact, rugged, metal enclosure that is fully lined with Tuflex insulation and ported for optimum low-frequency response, the announcement said. Power, 15 w; impedance, 8 Ω; response, 70-15,000 cps. Size 18 x 8 x 5½ in. Atlas Sound.

CB UTILITY UNIT 208

The Hi-Gainer is said to be a fully transistorized audio compressor-clipper-amplifier designed for



citizen band, amateur, and commercial radio-telephone transmitters. Powered by a 9 v battery and may be used mobile or base. Control Radio Labs.

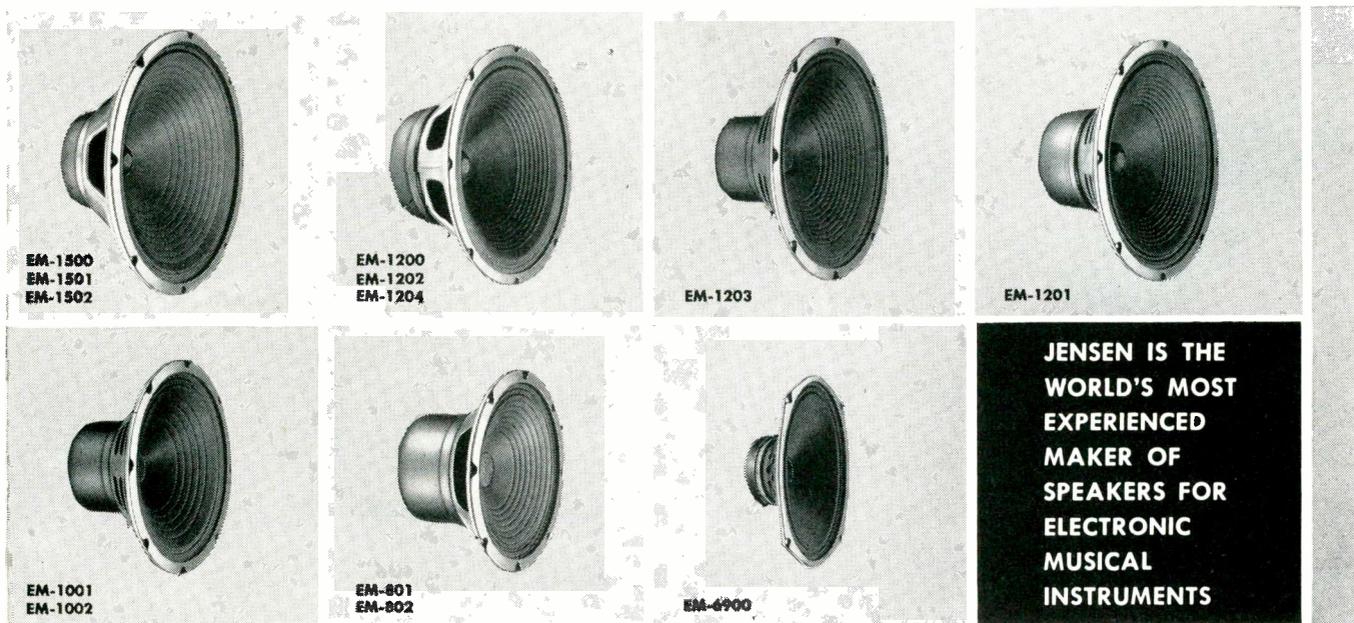
TRUCK 209

A three-wheeled utility vehicle, equipped with automatic transmission, is announced. Called the

Here's the **NEW** Jensen Electronic Musical Instrument Concert Series Loudspeakers

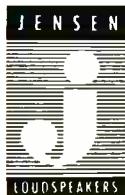
Jensen electronic musical instrument loudspeakers are highly special devices designed to give (1) exactly the correct musical quality or "voicing" required for the particular instrument; (2) the power capability to reproduce the characteristic wave shapes of the instrumental notes without distortion at loud volumes, and (3) unprecedented ruggedness for unusually long life under the severe peak load conditions imposed in these demanding applications. All designs are new and are based on recent research and development culminating our years of experience as the original and predominant source of speakers for musical instruments. Among the many features which insure better performance and trouble-free service are (1) special voice coils with high temperature enamel coatings and phenolic bobbins for dependable high power operation, epoxy cemented for permanent adhesion to the radiator; (2) formed, flat-sheet specially-processed fibre cone material which is extra stress resistant and immune to sub-harmonic breakup; (3) unique elastomer edge treatment to resist cracking; (4) breakage-proof leadout connections that multiply service life; (5) higher efficiency SYNTOX-6® magnet material.

GET THE COMPLETE JENSEN CONCERT SERIES STORY—SEND FOR CATALOG 1090



Type	Nominal Size, Inches	List Price	Model Number	Magnet* Wt. Oz.	Voice Coil			Dimensions, Inches		
					Imped. Ohms	Power Watts**	Dia. Inches	H & W	Depth	Baffle Opening
Bass	12	\$35.95	EM-1200	16	8	50	1½	12¼	6¼	10½
Guitar	15	52.00	EM-1500	27	8	60	1½	15½	7	13¼
Guitar	8	19.95	EM-801	10	8	25	1	8¼	4½	6¾
	10	21.50	EM-1001	10	8	30	1	10¾	5¼	8¾
	12	29.50	EM-1201	11	8	40	1½	12¼	6½	10½
	12	35.95	EM-1202	16	8	50	1½	12¼	6¼	10½
	15	52.00	EM-1501	27	8	60	1½	15½	7	13¼
Accordion	12	35.95	EM-1202	16	8	50	1½	12¼	6¼	10½
	15	52.00	EM-1501	27	8	60	1½	15½	7	13¼
Organ	6 x 9	14.75	EM-6900	10	8	12	1	6¾ x 9¾	3	5¼ x 8½
	8	19.95	EM-802	10	8	15	1	8¼	4½	6¾
	10	21.50	EM-1002	10	8	18	1	10¾	5¼	8¾
	12	22.50	EM-1203	10	8	20	1	12¼	6½	10½
	12	35.95	EM-1204	16	8	25	1½	12¼	6½	10½
	15	52.00	EM-1502	27	8	30	1½	15½	7	13¼

*All models have Syntox-6® ceramic magnets. **Program power. Peak power is twice program rating.



JENSEN MANUFACTURING COMPANY / DIVISION OF THE MUTER COMPANY / 6601 SOUTH LARAMIE AVENUE, CHICAGO 38, ILLINOIS
Canada: Radio Speakers of Canada, Ltd., Toronto • Argentina: Ucoa Radio, S.A., Buenos Aires • Mexico: Fapartel, S.A., Naucalpan, Mex.

--- for more details circle 33 on post card

FREE!

2 EXTRA DE-SOLDERING TIPS WORTH \$1.20...



when
you buy
the *Ungar* #270
De-Soldering Kit

ONLY \$5.83 EACH AT YOUR AUTHORIZED DISTRIBUTOR

Buy this kit, and mail the enclosed bonus coupon to Ungar. We will send you #861 Triangle Tip and #863 Cube Tip... a \$1.20 value - absolutely FREE.

The Ungar #270 Kit meets every requirement for fast, safe, easy component desoldering and removal. Avoids lug breaking, shorting and printed board rupturing.

Ungar's De-Soldering Kit speeds up work and increases efficiency. Here's how: The slotted tip melts solder quickly so that lugs bent close to the

printed board can be lifted and straightened out in a fraction of the time.

The bar tip makes it easy to de-solder all multiple straight line network components.

A variety of cup tips is a must for de-soldering tube sockets or i-f transformers. The Ungar kit includes the 5/8", 3/4", and 1" size - a complete assortment for most jobs.

The two FREE tips are ideal for electrolytic capacitor removal, tube socket pins, and harness leads.

BONUS OFFER

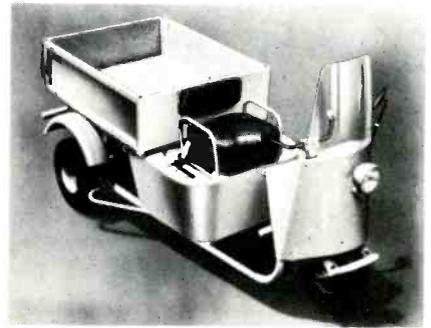
FREE...A DE-SOLDERING BOOKLET

For Just Visiting Your Authorized Ungar Distributor! Get it now!

UNGAR ELECTRIC TOOLS

ELECTRONIC DIVISION OF ELDON INDUSTRIES, INC., Hawthorne, Calif. 90252

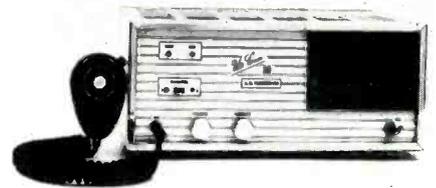
NEW PRODUCTS



Pacer, its automatic transmission functions like a fully automatic drive in a modern automobile, the announcement said. The engine, a 4-cycle, single cylinder unit, is available in two horsepower, and will operate on a liquified petroleum gas system or gasoline it was said. Drives through a 4½ ft passage-way, can turn inside a 16 ft circle, cruise at 27 mph and weighs 650 lb, the specifications indicated. Tubular Aircraft Products.

BUSINESS TRANSCEIVER 210

The Uti-Com "30" is an AM business radio transceiver designed for operation in the 30 to 50 Mc



band. The unit has dual frequency availability, a 30-w input, dual power supply, 117 vac and transistorized 12 vdc power supply, adjustable squelch and volume control, built-in noise limiter, high level push-pull modulation, TVI trap, Pi network, dual conversion super-hetrodyne receiver and a key lock off-on switch, the specifications indicated. Price \$259.95. Utica.

MUNICIPAL RECEIVER 211

An "On-Call" transistorized monitor-type Fire/Police department radio is announced. It is specifically designed as a reliable receiver to alert off-duty or volunteer fire or policemen, emergency

... for more details circle 57 on post card

ALLIANCE C-225...

THE ONLY SOLID STATE TENNA-ROTOR®



TV's better color getter...

Distributors and dealers are enjoying amazing sales results with the solid state C-225 Tenna-Rotor®.

Its patented phase-sensing bridge circuit is patterned after scientific test equipment to afford the TV and FM stereo owner life-like 'studio' reception.

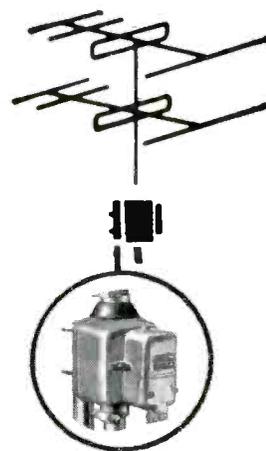
Alliance Tenna-Rotors are built to handle today's larger new antennas. They will support, hold and turn any antenna that can be lifted and placed on them. Careful workmanship and precision components provide longer life and dependable, trouble-free operation.

Check the C-225 "plus" features

- accurate repeatability
- constant synchronization
- silent operation
- greater sensitivity

Quality features you expect from the world's leading manufacturer of antenna rotating devices. Sell the line you sell with confidence—Alliance Tenna-Rotor®!

Order the C-225 and other quality Alliance models today.



The **ALLIANCE** Manufacturing Co., Inc., Alliance, Ohio

(Subsidiary of Consolidated Electronic Industries Corp.)

... for more details circle 12 on post card

BEST BUY SCOPES

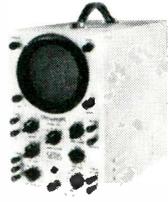
Eico's uncompromising attention to engineering excellence plus efficient Eico manufacturing and marketing techniques, give you laboratory standard performance at dramatic savings. Whether you buy kit or factory-wired, you can always count on getting the most for your test equipment dollar from Eico.

5-INCH



EICO 427 ADVANCED GENERAL PURPOSE 5" SCOPE High sensitivity scope has all the facilities and quality demanded for servicing audio, communications and industrial equipment. Vert. amp. flat from DC to 500 kc, —6 db at 1 mc; 3.5 mv rms/cm sensitivity. Horiz. amp. flat from 2 cps to 450 kc; 0.18 v rms/cm sensitivity. Automatic sync. Sweeps from 10 cps to 100 kc. Kit \$69.95; Wired \$109.95.

EICO 460 WIDEBAND 5" SCOPE For color & black-and-white TV servicing. Easily reproduces 3.58 mc color TV synchronizing burst. Vert. amp. flat from DC to 4.5 mc, usable to 10 mc; 25 mv rms/inch sensitivity. Horiz. amp. flat from 1 cps to 400 kc; 0.6 v rms/inch sensitivity. Automatic sync. Sweeps from below 10 cps to 100 kc. Kit \$89.95; Wired \$129.50.



3-INCH



EICO 430 PORTABLE GENERAL PURPOSE 3" SCOPE Remarkably fine compact scope. Excellent for servicing audio, communications, and industrial equipment. Ideal as a ham shack monitor. Flat-face 3" CRT with mu metal shield eliminates affects of external fields. Vert. amp. flat from 2 cps to 500 kc, —6 db at 1 mc; 25 mv rms/cm sensitivity. Horiz. amp. from 2 cps to 350 kc, 0.25 v rms/cm sensitivity. Sweeps from 10 cps to 100 kc. Kit \$69.95; Wired \$99.95.

sensitivity. Horiz. amp. from 2 cps to 350 kc, 0.25 v rms/cm sensitivity. Sweeps from 10 cps to 100 kc. Kit \$69.95; Wired \$99.95.

PLUS—the new 435 wide band 3-inch scope. All the features of the 460 in a 3-inch compact portable. Zener diode calibrator. Distortionless sweep expansion, horizontal and vertical to several times screen width. Weighs only 15 lbs. Kit \$99.95; Wired \$149.95.



EICO

EICO Electronic Instrument Co., Inc.
131-01 39th Avenue, Flushing, N.Y. 11352

Please send 1964 Catalog

Name _____

Address _____

City _____ Zone _____ State _____



NEW PRODUCTS

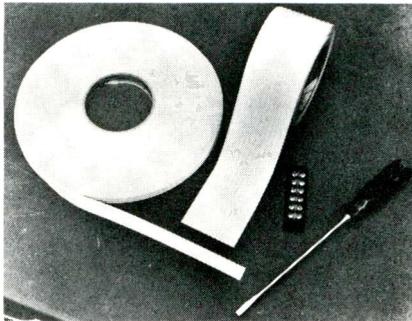


squads, or private ambulance crews. Frequencies 150-175 Mc or 30 to 50 Mc. Prices begin @ \$99.95. Regency.

FLAT CABLE

212

A "Scotchflex" brand flat cable, No. 550, is designed for low current wiring installations and may be



obtained in a wide range of conductors, from 2 to 24, for easy adaptability to specific jobs. It is said that a terminal strip and a sharp bladed screwdriver are all that are needed for installation. 3M Co.

SOLID STATE PORTABLE

213

A component portable, high fidelity phonograph, featuring a solid-state amplifier and pre-amplifier, is introduced. Called the Exponent 4/40, the portable features 70 w of peak power, 40 w EIA. It is



sooner
or
later...



you will demand the extra quality and precision of Nortronics tape heads! All Nortronics heads feature:



laminated core structures and deposited quartz gaps for superior high frequency response, and . . .



hyperbolic, all-metal faces for intimate tape-to-head contact—longer wear with minimum oxide loading.

Now, you can demand the best! Offer your customers Nortronics tape heads . . . *designed and produced to the highest standard of excellence.*

Get full details! Write today for your FREE copy of Nortronics Tape Head Replacement Guide.

Nortronics 

8133 Tenth Ave. N., Minneapolis, Minn. 55427

--- for more details circle 40 on post card

ELECTRONIC TECHNICIAN



*“I can’t afford
to carry a large
inventory*

...that’s why I specify Greyhound Package Express!”

You may not have the space of a warehouse, but your customers will think so when you specify Greyhound Package Express. Order only *what* you need, *when* you need it. Greyhound Package Express will get it where you want it, quickly, easily, economically.

Your orders travel aboard regular Greyhound buses, on fast, frequent schedules...365 days a year,

24 hours a day, week-ends and holidays. Save time, money, space, with Greyhound Package Express. Convenient C.O.D., Collect, Prepaid or special charge account service, too.

For information on service, rates and routes, call Greyhound or write today: Greyhound Package Express, Dept 53-J, 140 S. Dearborn St., Chicago 3, Ill.

It’s there in hours...and costs you less

For Example:	Buses Daily	Running Time	20 lbs.	30 lbs.	40 lbs.*
BOSTON— NEW YORK	20	5 hrs. 15 min.	\$1.80	\$2.10	\$2.30
LOS ANGELES— SAN FRANCISCO	28	9 hrs. 20 min.	2.10	2.45	2.80
DALLAS— SAN ANTONIO	10	7 hrs. 15 min.	1.90	2.15	2.45
CINCINNATI— LOUISVILLE	14	2 hrs. 40 min.	1.50	1.70	1.95

*Other low rates up to 100 lbs.



One of a series of messages depicting another growing service of The Greyhound Corporation.

... for more details circle 27 on post card

New products
from

Sherwood



NEW . . .

S-9000, 150 watt all-silicon solid-state stereo amplifier
. . . \$299.50

Sherwood's silicon solid-state circuitry makes the difference! The Sherwood S-9000 solid-state amplifier uses only silicon transistors; runs cool-as-a-cucumber with a temperature reserve great enough to boil water. Heat has been whipped as a cause of failure. This, plus advanced patent-applied-for short-circuit protection circuitry makes maintenance virtually a thing of the past. Hum and microphonics are absent . . . distortion at full power is less than 1/2% . . . less than 1/10% at lower levels. Phono input noise is less than -65db. Sherwood's S-9000 is a truly superb solid-state high fidelity amplifier that will outperform and outlast anything on the market.

*It pays to sell
the high fidelity line engineered for
performance and reliability . . .
priced for protected-dealer-profit*

Sherwood

Sherwood Electronic Laboratories, Inc.
4300 North California Avenue,
Chicago, Illinois 60618

--- for more details circle 48 on post card

NEW PRODUCTS

finished in black with padded sides, and has a Garrard Custom professional turntable and a deluxe ceramic cartridge. This model is equipped with an air-suspension speaker system for console-like sound reproduction, the announcement said. Comes with a headphone jack for private listening and a jack system for tape recording. Sylvania.

SOUND/SLIDE PROJECTOR 214

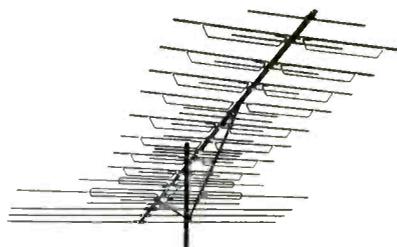
A fully automatic synchronized sound/slide projector combines an automatic tape cartridge playback



mechanism having fully transistorized electronics and a 500/300 watt projector. A choice of three sizes of cartridges provide playing times ranging from minutes to four hours. Tapes are prepared by using any standard stereo tape recorder and audio-visual synchronizer (an accessory.) Amplifier Corp.

ANTENNAS 215

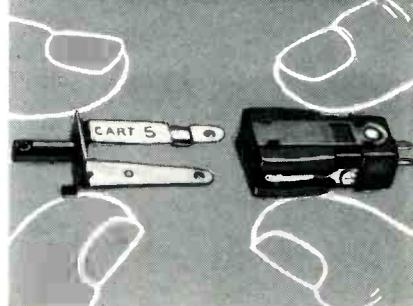
A line of "Colormagic Antennas" for TV is announced. Six models, based on the Fundamental Har-



monic Resonance (FHR) principle are designed to cover all reception areas. Other features include "Solid-Sembled" construction for quick, easy installation and long-life; "Gold" anodizing for protection against pitting, chipping, rust and corrosion, the announcement said. GC Electronics.

Why doesn't
everybody
stock

Jensen[®]
**SNAP-IN
CARTRIDGES?**



If you've been shying away from profitable cartridge replacement business because of the cost and conniptions of cumbersome inventories, let Jensen get you back on the right "track." Here's how:

- Less inventory
- Complete coverage
- Superior performance
- Respected, accepted brand name

Why doesn't everybody stock Jensen Snap-In Cartridges? Give 'em time. Soon they will.

SPECIAL K-1964 DEAL

Write for details on special Dealer Starter Kit K-1964—12 brackets and 6 interchangeable cartridge bodies which will replace 80% of all basic cartridge requirements.

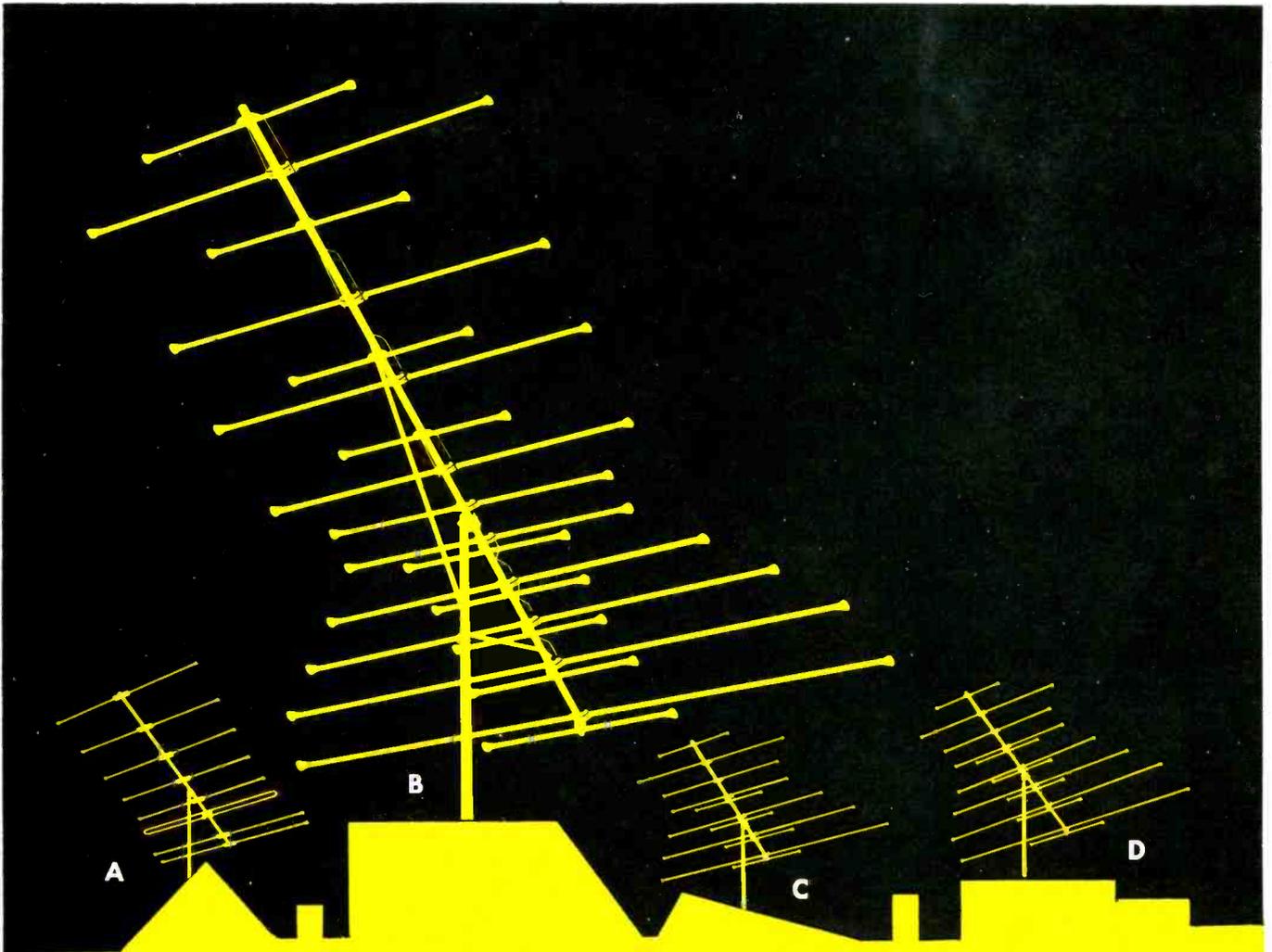
World's finest phonograph needles, cartridges, drives, accessories

Jensen[®]
INDUSTRIES, INC.
301 Interstate Rd., Addison, Ill.

In Canada: A. T. R. Armstrong,
P.O. Box 244, Islington, Ontario

--- for more details circle 32 on post card

ELECTRONIC TECHNICIAN

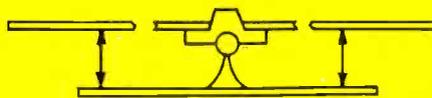


RCA OUTDOOR ANTENNAS

the name...the features...the line that sells

Now you can select the best model for your customer's location from this new RCA outdoor antenna line that combines all-channel yagi and multiple cross-driven types. Satisfy them with the sharpest color and black-and-white pictures.

Explain the RCA *exclusive* feature in customer language. Only RCA antennas feed energy directly into the transmission line from low band driven elements. These are capacitively coupled, positioned directly above high band driven elements. RCA, of course, phases low and high band directors for best high band performance.



CAPACITIVELY COUPLED

In addition, RCA's electro-lens director system absorbs maximum incoming signal power, gives extremely high gain across the VHF band, offers excellent forward gain on the front end.

More customer interest! A gold anodized finish protects every RCA antenna from weather corrosion. Wrap-around mast clamp aligns antenna on mast, prevents boom crushing.

Just call your RCA Victor distributor. Look at and learn about RCA 200, 300, 400 antennas... from the color TV pioneer! From there on... sell!

A. RCA 500 FM antenna. Eight-element yagi. Acute directivity. 88 to 108 MC. VSWR 1.25:1. Average eight db gain.

B. RCA 400 antenna. 19 elements, for fringe area or distant reception.

C. RCA 200 antenna. 11 elements, for local reception.

D. RCA 300 antenna. 13 elements, for suburban and near fringe area locations.

RCA PARTS AND ACCESSORIES, CAMDEN, N.J.



THE MOST TRUSTED NAME IN ELECTRONICS



Be a wise owl!

How to save time, increase profit with Admiral antennas!



Simplified for easier installation . . . priced for bigger profits! All Admiral antenna kits are designed to help you increase outdoor antenna sales and installations. New "All-Snap" assembly overcomes customer complaints of slow installation and high cost.

Each kit is prepacked in its own carton with all the necessary hardware. There's nothing more to buy! No need to have extra hardware lying around your shop—or in your service vehicle.

You can sell every antenna need with conical, in-line, yagi, uhf, and new parabolic styles. Many are available with gold anodizing for custom installations.

And the remarkable Admiral price gives you bigger profits from the expanding antenna market.

Call your Admiral Distributor today . . . start saving installation time, pocketing new profits tomorrow.

Be wise . . . standardize on

Admiral "ALL-SNAP" ASSEMBLY ANTENNAS

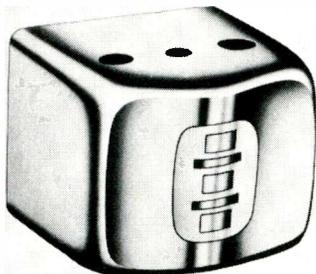
Always Precision Crafted Quality

--- for more details circle 10 on post card

NEW PRODUCTS

TAPE RECORDER HEAD 216

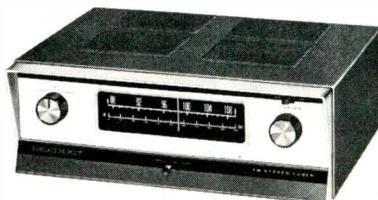
A three-channel model B3Q (5700 series) is an all-metal laminated core head with hyperbolic



contour which meets NAB standards for tape cartridge players in stereo applications. Designed for three-channel record and playback, this head has three 0.043-in. tracks located on 0.100-in. centers, deposited quartz gaps and precision lapped, low-loss core structures, the announcement said. Available in rear-mount, base-mount, side-mount and no-mount styles. Nortronics.

FM STEREO TUNER 217

An FM stereo tuner kit, model AJ-13, is introduced. The tuner features only three controls, an auto-

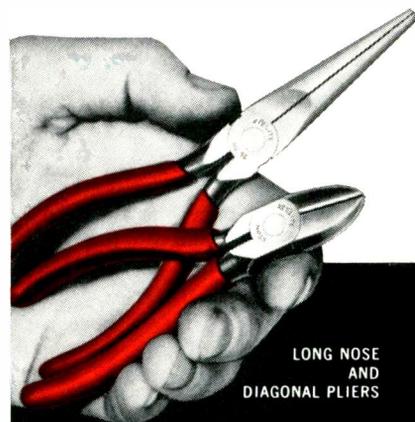


matic frequency ON-OFF switch, an ON-OFF-FM-stereo selector and a flywheel tuning control. The 7-tube circuit has a 12-tube function which includes built-in FM multiplex. Sensitivity $2\frac{1}{2}$, μv for 20 db quieting, a monophonic frequency response of ± 1 db from 30 to 20,000 cps, stereo response ± 2 db from 50 to 15,000 cps; harmonic distortion 1 percent or less at 1 kc; channel separation 25 db or more at 1 kc, the specifications indicated. Price \$49.95. Heath.

UHF ANTENNA 218

A twin imperial-booster antenna combination for UHF reception beyond the fringe area is announced.

look to Xcelite for the best in pliers & snips, too



LONG NOSE AND DIAGONAL PLIERS



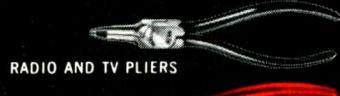
CHAIN NOSE ELECTRICIAN'S PLIERS



COMBINATION SLIP JOINT PLIERS



NEEDLE NOSE PLIERS



RADIO AND TV PLIERS



SIDE CUTTING PLIERS



TRANSVERSE CUTTING PLIERS



UTILITY PLIERS



ELECTRONIC SNIPS

Same professional quality as famous Xcelite screwdrivers and nutdrivers. Forged alloy steel construction. Precision machined. Scientifically proportioned. Variety of sizes. All available with permanent, plastic coated Cushion Grip handles for extra working comfort (except slip joint models).

WRITE FOR CATALOG SHEET N664



XCELITE, INC., 14 BANK ST., ORCHARD PARK, N. Y.
Canada: Charles W. Pointon, Ltd., Toronto, Ontario

--- for more details circle 63 on post card

ELECTRONIC TECHNICIAN



DYMO IDENTIFICATION SYSTEM

THE ELECTRONICS INDUSTRY IDENTIFIES ITSELF WITH DYMO! DYMO's M-55 TAPEWRITER makes raised-letter labels on-the-spot. Just dial letters, numbers, or symbols—and squeeze the handle. Letters come out crisp white on a colored background of self-sticking vinyl. Complete with round and square corner cutters, accessory wheels for technical symbols and vertical labels. With one tool, a complete system of identification. Always use DYMO tape!

Suggested Price **\$29⁹⁵**



FREE: Tape samples and full details. DYMO INDUSTRIES, INC., P.O. Box 1030, Berkeley, Calif. Dept. ET-9-55

NAME _____
 COMPANY _____
 STREET _____
 CITY _____ STATE _____

Price slightly higher in Canada



The announcement said that features include UHF preamplifier using two transistors, a single 300 Ω transmission line for 18 v power to booster and bring amplified UHF signal down to power supply at TV set and rust proof aluminum terminals. \$53.95 complete. Gavin.

PORTABLE PLAYER 219

The VP25, a 20-w continuous sine wave (30-w peak) portable transcription player and sound sys-



tem, includes a B51 turntable with professional bearing-mounted tone arm and a G-E variable reluctance cartridge with dual sapphire styli. It features an automatic tone arm cueing lever, heavy duty formed steel platter and continuously variable turntable speeds from 29 to 86 rpm with click stops for 16, 33-1/3, 45 and 78 rpm. A 45 rpm spindle adapter is provided. It incorporates a transistorized amplifier designed for trouble-free low heat operation, with a frequency response plus or minus one db from 45 to 18,000 cps, the specifications indicated. Bogen.

FM STEREO ANTENNA 220

A log periodic type FM stereo



Be a wise owl!

How to cut call backs, increase profit on receiving tubes!



Engineered for peak performance... priced for extra profit! Every Admiral Supertron Electronic Tube must pass rigorous *super-quality* control tests and life tests to meet the high premium standards required for circuit approved tubes.

The remarkable Admiral price and volume discount helps you make *more dollar profit* on every service job! Reduce expensive call backs.

Order a complete supply of new Admiral Supertron Receiving Tubes today... start pocketing big profits tomorrow! Call your Admiral Distributor now!

Be wise... standardize on

Admiral[®] SUPERTRON RECEIVING TUBES

Always Precision Crafted Quality

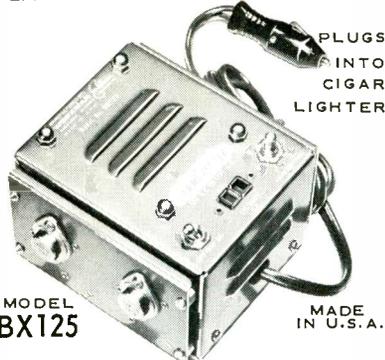
... for more details circle 11 on post card

TRANSISTORIZED POWER CONVERTER

12 VOLT DC to 117 VOLT AC

FOR \$ **29.95** DEALER
ONLY NET

POWERFUL 125 WATT CONTINUOUS
DUTY. PROVIDES 117 VOLT 60
CYCLE A.C. BY PLUGGING INTO
CAR OR BOAT 12 VOLT CIGARETTE
LIGHTER RECEPTACLE.



PLUGS
INTO
CIGAR
LIGHTER

MODEL
BX125

MADE
IN U.S.A.

ASK YOUR ELECTRONIC
PARTS DISTRIBUTOR FOR

TRANSVERTER

Designed and Manufactured by:

WORKMAN *Electronic*
SARASOTA, FLORIDA PRODUCTS, INC.

- - - for more details circle 62 on post card

Save Time on PC Board Repairs!



MODEL 100A

Melted solder
disappears up
hollow tip
into tube

The **ENDECO** Desoldering Iron
Removes Soldered Components
in seconds... without damage!

Endeco melts solder, then removes it by vacuum • Leaves terminals and mounting holes clean • Resolders too • One-hand operation • Temperature controlled for continuous use • Ideal for use with shrinkable tubing • 4 tip sizes • Quickly pays for itself in time saved • Only \$18.75 net.

SEE YOUR DISTRIBUTOR OR WRITE

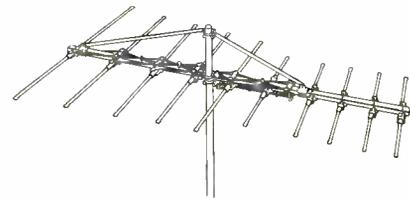


**ENTERPRISE
DEVELOPMENT
CORPORATION**

1102 E. 52ND • INDIANAPOLIS, IND. 46205

- - - for more details circle 24 on post card

NEW PRODUCTS



antenna is designed to provide high gain. Available in four models with gains from 15.6 to 26 db, the announcement said. Prices \$19.95 to \$49.95. JFD.

PORTABLE AMPLIFIER 221

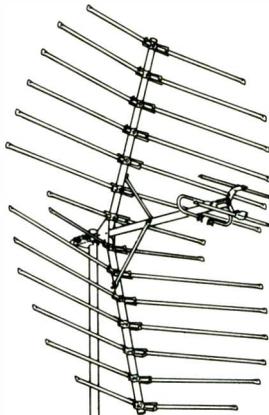
A portable flashlight-battery operated amplifier is announced. The model S-700 features all-transistor



design for instant performance, one-knob operation, and is rated at 25 w EIA music power, the announcement said. Perma-Power.

UHF ANTENNA 222

An all-channel UHF antenna, Model U-540, uses the "incident wave" principle with a tangent par-



aboloid reflector system. An extremely uniform frequency response is achieved across all UHF channels 14-83 with a measured gain of +13 db, and impedance match into 300 Ω is 1.5:1 or better at all UHF frequencies, the announcement said. Price \$29.95 list. Winegard.



send for NEW FREE
CRYSTAL CATALOG
with NEW TRANSISTOR
OSCILLATOR CIRCUITS



3 PLANTS TO SERVE YOU BETTER
**HERMETICALLY SEALED
PRECISION GROUND
CUSTOM-MADE
NON-OVEN CRYSTALS**

Gold or silver plated, spring mounted, vacuum sealed or inert gas, high freq. stability, 10 milliwatt max. current cap. Meet mil. specs.
1000KC to 1600KC (Fund. Freq.)

	Prices on Request
1601KC to 2000KC (Fund. Freq.)	\$5.00 ea.
2001KC to 2500KC (Fund. Freq.)	4.00 ea.
2501KC to 3000KC (Fund. Freq.)	3.50 ea.
3001KC to 3500KC (Fund. Freq.)	3.90 ea.
3501KC to 4000KC (Fund. Freq.)	3.25 ea.
4001KC to 4500KC (Fund. Freq.)	3.75 ea.
4501KC to 5000KC (Fund. Freq.)	5.00 ea.

OVERTONE CRYSTALS	
15MC to 30MC Third Overtone	\$3.85 ea.
30MC to 40MC Third Overtone	4.10 ea.
40MC to 65MC Third or Fifth Overtone	4.50 ea.
65MC to 100MC Fifth Overtone	6.00 ea.
DRAKE 2-B Receiver Crystals	\$4.00

(All Channels—Order by Freq.)

OVEN-TYPE CRYSTALS

For Motorola, GE, Ganset, Bendix, etc.

Add \$2.00 per crystal to above prices

SUB-MINIATURE PRICES slightly higher

ORDER FROM CLOSER PLANT
TEXAS CRYSTALS

DEPT. T
1000 Crystal Drive
FORT MYERS, FLORIDA
Phone 813 WE 6-2109

Division of



AND
4117 W. Jefferson Blvd.
LOS ANGELES, CALIF.
Phone 213-731-2258

- - - for more details circle 55 on post card

IT ONLY COSTS
1/100 OF 1¢ MORE*
PER SOLDER JOINT
TO KNOW YOU
ARE USING THE
WORLD'S FINEST
CORED SOLDER

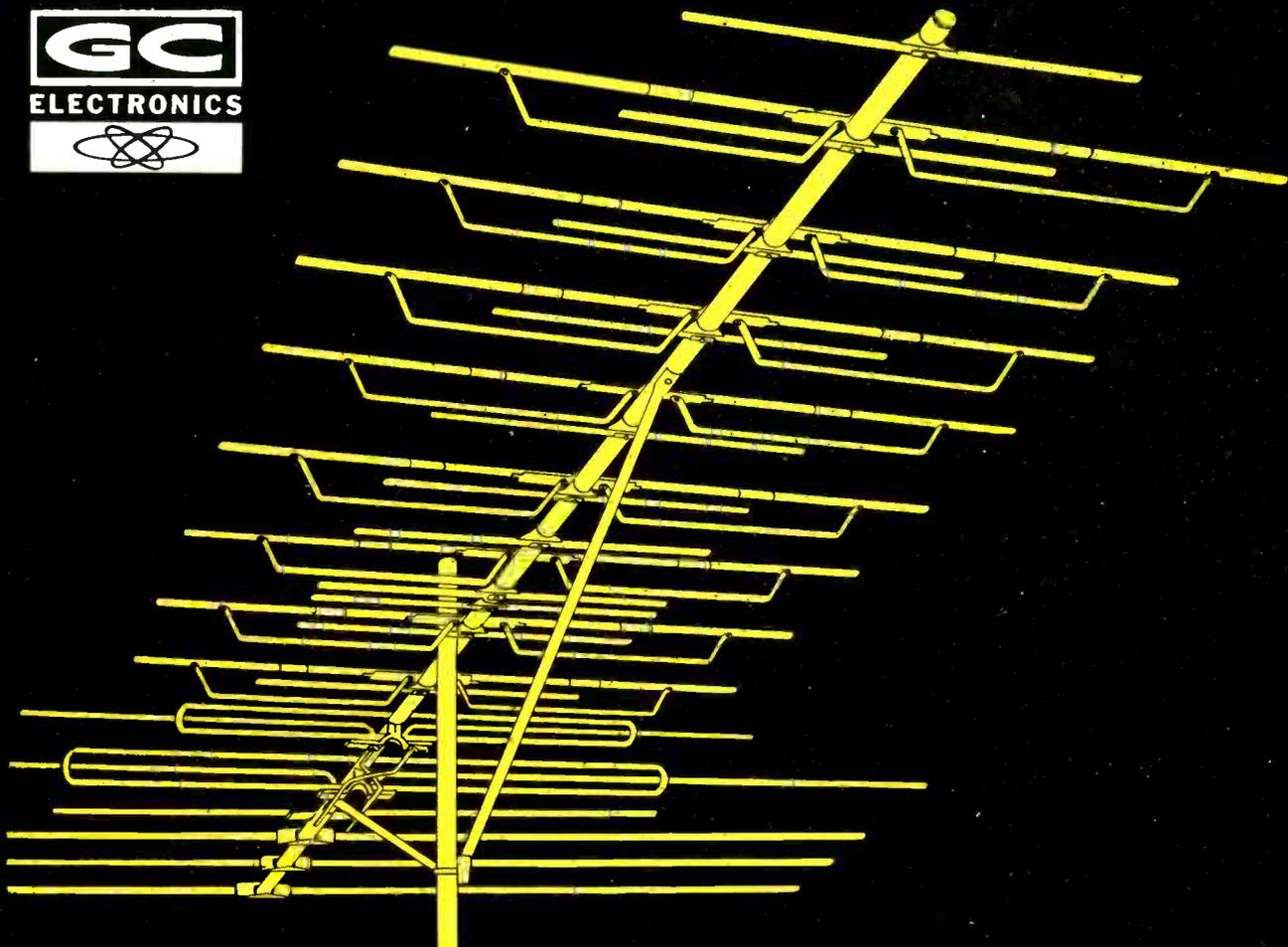


ERSIN
Multicore
FIVE-CORE SOLDER
Sold only by Radio Parts Distributors

*Based on cost comparison in current catalogs.
MULTICORE SALES CORP., PORT WASHINGTON, N.Y.

- - - for more details circle 39 on post card

ELECTRONIC TECHNICIAN



COLORMAGIC

Patent Pending

FHR

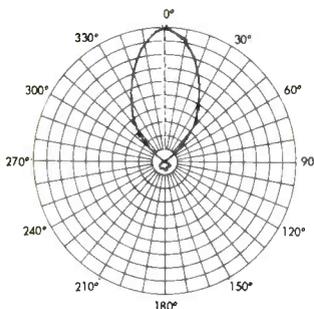
FUNDAMENTAL HARMONIC RESONANCE...GC'S EXCLUSIVE DESIGN PROCESS!

Colormagic elements resonate on the fundamental harmonics within both the high and low bands. Colormagic FHR outperforms the average second harmonic TV element by producing a tight, laser-linked directivity of signal...higher gain! It's in the elements!

GC "GOLD-GUARD" anodizing process guards against pitting, chipping, rust and corrosion...makes the Colormagic series the best protected, all-weather line available!

GC "SOLID-SEMBLED" construction insures quick, easy installation...rigid-lock elements snap securely into place!

Compare! Colormagic Antenna Systems offer pencil-point polar patterns...laser-linked directivity...flat plateau response curve...no traps or peaks...excellent for color or black & white TV reception.



15 All-New Colormagic Combo-Couplers permit cross-direction reception of UHF-VHF-FM antenna combinations...each unit encased in high-impact polystyrene case...supplied with stainless Steel mounting strap. Complete sales program available.



See your GC Distributor! He'll fill you in on this "prestige" package. **CONSIDER THE ELEMENTS INVOLVED!** ...then GO COLORMAGIC! If not stocked locally, write us for name of Distributor nearest you.

GC ELECTRONICS CO.
Division of Textron Electronics, Inc.

Western Plant: 3225 Exposition Place, Los Angeles 18, Calif.
MAIN PLANT: 400 S. Wyman St., Rockford, Ill., U.S.A.

... SOME ANTENNAS HAVE 'IT'

Continued from page 45
in modest and high winds. Two methods of construction can help strengthen these critical points. One concept employs a metal sleeve placed on the outside or on the inside of the antenna element to add strength. This sleeve length is critically important because of the cantilever action of the elements. If the sleeve is too short it is of little value. But if it is from 6 to 8 in. long, it will help considerably to distribute the stresses over a wider area. But there's one flaw in this concept: when more metal is

added to the antenna, the over-all weight is increased—placing more stress on the boom and hardware.

Wooden dowels are also used to strengthen the rivet joints and distribute stress and strain. The added weight is slight and dowels may be used in extended lengths. This appears to be the most practical method developed thus far to strengthen the antenna's rivet joints which contributes to a longer service life from the product.

The hardware used in TV antennas must also be considered. It must have great strength because of the length of the elements on

VHF types which increases the cantilever action; and should have a positive snap-into-place action that will keep the elements from slipping out of position in high winds. The best aluminum and plastic combinations are used to insure long life.

To make sure the antenna you choose won't topple off the roof in a puff of wind, especially after taking all the important basics into consideration, mounting hardware—chimney, roof and wall mounts and heavy-duty masts (16 gage or heavier for tubular-type masts)—should all be chosen from top

TWIN TRANSISTOR SUPER COLORTRON

Not 10 DB, not 15 DB but a whopping
33 DB gain on the low band and FM—
33 DB gain on the high band actually
amplifies the signals 45 times



TWIN TRANSISTOR STANDARD COLORTRON

18 DB gain on the low band and FM—
18 DB gain on the high band



NEVER BEFORE — 33 DB gain!

NEVER BEFORE — Same gain on every channel 2—13 plus FM!

NEVER BEFORE — 3.5 DB noise figure or less on all channels!

quality brands. Those plated with zinc dichromate processes resist rust well and logically provide longer life.

But this is not all it takes to end up with an "it" installation. The installation needs the refined, finishing touches of an expert technician who knows where he is going and how to get there.

Finishing Touches

The days of .98¢, uncoated, 20-gauge, butted-seam mast and \$1.69 wobbly-element antennas are gone. Few TV-viewers want that kind of junk any more—at any price.

When you have selected your well-designed, constructed, high-performance-type antenna and comparable hardware, don't forget to tie good twin-lead into it. Make sure the copper is good, the polly is virgin and the machine-run is true. Don't tie "reject" type wire into your otherwise good antenna. And when you attach the two bright, twisted copper strands, give the connections a "swish" of insulating plastic spray, then tape the connections well to remove strain and protect from corrosion. Use plastic electrical tape.

If you have to run the antenna

up 20 ft or more—using swaged-ended mast sections—guy the mast at 3 points with wires attached near or just below the 15 ft level. Use a good grade of coated, stranded steel wire or the hardened aluminum alloy type. If you use snap-on mast standoffs—tape them well to the mast with ordinary friction tape.

If you have done all these and some other things well, then your installation will have a satisfied customer. You will be in possession of a formula that will ultimately yield increasing profits and provide you with a more satisfying existence. ■

POTENT NEW PRE-AMPS

from Winegard with Super High Gain

- First Pre-amps That Have Same Gain on Both TV Bands plus FM.
- Will Take Highest Signal Input of Any Twin Transistor Antenna Amplifiers Made.
- Have Lowest Noise Figure Ever Obtained on TV Antenna Pre-amps.
- Can Be Used on Any TV Antenna for Black and White, Color or FM.

Up to now there have been two serious drawbacks to all antenna pre-amps (including our own)—

First—there have never been antenna pre-amps that had enough gain for every application. Second—all antenna pre-amps have had from 4 to 6DB gain less on the high band. This is unfortunate because the high band channels normally need pre-amplification more than the low band due to greater reception losses at the higher frequencies.

NOW Winegard has created two big solutions to this problem—the Super Colortron with a flat 33 DB measured gain on all channels 2—13 and the Standard Colortron with a flat 18 DB gain on all channels 2—13. For example, the Super Colortron will blow up a 50 microvolt signal to 2250 microvolts even on 13, the highest channel. Compare this with the best twin transistor pre-amps previously available where a 50 microvolt

signal would be amplified only to 175 microvolts—a tremendous difference in signal power. This increase in amplification will cover all applications—particularly for fringe area color. (See comparison charts to the right).

Of equal importance to gain is the noise figure of a pre-amp. Winegard engineers have lowered the noise figure on these new pre-amps as much as 2 DB over any other TV pre-amp available. They will bring perfect color even to deep fringe areas.

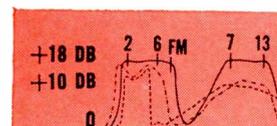
Compare these new Winegard antenna pre-amps with any others on the market today. Compare construction—totally weather-proofed polystyrene case, even the terminals are protected . . . convenient, rugged mounting bracket that snaps-on boom. Compare performance—highest gain . . . lightning protected circuit . . . lowest noise! Then try a new Twin Transistor Colortron and see it in action!

The Super Colortron (AP75T) uses a 75 ohm system with RG59U Coaxial cable. Has three RG59U Connectors. For runs of over 70 ft., RG11U is recommended. The AP75T supercedes the AP215N. Model AP75T lists for only \$79.95.

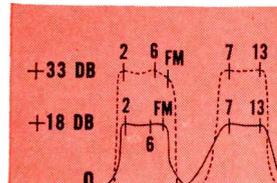
SPECIFICATIONS: GAIN: +33 DB per band. BAND PASS: 54MC-108MC, 174MC-216 MC. RESPONSE $\pm \frac{1}{2}$ DB per 6 MC channel. VSWR: Input 1.5:1. Output: 1.75:1. MAX. SIGNAL INPUT: 55,000 MV. MAX. SIGNAL OUTPUT: 2,000,000 MV. INPUT IMPEDANCE: 300 ohm. DOWNLEAD IMPEDANCE: 75 ohm. OUTPUT IMPEDANCE 75 or 300 ohm. 117V 60 CPS 1.8 watts.

The Twin Transistor Colortron Antenna Amplifier (AP220T, 300 ohm) lists for only \$44.95. The AP275T (75 ohm) amplifier lists for \$49.95.

SPECIFICATIONS: GAIN +18 DB per band. BANDPASS: 54 MC-108 MC, 174 MC-216 MC. RESPONSE $\pm \frac{1}{2}$ DB per 6 MC channel. VSWR: Input 1.5:1. Output: 1.75:1. MAX. SIGNAL INPUT: 80,000 MAX. SIGNAL OUTPUT: 660,000 MV. INPUT IMPEDANCE: 300 ohm. OUTPUT IMPEDANCE: AP-220T —300 ohm, AP275T—75 ohm. 117V, 60 CPS. 1.8 Watts.



COMPARE THESE GAIN CURVES AGAINST COMPETITIVE MAKES. CURVES TAKEN FROM SCOPE PHOTOS.
 ---- BRAND J
 _____ BRAND B
 WINEGARD COLORTRON (AP220T)



ACTUAL MEASURED CURVES PROVE A FLAT 18 OR 33 DB GAIN . . . HIGH BAND, LOW BAND, FM, TOO.
 ---- WINEGARD AP75T
 _____ WINEGARD AP220T

 <p>COLORTRON TWIN NUVISTOR (AP220N). 300 ohm. Input: 400,000 microvolts . . . highest of any amplifier, tube or transistor. List \$39.95. AP275T (75 ohm) List \$44.95.</p>	 <p>TWIN NUVISTOR FM AMPLIFIER ONLY. (AP320), 18 DB gain. 180,000 Microvolts Input. List \$39.95. AP375—same, but coax. List \$44.95.</p>	 <p>REDHEAD SINGLE TRANSISTOR ANTENNA AMPLIFIER (RD300) Most reliable, highest gain single transistor model available. Input: 20,000 microvolts. 300 ohm input and output. List \$29.95.</p>	 <p>UHF 212—Twin Transistor UHF antenna amplifier has 12 DB gain on all UHF channels 14-83. Noise figure 8 DB at 900 MC. List \$44.95.</p>	 <p>UHF 110X Single transistor UHF antenna amplifier has +8 DB gain on channels 14-72. List \$34.95. UHF 110T (translator model) —same, but has 12 DB gain on channels 72-83. List \$34.95.</p>
---	---	--	--	---



Winegard Co.
 ANTENNA SYSTEMS

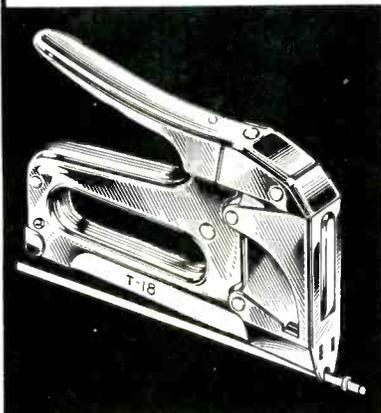
3019-J Kirkwood, Burlington, Iowa

World's most complete line of TV&FM reception equipment.

... for more details circle 60 on post card

ARROW Staple Gun Tackers

SAVE YOU TIME AND MONEY!



Tapered striking edge gets into tight corners!

MODEL T-18 — For wires 3/16" and less in diameter. Loads (85) T-18 staples with 3/16" crown, divergent-pointed, of .050 wire in 3/8" leg length.

MODEL T-25 — For wires up to 1/4" in diameter. Loads (85) T-25 staples with 1/4" crown, wedge or divergent-pointed, of .050 wire in 9/32", 3/8", 7/16" and 9/16" leg lengths.

Write for catalog and information.

ARROW FASTENER COMPANY, INC.

One Junius Street • Brooklyn 12, N. Y.

SAFE!

Can't damage wire because staples automatically stop at right height! Won't even break 1/4" hollow glass tubing.

FAST!

Proved by test 10 times faster than old hammer method. Saves you 70% in fatigue and efficiency . . . saves many dollars.

HOLDS!

New staples get tremendous holding power from tack points that spread to lock into wood!

- All-steel construction with chrome finish.
- Jam-proof patented mechanism for trouble-free operation.

- - - for more details circle 13 on post card

SYNC ON BUSINESS

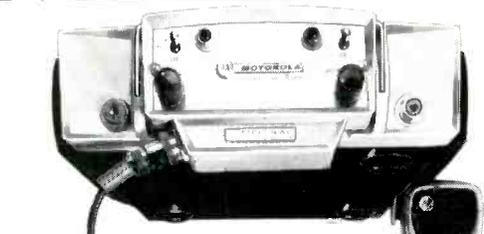
PA sound gets bigger each year. A 7,000-lb, 16-ft dia loudspeaker has a maximum output equal to some 1,000 console phonographs operating at full volume. The giant speaker, designed by RCA and Commercial Radio-Sound Corp., pours forth Hi Fi music as part of a synchronized display of water patterns, color, sound and fireworks, in the center of the New York World's Fair "Fountain of the Planets."



Portable battery powered cordless drills took another step forward recently when NICAD Division of Gould National Batteries and the MIRA Corporation developed one for use in surgical procedures.



A common medicinal product found in almost every home in the United States killed 144, last year and is only one of 250,000 potential poisons easily available from neighborhood stores, according to a folder on childhood poisoning published by the Children's Hospital Medical Center in Boston. The folder, "How to Prevent Childhood Poisoning," claims that aspirin is "by far the most common poison—responsible for 100,000 childhood poisonings in the U. S. each year."



ARE YOU CASHING-IN ON THE PROFITABLE 2-WAY RADIO SERVICE BUSINESS?

- ★ Motorola will train you for this rewarding, elite profession
- ★ Send for our FREE EVALUATION EXAM. Prove to yourself that you are ready to learn FM 2-way radio servicing.

Opportunities in 2-way radio servicing are virtually unlimited. Just one of the hundreds of successful Motorola Service Stations writes, "we would be pleased to interview any graduate of your school that has received some training in 2-way radio maintenance. We are an established firm, 10 years old, with a promise of expansion governed by our ability to obtain competent technicians." Get all the facts today. There is no obligation and no salesman will call.

MOTOROLA TRAINING INSTITUTE

4545 West Augusta Blvd. • Chicago 51, Illinois • Dept. AEM436

Send me FREE entrance exam.

Send full details on Home Study Course on FM 2-way Radio Servicing

Send me details on how you can help me prepare for an FCC License.

Name _____ Occupation _____

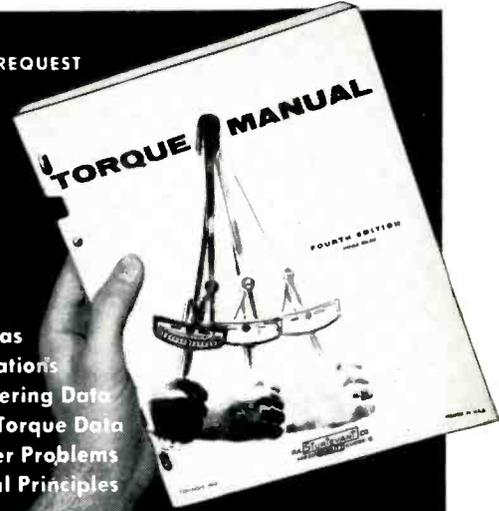
Address _____

City _____ Zone _____ State _____

- - - for more details circle 38 on post card

"TORQUE WRENCH" MANUAL

SENT UPON REQUEST



- Formulas
- Applications
- Engineering Data
- Screw Torque Data
- Adapter Problems
- General Principles

P.A. **STURTEVANT CO.**
ADDISON QUALITY ILLINOIS

Manufacturers of over 85% of the torque wrenches used in industry

- - - for more details circle 52 on post card

To become more competitive, Olympic Radio and TV "... will have a product line constantly updated each month with new models, new prices and new values to give the consumer the most for his money all year around," according to Morton M. Schwartz, President.



Customers you call on now may not need your services again until this winter when their antenna system fails. Sell them now on an antenna installation or check-up. Your customers deserve to know that your time is at a premium in the fall and that conditions may make prompt winter antenna system repair impossible.



Lettering and painting your truck at this time of year will add a new sparkle to your business vehicle that won't hurt your business any. And you can help the painter—his business is about as slow as yours in the summer.



A color TV field service guide, prepared by the Philco Electronic Service Publication and Training Department, covers instrument disassembly, tuner and chassis removal, CRT removal and replacement, AGC adjustment, purity adjustment and other essential adjustments. The address is 3900 Welsh, Willow Grove, Pa.



FOR THE **ULTIMATE**
IN TV TUBE **PERFORMANCE**

SPECIFY GRIFFITHS GUN MOUNTS

Griffiths unique and patented method of treating cathodes (processed in an air-conditioned, humidified, atmosphere) results in the closest tolerance of finished tubes. For the mark of quality... Ask for the Griffiths Grid, "the grid with the lid."

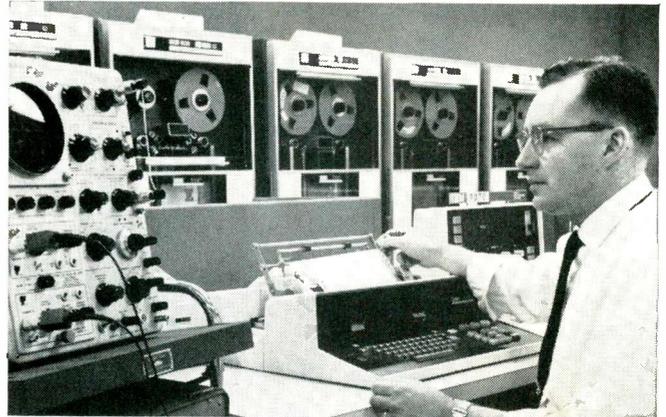
See your independent Tube Manufacturer

GRIFFITHS ELECTRONICS

1301 E. Linden Avenue, Linden, N. J. P.O. Box 602
Area Code 201 925-7300

... for more details circle 28 on post card

JOIN THIS MAN!



MAKE MORE MONEY IN ELECTRONICS

SEND COUPON NOW FOR FREE BOOK

Trained men get ahead fast in the exciting field of Electronics. Learn all about Transistors, Communications, Aerospace Electronics, Computers. Cleveland Institute of Electronics can teach you ... at home for a fraction of classroom training cost. Check these CIE advantages:

No Experience Needed: "Check-Point" Home Study Plan presents material in small, easy-to-understand bits ... reinforced with clear explanations, diagrams, examples.

Nationwide Job Placement: Cleveland Institute students get bi-monthly listings of hundreds of high-paying jobs in electronics ... the world's fastest growing industry!

A Commercial FCC License ... or Your Money Back: Should you fail your FCC exam after completing your licensing program, CIE will refund all your tuition!

Cleveland Institute is an accredited member of the National Home Study Council; is also approved for Veteran's training under the Korean GI Bill.

ACT NOW...SEND COUPON FOR FREE BOOK

Cleveland Institute of Electronics

1776 E. 17th St., Dept. ET-10
Cleveland, Ohio 44114

Please send FREE Electronics Career Book without obligation. I'm a high school graduate interested in (check one):

- Electronics Technology
- Broadcast Engineering
- Industrial Electronics
- First Class FCC License
- Electronic Communications
- Advanced Engineering



Your Occupation _____

Name _____ Age _____
(Please Print Clearly)

Address _____

City _____ State _____ Zip Code _____



BUSS quick-acting Fuses

"Fast Acting" fuses for protection of sensitive instruments or delicate apparatus;—or normal acting fuses for protection where circuit is not subject to starting currents or surges.

BUSS

Write for BUSS
Bulletin SFB

BUSSMANN MFG. DIVISION, McGraw-Edison Co., St. Louis, Mo. 63107

Buys Comsat Stock

Telephones, Inc., a leading independent telephone holding company, with corporate offices in Chicago, reportedly purchased 100,000 shares of Common Stock of the Communications Satellite Corporation (Comsat) at a cost of \$2,000,000. This is believed to be the largest single purchase of shares in its category, issued to communications common carriers authorized by the FCC to own stock in Comsat. "We believe that Comsat will develop many outstanding achievements," said Perry D. Woodward, Telephones' President, "and our purchase was made with the intent of investing in the international telephone company of the future."

J-Jacks Patented

The Jerrold J-Jacks system, a single-cable, dual-function distribution system for master antenna and closed-circuit TV has been issued patent number 3,105,873 by the U. S. Government Patent Office. The J-Jacks system provides outlets to which cameras or receivers can be attached interchangeably through a simple plug-in unit. It is said this feature simplifies the functional design of TV communications facilities for schools, hospitals, industrial plants, and military establishments.

RCA Earnings Rise

Earnings of the Radio Corporation of America during the second quarter of 1964 increased 32 per-

BUSS: 1914-1964, Fifty years of Pioneering...

NEWS OF THE INDUSTRY

Allerton Conference

The second annual Allerton Conference on Circuit and System Theory will be held at Allerton House, Conference Center of the University of Illinois, Monticello, Illinois, from September 28 to 30, 1964. The Conference will be devoted to theoretical aspects of circuit and system theory.

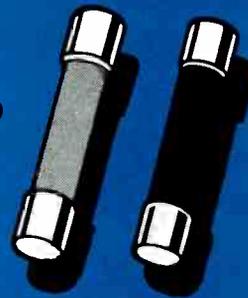
ISA Sponsors Course

The Instrument Society of America (ISA) will sponsor a three-day short course on Instrumentation in Hazardous Areas. The course, hosted by the ISA Wilmington Section and endorsed by ISA's Standards and Practices Department, will be held in Wilmington, Delaware, from November 11 to 13, 1964.

New Sylvania Department

Formation of a Signal Lamps and Devices Department for indicator and pilot lamps and hardware and other special light sources has been announced by Garlan Morse, Vice President, Operations, of the Lighting Products Division of Sylvania Electric Products Inc.

BUSS MBO
1/4 x 1-1/4
inch



BUSS ABC
1/4 x 1-1/4
inch

BUSS high interrupting capacity Fuses

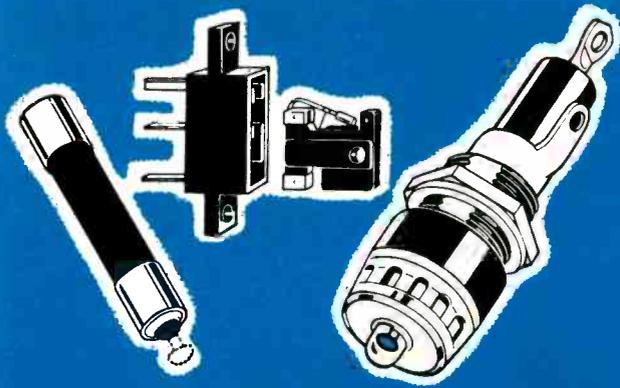
For the protection of circuits capable of delivering currents as high as 25,000 amps. at 125 volts or 10,000 amps. at 250 volts.

BUSS

Write for BUSS
Bulletin SFB

BUSSMANN MFG. DIVISION, McGraw-Edison Co., St. Louis, Mo. 63107

... for more details circle 17 on post card
ELECTRONIC TECHNICIAN



INDICATING FUSES AND FUSEHOLDERS HAVE MANY USES

Unusual fuseholders and fuses perform complex functions in addition to providing safeguards for circuitry and components.

They can provide quick, positive identification of faulted circuits . . . by visual signal, by activating an alarm, or both.

BUSS

Write for BUSS
Bulletin SFB

BUSSMANN MFG. DIVISION, McGraw-Edison Co., St. Louis, Mo. 63107

tion of KTV Tower and Communications Company of Sullivan, Illinois. The company, once known as Kuehne Tower Company, manufactured home TV and amateur antenna towers. The line will now be available from Rohn representatives.

Eastern Wins Bourns Award

Eastern Radio Corp., Clifton, N. J., distributors of industrial electronic components, has been awarded the coveted Bourns Award for the "Distributor of the Year." The presentation was made by Mr. Russell French, Distributor Sales Manager, TRIMPOT Division of Bourns, Inc., to Mr. Lewis A. Ross, President of Eastern Radio Corp. In making the award, Mr. French cited Eastern Radio for "outstanding overall achievement and marketing excellence."

Pilot Returns to TV

Pilot Radio Corp. announces the introduction of home entertainment centers featuring color television and a new line of sidetable stereo instruments, both equipped with completely solid state electronics. The new units were shown for the first time at the National Association of Music Merchants show in Chicago recently. This marks the return of Pilot to TV marketing. A TV pioneer, the firm dropped TV in 1952 to concentrate on Hi Fi equipment. The 21-in. color TV set will be available only as part of Pilot's home entertainment centers and not as separate units. The home entertainment centers also include solid state stereo electronics.

...New Developments in Electrical Protection

cent over the same quarter last year to establish an all-time record for the period, Chairman David Sarnoff and President Elmer W. Engstrom announced. RCA's operating earnings for the first six months of 1964 also established a record for the period, rising 28 percent over the first half of 1963.

UHF Story

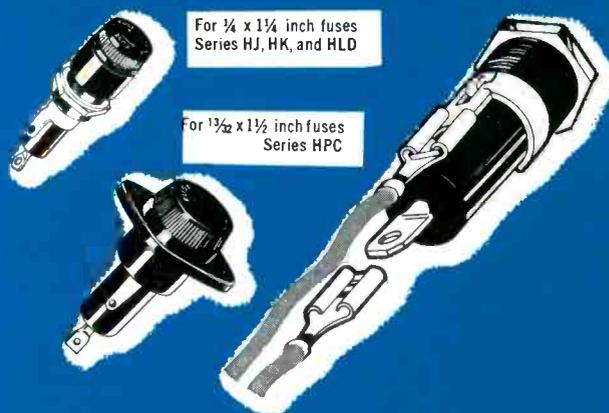
The Federal Communications Commission estimates that about 200,000 interested persons have seen the "UHF Story on Slides," which was produced in 1963 by the FCC in cooperation with the Committee for the Full Development of All Channel Broadcasting. This is based on indications by the Electronic Industries Association that viewers have included some 150,000 TV dealers, distributors and service technicians and by FCC estimate that 50,000 other individuals have also seen it.

Association Convention

Television Service Association of Ohio is holding its annual fall convention September 11, 12 and 13, 1964, at the Brown Derby Motor Inn in Cuyahoga Falls, Ohio. In conjunction with the convention, the association is arranging a display fair designed expressly for the electronics industry. Since this is an Ohio first, the association feels that the convention will benefit technicians, dealers, and manufacturers.

Rohn Buys KTV

Rohn Manufacturing Co. announces the acquisition of KTV Tower and Communications Company of Sullivan, Illinois. The company, once known as Kuehne Tower Company, manufactured home TV and amateur antenna towers. The line will now be available from Rohn representatives.



Save Assembly Time with Quick-Connect Terminals on BUSS Fuseholders

Eliminates soldering. Permits use of pre-assembled harness. Reduces assembly time.

BUSS

Write for BUSS
Bulletin SFB

BUSSMANN MFG. DIVISION, McGraw-Edison Co., St. Louis, Mo. 63107

... for more details circle 17 on post card

Winegard

Dealer of the month

No. 24 of a Series

Bob Power says: "Our major problem is too many stations, and we find Winegard antennas and amplifiers the answer every time."



Winegard salutes Town & Country TV Service, Harvard, Illinois and their distributor, Stolz-Wicks, Inc., Elgin, Illinois.

Town & Country's service area reaches out in a 25 mile radius to encompass the entire Harvard area. The operation is strictly service and, in addition to handling his direct business, Bob Power and his 4 men handle the service for 6 other dealers.

Bob has been with Winegard products for 10 years now, and says, "With 25 VHF and UHF stations in our receiving area, our antennas must be highly directive and have excellent reflective abilities, too. By using the various combinations of VHF, UHF, and FM antennas, amplifiers, couplers, etc., we haven't had a case where we could not work out a good system by using Winegard products exclusively." Commenting on the construction of Winegard Colortron's Bob said, "After about 1,000 Winegard installations in the last 10 years, we have yet to have a Winegard fail because of wind or ice damage."

Bob Power is one more important service man who knows Winegard's standards of excellence first hand.

Winegard Co.
ANTENNA SYSTEMS

30191 Kirkwood • Burlington, Iowa

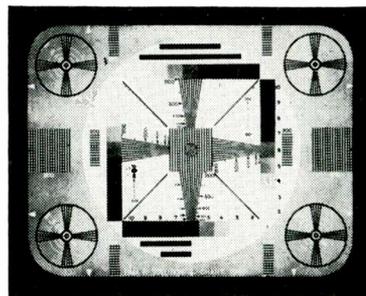
for more details circle 61 on post card

ADVERTISERS INDEX

Admiral Corporation	92
Admiral Corporation	93
Alliance Manufacturing Co.	87
Arrow Fastener Company, Inc.	98
B & K Manufacturing Company	63
B & K Manufacturing Company	65
Belden Manufacturing Company	19
Bussmann Mfg. Division	100-101
Channel Master Corp.	31
Channel Master Corp.	33
Channel Master Corp.	35
Cleveland Institute of Electronics	99
Columbia Wire & Supply Co.	82
Dymo Industries, Inc.	93
EICO Electronic Instrument Co., Inc.	88
Enterprise Development Corporation	94
The Finney Company	24-25
Gavin Instruments	67, 68, 69, 70
GC Electronics	95
Greyhound Corporation	89
Griffiths Electronics	99
Hallmark Instruments	80
Heath Company	34
Injectorall Electronics Corp.	82
Jensen Industries, Inc.	90
Jensen Manufacturing Company	85
Jerrold Electronics	20-21
JFD Electronics Corporation	39
P. R. Mallory & Co., Inc.	42
J. W. Miller Company	34
Motorola Training Institute	98
Multicore Sales Corporation	94
Nortronics, Inc.	88
Perma-Power Company	84
Philco Corporation	40-41
Radio Corporation of America	
RCA Electronic Components and Devices	4th cover, 73
RCA Parts & Accessories	91
Rohn Manufacturing Company	30
Sarkes Tarzian Tuner Service Div.	22
Seco Electronics	3rd cover
Semitronics Corporation	32
Sencore, Inc.	2nd cover
Sencore, Inc.	81
Sherwood Electronic Laboratories, Inc.	90
Sonotone Corporation	28
Sprague Products Company	27
Sprague Products Company	29
P. A. Sturtevant Company	98
Sylvania Electric Products, Inc.	83
Sylvania Electric Products, Inc.	75
Tektronix, Inc.	77
Texas Crystals	94
Triad Distributor Div.	102
Ungar Electric Tools	86
University Loudspeakers	36
Viking Cable Company	26
Winegard Company	96-97
Winegard Company	102
Workman Electronic Products	94
Xcelite, Inc.	92

TV TIPS FROM TRIAD

NO. 24 IN A SERIES



Junior PTM Joe had successfully bird-dogged a no-high-voltage problem to a shorted shielded lead from flyback to AGC coupling capacitor. The normally high peak-to-peak voltage (700 to 800 volts) had triggered a breakdown. Confidently, he replaced the shielded lead. The raster bounced back to life, but both width and brightness were sadly lacking. Like a good, level-headed serviceman should, he methodically checked out the components in the horizontal output circuit. They checked fine. Joe groaned out loud, "Dubble trubble?"

"Come again?" said Senior PTM Bill. Joe explained his quandary in detail and ended with a query, "Think the flyback might be damaged?"

"Sounds more like the electrolytic cathode capacitor?"

"But it checks out okay on the capacity indicator?"

"Let's try a new one anyway!"

Joe did. The raster filled out. Full brightness returned. He looked at Bill.

"A capacitor will often measure normal, yet will not be effective at the high horizontal sweep frequency," explained Bill readily. "Therefore, it's good practice to install a paper capacitor in parallel. Another thing. Carefully check the electrolytic boost filter capacitor when the symptoms are reduced high voltage and insufficient width, especially if loss of height is also evident!"

Joe nodded, mentally filing the information.

Bill wasn't through. "A final point. Since this chassis has a linearity coil, be sure to connect a voltmeter across the cathode resistor and adjust the coil for minimum voltage. Doing this insures minimum plate and screen current for most efficient operation of the horizontal output circuit!"

"Good thinking," said Joe and squirreled away that information also.

MORAL: The best way to take advantage of the latest techniques and the most advanced materials in flybacks is to buy Triad. So jot down T-R-I-A-D F-L-Y-B-A-C-K-S in big black letters in your cerebral notebook along with the reminder that every flyback comes packaged with complete instructions. Triad Distributor Division, 305 North Briant Street, Huntington, Indiana.

A DIVISION OF LITTON INDUSTRIES

for more details circle 56 on post card

ELECTRONIC TECHNICIAN

NEW . . . JUST \$119.50 FOR A COMPLETE COLOR BAR GENERATOR WITH EXCLUSIVE SECO STABILITY!

- 15-second warmup for your convenience
- Day-long performance without variation
- Simple sync control—just vertical and horizontal hold
- Work-a-day ruggedness—crystal controlled in heavy metal case

JUST IN TIME FOR THE BIG BOOM IN COLOR TV!

Cash in on the bigger volume coming from the new lower cost color TV's. Here are two color bar generators built to take the toughest use in truck or shop. Fast hookup—just clip on two antenna leads. Foolproof crystal controlled color bars. Fast warm up. Highly stable, after just 15 seconds and all day long—speeds work in home or at bench. Factory set to Channel 3 and can be tuned to Channels 2 or 4. Steel case. See your electronic supply dealer or write for information.



MODEL 990

MODEL 980

MODEL 980 does everything you need to set up a color TV set

- **KEYED COLOR BARS** for aligning and trouble shooting color circuitry—10 standard bars.
- **DOT PATTERN** for DC or static convergence—54 dots.
- **CROSSHATCH** for dynamic convergence, overscan and linearity adjustments—6 horizontal bars, 9 vertical bars.
- **VERTICAL BARS** for adjusting dynamic horizontal convergence controls—9 vertical bars.
- **HORIZONTAL BARS** for adjusting dynamic vertical convergence controls—6 horizontal bars.

ONLY \$119.50 net

MODEL 990 gives you all the deluxe features!

- **ALL** the tests of the Model 980—with these extra advantages—
- **COLOR GUN KILLER** to actuate any combination of guns.
- **RAINBOW COLOR PATTERN** to supplement keyed color bar tests.
- **VARIABLE DOT PATTERN** with 54 or 144 dots of adjustable size.
- **VARIABLE CROSSHATCH** with 6 or 16 horizontal bars.
- **VARIABLE HORIZONTAL BARS** with 6 or 18 lines.
- **GREY RASTER** for tests required on older sets.

ONLY \$149.50 net

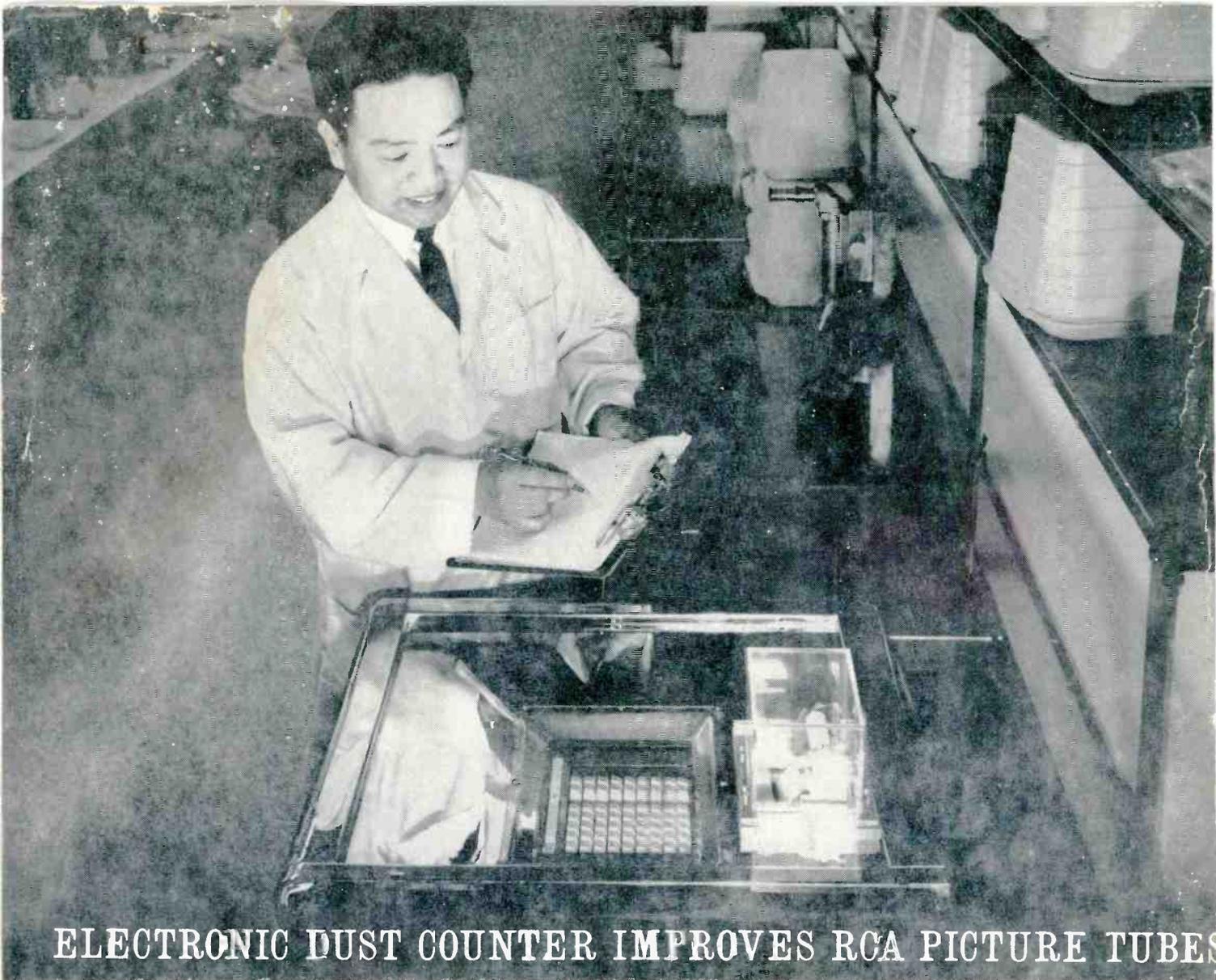


SECO also manufactures a full line of tube testers

SECO ELECTRONICS, INC.

1211 S. CLOVER DRIVE • MINNEAPOLIS, MINNESOTA 55420
A DIVISION OF DI-ACRO CORPORATION

... for more details circle 44 on post card



ELECTRONIC DUST COUNTER IMPROVES RCA PICTURE TUBES

Strict environmental control extends electron gun life and performance

Even the smallest particle of dust can affect the life and precision performance of an electron gun in a television picture tube. In order to assure ultra-clean conditions for assembling guns that go into Silverama® Picture Tubes, RCA designed and built a space-age white room in its Marion, Indiana, plant.

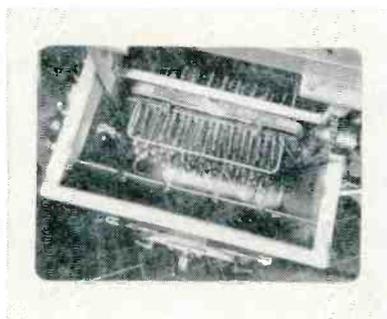
Air in the white room is controlled by an electrostatic precipitator-type air conditioner. Higher than normal air pressure is maintained in the white room so no outside air can enter. At the entrance, "sticky floor mats" remove dust from workers' shoes. Workers wear lint-free Dacron smocks, lint-free nylon gloves, and rubber finger cots.

Yet, in addition to these precautions, RCA continually monitors

the white room's dust count by means of the digital-dust counter shown in the photo above. The unit is so sensitive it counts all dust particles from 0.32 micron (a micron is about one 39-millionth of an inch) to 8 microns. Only when the "dust count" is below an acceptable level can electron guns be processed.

These exceptionally strict environmental controls are another reason why you can be sure of customer satisfaction when you install an RCA Silverama Picture Tube.

Silverama is made with an all-new electron gun, finest parts and materials, and a glass envelope that has been thoroughly cleaned and inspected prior to re-use.



Electron gun mounts are washed by ultra-sonic vibration in extra-pure water to remove microscopic particles.



Electron guns, after drying, are kept in covered racks as further assurance against dust contamination.

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



The Most Trusted Name in Electronics