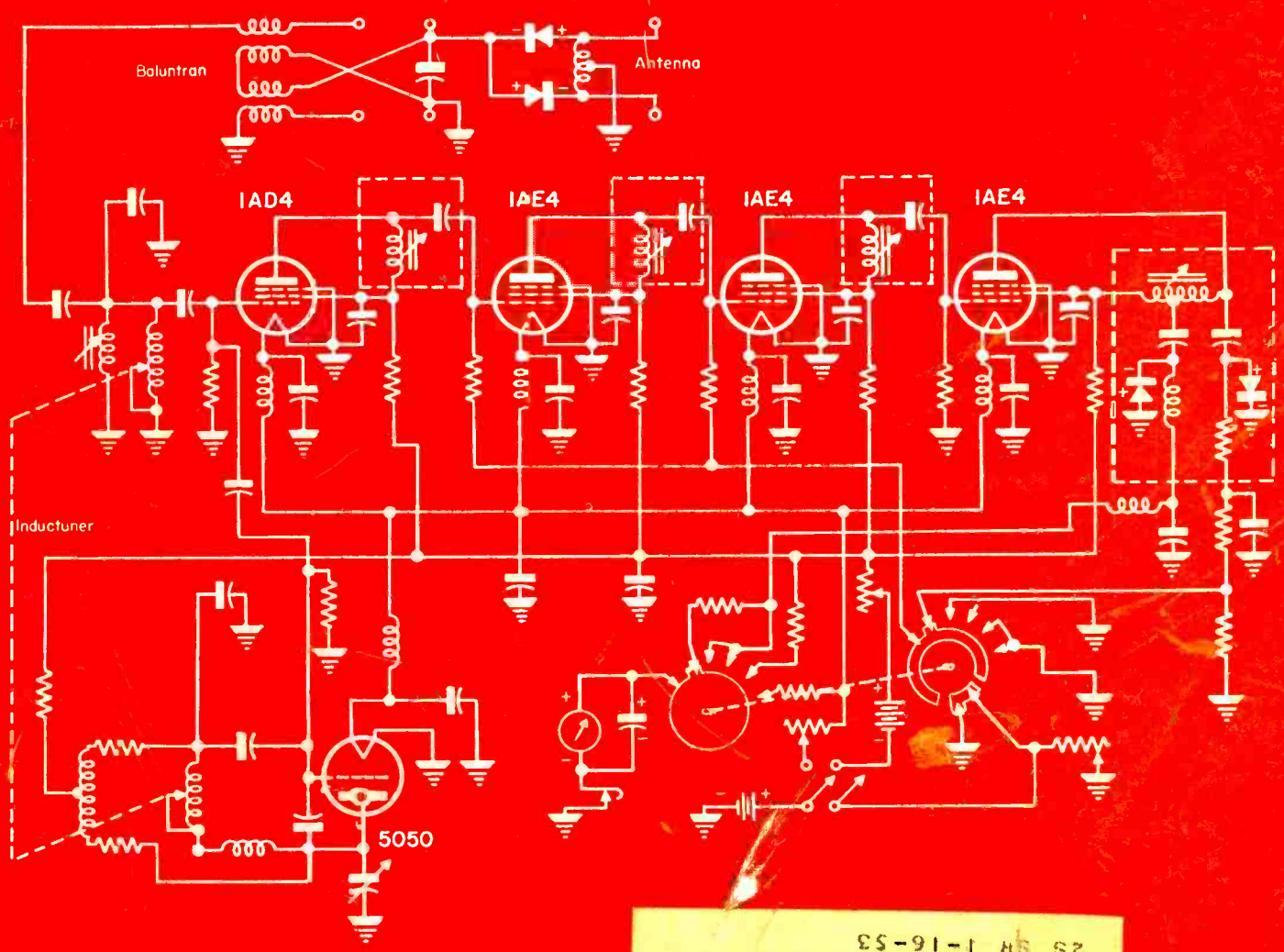
RADIO · TELEVISION · ELECTRONIC

SERVICE

VOL. 22

THE TECHNICAL JOURNAL OF THE TELEVISION-RADIO TRADE

SEPTEMBER
1953



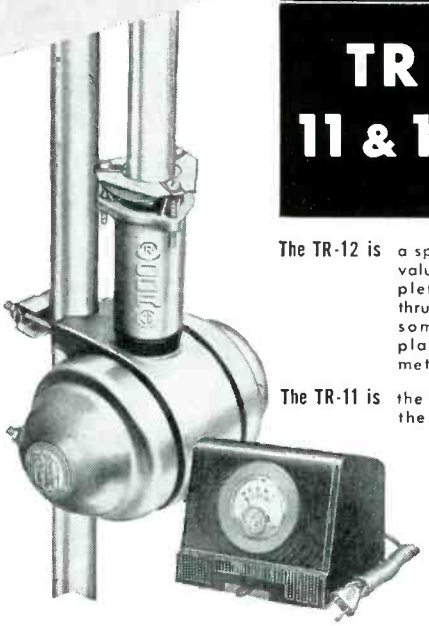
Battery portable field-strength meter for 50-220 and 260-940 mc coverage.
[See circuit analysis, this issue]

PRE-SOLD for you—

by an extensive consumer campaign in TELEVISION and NEWSPAPER... in KEY ROTOR MARKET AREAS*

the C·D·R Rotor

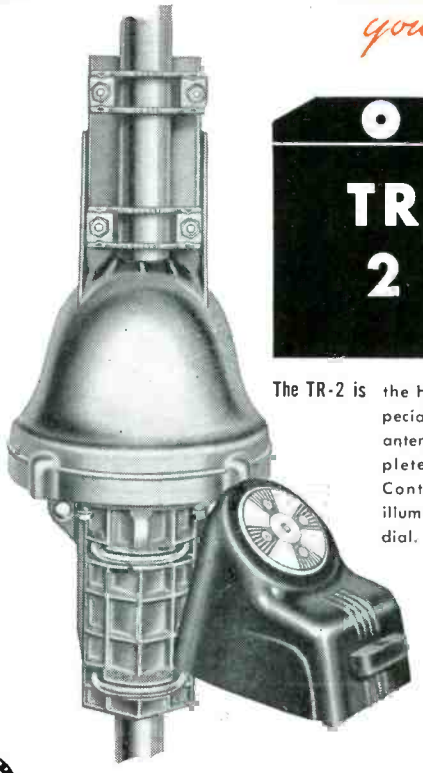
*coming to your city too!



TR 11 & 12

The TR-12 is a special combination value consisting of complete rotor including thrust bearing... handsome modern design plastic cabinet with meter control dial—

The TR-11 is the same unit without the thrust bearing.



TR 2

The TR-2 is the HEAVY DUTY rotor especially suited for special TV antenna installations. Complete rotor with "Compass Control" cabinet having illuminated "perfect pattern" dial.

THE *RADIART* CORPORATION
CLEVELAND 13, OHIO

CORNELL-DUBILIER ELEC. CORP.
SOUTH PLAINFIELD, NEW JERSEY

NEW

TIGHTEST SEAL
LOCKS IN PERFORMANCE

TOUGHEST SHELL
LOCKS OUT TROUBLE

ATTRACTIVE YELLOW MOLDED PLASTIC SHELL
Non-inflammable. Will not burn or melt under soldering iron or flame.

BONDED SEAL
Positive, heat resistant, non-inflammable bond seals leads and shell, locks out humidity.

FIRMLY SECURED LEAD
Can't be pulled out, even under soldering iron heat.

PATENT PENDING

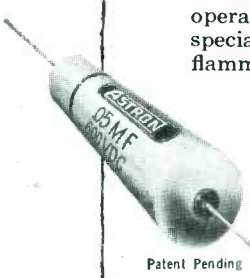
ASTRON BLUE·POINT† MOLDED PLASTIC PAPER *Capacitors*

THE NEWEST ADDITION TO THE SM† LINE

Yes, the ASTRON BLUE-POINT's *tighter seal* and *tougher shell* give you heat and moisture protection to a degree never before possible—providing a longer life and greater dependability than has ever been achieved in a molded plastic capacitor! BLUE-POINT is a capacitor you can rely on *completely*, under every condition.

BLUE-POINT is suitable for continuous operation at 85°C. The bonded seal uses a special thermo-setting, heat-resistant, non-inflammable bonding agent—*positive* protection against moisture. Solder leads as close to the capacitor as you like—they *won't* pull out! Every BLUE-POINT is clearly marked with voltage and capacitance, bears outside foil identification. Every BLUE-POINT is *tested* and *guaranteed*. Look for the ASTRON BLUE-POINT when you buy capacitors from your jobber, or if he doesn't carry it, send us his name. Insist on ASTRON BLUE-POINT, the capacitor you *know* you can depend on. Order a supply today.

For complete performance characteristics, specifications and listings, write for Bulletin AB-20A



Patent Pending

DEPEND ON—INSIST ON

ASTRON CORPORATION ASTRON CORPORATION **255 Grant Ave., E. Newark, N. J.**

†Trade Mark Safety Margin capacitors for every radio, television and electronic use.

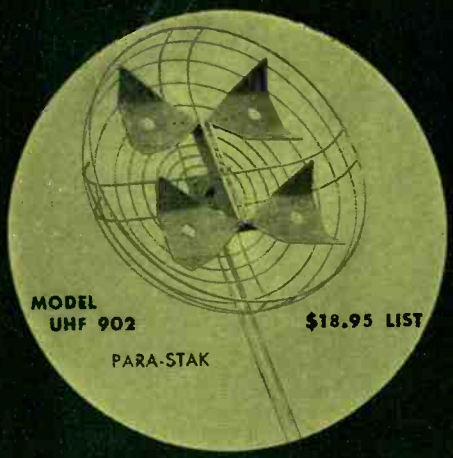
SERVICE, SEPTEMBER, 19

GOLD-COLORED ANTENNA... FULL-YEAR GUARANTEE AGAINST RUST AND CORROSION... ADVANCED HIGH-GAIN ANTI-VIBRATION DESIGN...

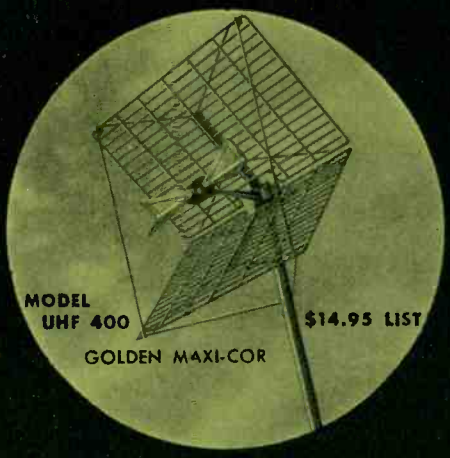
These revolutionary features are your identification of the new JFD "Gold Shield" UHF antennas—introducing to the TV antenna field an unprecedented consumer attraction.

JFD GOLD SHIELD GUARANTEE

This JFD Gold-Shield Antenna is Guaranteed Against Rusting for 1 Year (normal use)

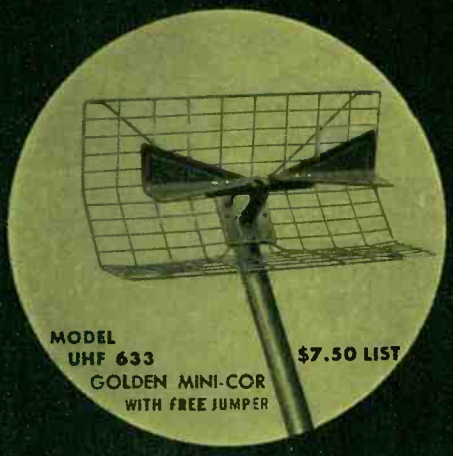


MODEL UHF 902 — $18.95 LIST
PARA-STAK



MODEL UHF 400 — $14.95 LIST
GOLDEN MAXI-COR

MODEL UHF 900 — $14.95 LIST
PARA-BOW



MODEL UHF 633 — $7.50 LIST
GOLDEN MINI-COR
WITH FREE JUMPER

MODEL UHF 411 — $11.75 LIST
GOLDEN BRIDGE

MODEL UHF 611 — $6.95 LIST
GOLDEN BOW-FLECTOR
WITH FREE JUMPER

MODEL UHF 300 GOLDEN YAGI
WITH FREE JUMPER $5.50 LIST

JFD Electronics

Here's what the JFD "Gold Shield" UHF antennas offer you: An individual antenna for each installation requirement, ranging from the "Golden Para-stak" with 15 DB. gain and 20.5 DB. front-to-back ratio for fringe areas to the "Golden Bow-flector" with 6.5 DB. gain and 10 DB. front-to-back ratio for local signal areas. Add "Bronzidite" protective plating, and you have the antennas for greater UHF profits—without call-backs. See them at your jobber or write for Catalog No. 218.

BRONZIDITE

JFD MANUFACTURING CO., INC.
BROOKLYN 4, N.Y.
...d's largest manufacturer of TV antennas and accessories

Burton Browne advertising

Vol. 22, No. 9

RADIO · TELEVISION · ELECTRONIC
SERVICE

September, 1953

LEWIS WINNER
Editor

B. BLOCK
F. WALEN
Assistant Editors

Including SERVICE—*A Monthly Digest of Radio and Allied Maintenance;* RADIO MERCHANDISING, and TELEVISION MERCHANDISING. Registered U. S. Patent Office.

CIRCUITS

COVER

Manufacturers

Published monthly by Bryan Davis Publishing Co., Inc.

52 Vanderbilt Avenue, New York 17, N. Y. **Telephone MUrray Hill 4-0170**

Bryan S. Davis, Pres. Paul S. Weil, Vice-President F. Walen, Sec. A. Goebel, Cir Prom. Mgr.
Mid-West Representative: Stuart J. Osten, 333 N. Michigan Ave., Chicago 1, Ill. Telephone: DEarborn 2-3507
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Pacific Coast Representative: Brand & Brand, 1052 W. Sixth St., Los Angeles 14, Calif. Telephone: Michigan 1732
Metropolitan District Manager: Donald C. Weil, 52 Vanderbilt Ave., New York 17, N. Y.

Entered as second-class matter June 14, 1932, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Subscription price: $2.00 per year in the United States of America and Canada; 25 cents per copy. $3.00 per year in foreign countries; 35 cents per copy.

The TARZIAN UTP1 (Single Channel) Translator for UHF

Works on ANY TV Receiver

- Self-powered.
- Two units may be attached to receiver to receive two UHF channels.
- Input alignable to any UHF station (470-890 mc)
- Output into balanced 300 ohms, channels 2-6 inclusive
- Requires NO internal wiring changes.
- Easily attached.

COMPLETE RANGE OF FREQUENCIES AND ANTENNA SWITCHING POSSIBILITIES MAKE THE RECEPTOR

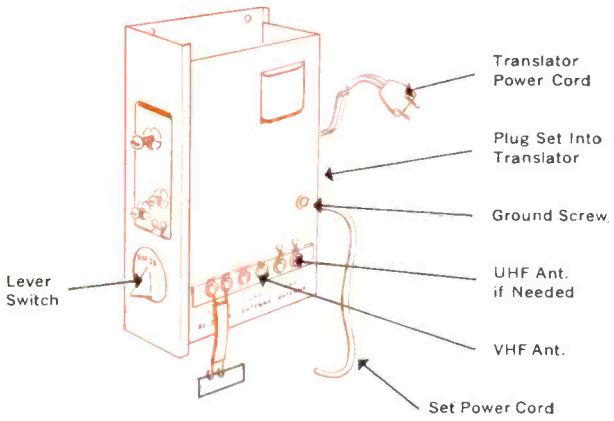
Completely Universal in Application

The UTP1 is the answer to set owners anywhere within the range of one or two UHF stations.

Adaptable to any type receiver, the UTP1 brings in the UHF station through one of the unused low channels, 2 to 6. None of the 12 VHF channels is sacrificed.

The same high standards of engineering quality . . . design . . . and development which have made the TARZIAN Tuners famous—are embodied in the UTP1 Receptor.

Moderately-priced to appeal to millions of present-day set owners. See your set dealer or service man or write for detailed information.



SARKES TARZIAN, INC., TUNER DIVISION
BLOOMINGTON, INDIANA

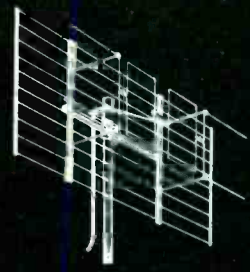
IMPACT IN UHF

FINCO series 500

Great UHF ANTENNAS

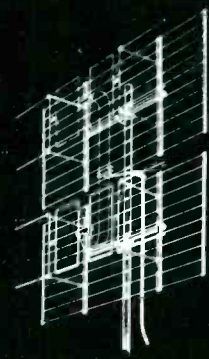
Engineered To Give
HIGHEST GAIN and
NARROWEST PATTERNS
to solve difficult 'GHOST'
problems in the FRINGE
AREA AND IN CLOSE
TO THE STATION

This great series once again reaffirms Finco leadership! Model 502 is a 2-bay unit of the colateral* type with a "snap-out" screen for instantaneous installation. Model 504 is the 4-bay version, highly effective in super fringe areas where ultra high gain is consistantly required. Both models feature high front to back ratio and excellent impedance match to 300 OHM line for low signal fringe areas. Completely preassembled — corrosion proof aluminum throughout (including screen) — one antenna, one transmission line!



Both Units available in 3 models which peak on channel ranges shown below and maintain high gain on balance of frequencies:

#502A — channels 14-32
#502B — channels 29-55
#502C — channels 53-83



#504A — channels 14-32
#504B — channels 29-55
#504C — channels 53-83

Patent No. 2,566,287
*Reg. U.S. Pat. Off.

IMPACT Through Advertising

LOCAL NEWSPAPERS
LIFE
FARM MAGAZINES
RADIO
TELEVISION

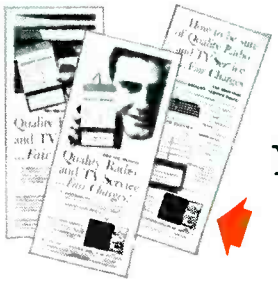
FINCO IS A NAME YOUR CUSTOMERS KNOW BECAUSE OF THIS POWERFUL *NATIONAL ADVERTISING PROGRAM!*

THE FINNEY COMPANY
Dept. 3S9 - 4612 St. Clair Ave., Cleveland 3, O

If *you* could advertise nationally, chances are *you'd* do just what CBS-Hytron is doing for *you*. *You'd* tell the world in LIFE and The Saturday Evening POST

Half-page advertisements will appear in LIFE Sept. 28, POST Oct. 3, LIFE Oct. 19, POST Oct. 31, LIFE Nov. 16, and POST Nov. 28. Reaching over 28,583,290 readers!

that *you* promise quality TV and Radio service, parts, and tubes . . . and at fair charges. And that's just what CBS-Hytron is doing for *you* with advertisements like these.



You'd identify *your* service repair shop as the *one* people are reading about in the magazines. *You'd* use this *Certified* **QUALITY SERVICE** decalcomania on *your* door.

These are just some of your *Certified* Quality Service advertisements. They sell *you* . . . and without a lot of sell for CBS-Hytron, although CBS-Hytron gladly pays the bill. Why? Because as we build *public confidence* in *Certified* Quality Service, we build greater faith *in you* and more business *for you* . . . our customers.

You'd use this *Certified* **QUALITY SERVICE** window streamer.

And

This *Certified* Quality Service decalcomania identifies *you* as a dealer with hard-earned technical knowledge and the latest in equipment. A dealer to whom the public can go for *Certified* Quality Service. It helps you cash in on your big *Certified* Quality Service plan.

Let folks know *you Certify* the quality of your service, parts, and tubes . . . and at fair charges. Use all the *Certified* Quality Service sales material available to you. Be sure this window streamer is *up* during *your* consistent advertising campaign this Fall.

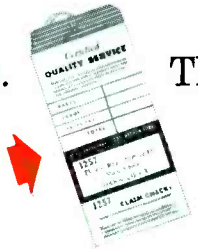
CBS HYTRON

Manufacturers of Receiving Tubes Since 1921

CBS-HYTRON, Danvers, Massachusetts

A DIVISION OF COLUMBIA BROADCASTING SYSTEM, INC.

A member of the CBS family . . . CBS Radio • CBS Television • Columbia Records, Inc. • CBS Laboratories • CBS-Columbia, Inc. • and CBS-Hytron

above all *you'd* use these *Certified* **QUALITY SERVICE** tags.  They tell *your* customer he is getting more for his money when he calls *your* service repair shop . . . because *you Certify* the quality of service, parts, and tubes . . . and at fair charges. Yes, by using all this material, and more to come, *you* cash in on *your* big *Certified* **QUALITY SERVICE** advertising campaign.

This plan goes *all* the way to do the job. When *you* use these *Certified* Quality Service tags you're putting right into your customer's hands convincing *proof* . . . Proof that *Certified* Quality Service means *more for your customer's money.*

Get *your* kit. 

It contains all the material *you* need to identify *you* as a *Certified* **QUALITY SERVICE** dealer. Ask your CBS-Hytron distributor for *special deal.* Or use coupon to order direct.

Make the most of *your* big *Certified* Quality Service advertising campaign. Be sure you have *all the facts* . . . *and all* the material you need. Get this *sales* promotion kit, today!

SEE YOUR CBS-HYTRON DISTRIBUTOR . . . OR MAIL COUPON TODAY!

CBS-HYTRON, Danvers, Mass.

Please rush me the *Certified* Quality Service promotion kit, containing:

1. 18- by 28-inch LIFE and POST easel display . . .
2. New *Certified* Quality Service decal . . .
3. 8- by 23-inch window streamer . . .
4. AND 250 *Certified* Quality Service tags imprinted with MY name and address.

HERE IS MY 3-LINE IMPRINT:

Name _____
(please print)

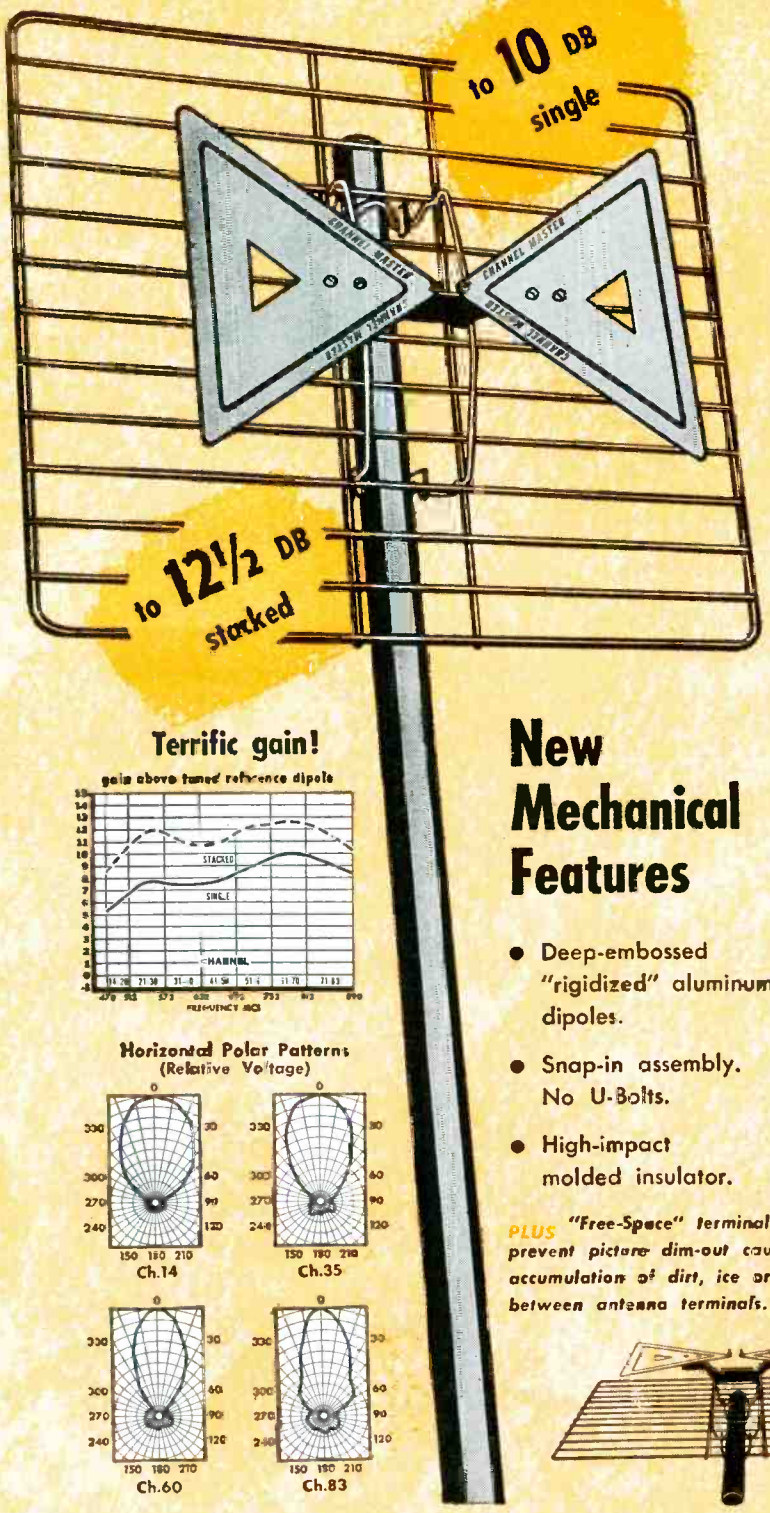
Street _____

City _____ *State* _____

I enclose $2.00 to cover the cost of imprinting.

Signed: _____

3 New Electrical Advances!



CHANNEL MASTER'S all-new UHF BOW-FLECTOR

model no. 408

The highest gain Bow and Screen antenna ever developed — single or stacked!

1. ***Enlarged Reflecting Screen.*** 53% more reflecting area — higher, flatter gain level.

2. ***Full-Wave Spacing*** of stacked antennas. Provides highest stacking gain ever obtained in an antenna of this type.

3. ***2-Stage Stacking Transformers*** for broad-band impedance match. Delivers high stacking gain over *entire UHF band.*

Terrific gain!

gain above tuned reference dipole

Horizontal Polar Patterns
(Relative Voltage)

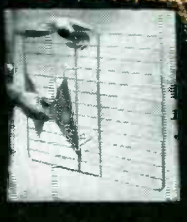
New Mechanical Features

- Deep-embossed "rigidized" aluminum dipoles.
- Snap-in assembly. No U-Bolts.
- High-impact molded insulator.

PLUS "Free-Space" terminals that prevent picture dim-out caused by the accumulation of dirt, ice or rainwater between antenna terminals.

Only 20 seconds to install!

Just snap Bow into Screen, then fasten entire assembly to mast with Channel Master's exclusive "SPEED-NUTS." The antenna cannot move, twist, flutter, or vibrate! The light-weight Bow Flector is the most rugged, fastest-installing antenna of its type.



One of 5 Great New Channel Master Products For Fall!

CHANNEL MASTER CORP.
ELLENVILLE, N. Y.

Ask your Channel Master distributor for complete technical literature.

You've never seen a mast like it!

CHANNEL MASTER'S

all-new

STRATO-MATIC

TELESCOPING MAST

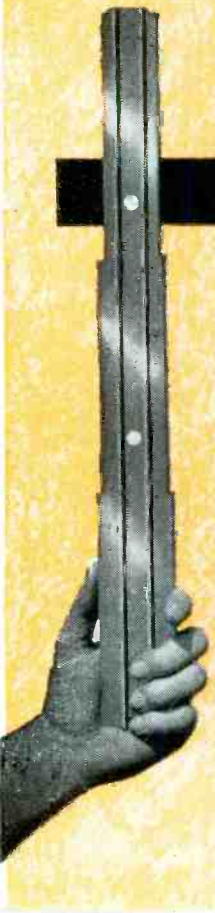
One of 5 Great New Channel Master Products For Fall!

for antenna installations that are

- ***easier***
- ***faster***
- ***safer***

Featuring the Amazing "Third Hand!"

— an automatic, removable locking device that actually acts as your "third hand," *holds* mast sections up when you let go! The Third Hand converts each guy ring, in turn, into a "safety lock." This permits you to raise sections freely, *using only one hand*. And . . . sections *cannot* slide down when you let go.



Automatic Mast Extension

The Step-Up Key, inserted through the bottom of the mast tubing, automatically extends each mast section 6 inches. Mast sections are kept partially extended even *after* mast is placed in vertical position — *without using hardware or locking bolts!*

World's Finest Mast Protection!

16-Gauge Masting
HOT-DIP GALVANIZED

Most permanent type of mast corrosion protection available today. Sections are immersed in cauldron of molten zinc, until a thick layer of pure zinc is fused to inner and outer surfaces — so thick it actually adds to the weight of the mast; gives long-term protection!

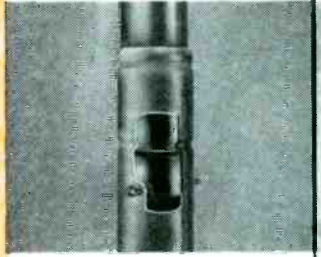
ZINC IS SELF-HEALING!

When the protective zinc coating is scratched or broken, the surrounding zinc actually goes to work to "heal" the wound. Thus, the base metal is automatically protected against damage due to installation or handling. The only coating with this ability.

13-Gauge Masting
HEAVY ZINC ELECTRO-PLATING

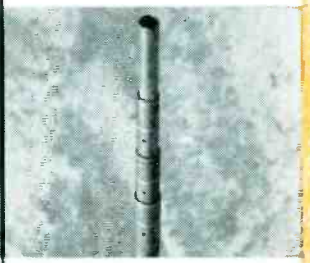
Heavy layer of bright zinc, exceeding Army-Navy specifications, provides effective long-lasting protection against elements. A chromate dip adds brightness; increases corrosion resistance. The strongest, most durable protection jacket of its type.

Inter-Locked Sections



Safety Rings prevent sections from pulling out of each other. Notches in sections engage bolt — no twisting.

No Hidden Holes



Step-Up Key automatically extends mast sections high enough to provide easy access to bolt holes. You don't have to pull up next section to insert bolt!

Model No. 16-Gauge	Model No. 18-Gauge	Sections	Lengths	Weights 16-Gauge	Weights 18-Gauge
1620	1820	A, B	20′	20 lb.	15 lb.
1630	1830	A, B, C	30′	32 lb.	25 lb.
1640	1840	A, B, C, D	40′	46 lb.	35 lb.
1650	1850	A, B, C, D, E	50′	61 lb.	47 lb.

IN PREASSEMBLED ANTENNA

CHANNEL MASTER CORP. ELLENVI

Ask your Channel Master distributor for complete tec

Look at the Selling Power of the RCA Radio Battery Package

SMART RCA package design means faster sales, greater inventory turnover for radio dealers and servicemen selling RCA Radio Batteries. This outstanding package styling is another example of the powerful sales appeal of the *Radio Battery for the Radio Trade.*

Call your RCA Battery Distributor for fast, reliable service. Stock, sell and promote RCA Batteries— *the Radio Battery for the Radio Trade.*

STEEL-ENCASED
(certain types only)

Special steel casings on RCA Battery types VS216, VS236, VS036, VS035, VS084, VS085, and VS086 protect their contents—control bothersome swelling, resist leakage, and damage from shock. This important feature will help you sell more of these RCA Battery types

FAMOUS RCA MONOGRAM

Consumers everywhere recognize RCA as the "greatest name in radio." The RCA trademark stands for experience in the marketing of quality products for radio. It is your assurance of immediate customer acceptance

REPLACEMENT AID

You see, at a glance on the side of the RCA Battery carton, which portable battery types of other manufacturers it will replace. This is another way RCA Batteries help you turn every customer inquiry into a battery sale

REPEAT BUSINESS PROMOTION

Space is provided right on the RCA Battery carton for you to stamp your name and address. In this way you can advertise your own store . . . remind the battery user to come back to you for fresh replacements

SMART DESIGN

RCA Radio Batteries are colorfully styled to catch the customer's eye when displayed in store windows, on counters, in merchandisers, and on shelves. You can use this valuable design in reminding customers to buy RCA Radio Batteries

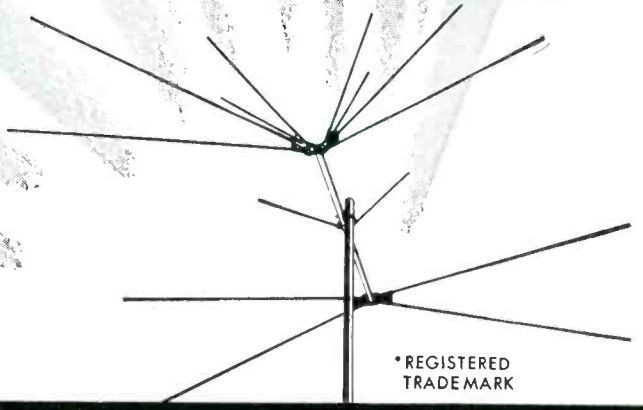
RADIO CORPORATION of AMERICA
RADIO BATTERIES **HARRISON, N. J.**

Your BEST antenna buy for channels 2 to 83!

telrex "DUO-BAND"

"CONICAL-V-BEAM"*

★ UNIFORMLY HIGH GAIN
★ EXCELLENT DIRECTIVITY
★ AUTOMATIC TRANSITION FROM UHF TO VHF
★ HIGH SIGNAL-TO-NOISE RATIO
★ ALL ALUMINUM RUGGED CONSTRUCTION



*REGISTERED TRADEMARK

Ask the DEALER!

INSTALL ONE ANTENNA, ONE TRANSMISSION LINE—Full UHF and VHF reception. The Telrex Duo-Band extends the famous "CONICAL-V-BEAM" principle The addition of two supplementary V splines compacts and adds in-phase the higher frequency signals.

AUTOMATIC, PERFECT TRANSITION FROM VHF TO UHF—No "lossy" filters or isolation networks are employed in the Telrex design. Both UHF and VHF signals are picked up at the same cone apex.

Ask the SERVICE MAN!

Ask the JOBBER!

ONLY A SINGLE TRANSMISSION LINE IS REQUIRED — Duo-Band provides uniformly high gain with one major lobe, channels 2 to 83 and actually improves reception on channels 7 to 13.

ASSURES HIGH SIGNAL-TO-NOISE RATIO . . . FREE FROM GHOSTS — Excellent directivity on VHF and UHF. A clear, unidirectional pattern makes Duo-Band the perfect array for reception near or far.

Ask the CUSTOMER!

DUO-BAND features include all aluminum rugged design, light weight. Practical design can be used single bay or stacked for increased sensitivity.

60 Models Available to meet every Antenna Requirement. Write for Illustrated Catalog on the Complete TELREX Line.

"CONICAL-V-BEAMS" are produced under Re-issue Patent No. 23,346. Canadian and Foreign Patents Pending.

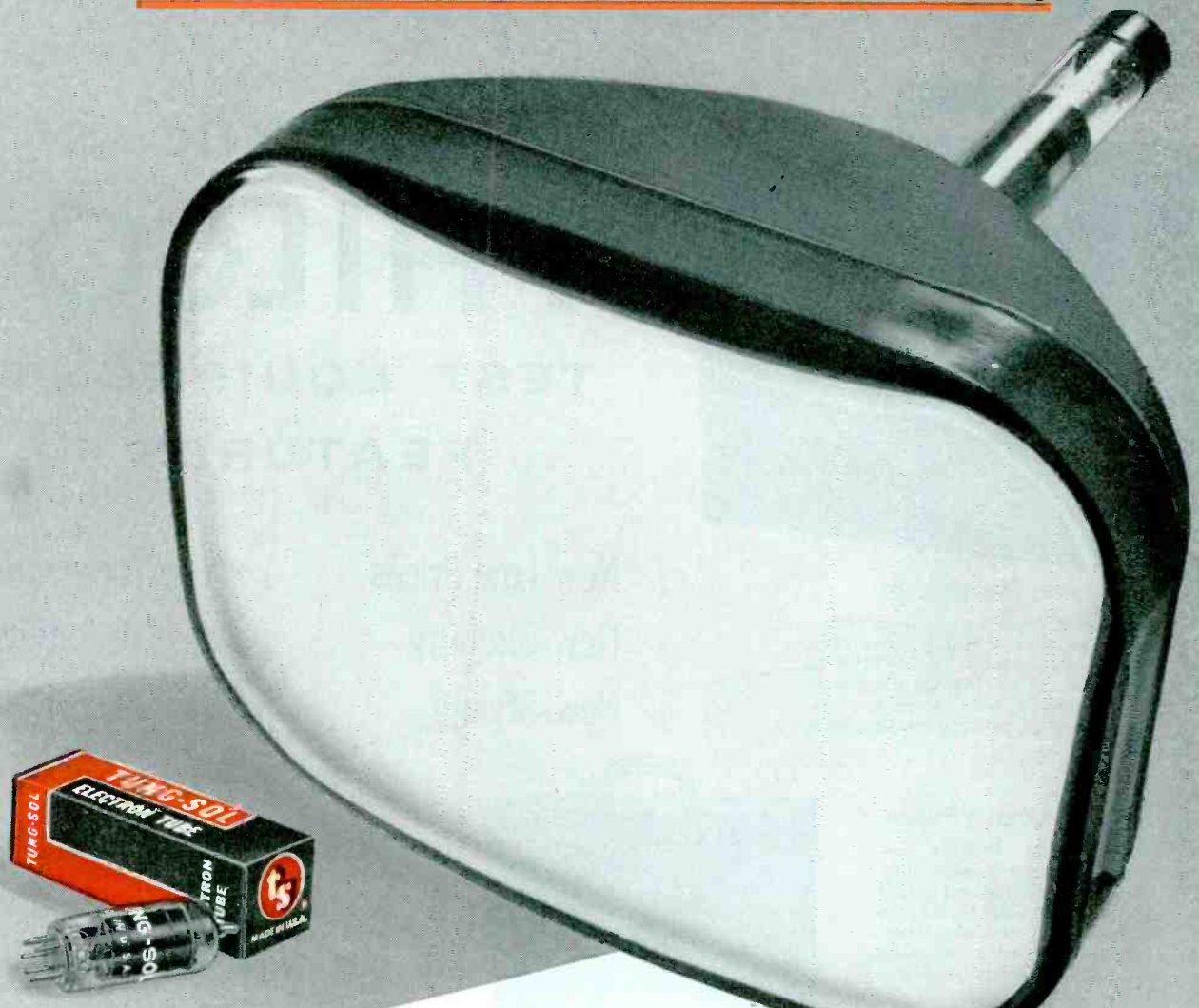
telrex INC. BETTER BY DESIGN
"CONICAL-V-BEAMS"

SERVICE MEN! Modify existing "CONICAL-V-BEAMS" with DUO-BAND! Existing antennas can be modified to operote efficiently on channels 2 to 83 by means of the new Telrex Modification Kit.

ASBURY PARK 11, N. J.

Originators and Manufacturers of "CONICAL-V-BEAMS" — insist on the Original! Look for the Telrex Trademark.

You can build a reputation on Tung-Sol Quality



Tung-Sol Picture Tubes have these outstanding quality features

Gun made of best grade non-magnetic steel.
Glass bead type assembly is stronger both mechanically and electrically—gives greater protection against electrical leakage.
Rolled edges in gun minimize corona.
Custom built stem with greater spacing between leads assures minimum leakage.
Low resistance of outside conductive coating minimizes radiation of horizontal oscillator sweep frequency.
Double cathode tab provides double protection against cathode circuit failure.
Selected screen composition resists burning (X pattern).
Rigid control of internal conductive coating provides utmost service reliability.
Designed for use with single or dquble field ion trap designs.
One-piece construction of parts assures better alignment.
Maximum dispersion of screen coating assures uniform screen distribution.

TUNG-SOL ELECTRIC INC., Newark 4, N. J. Sales Offices: Atlanta, Chicago, Columbus, Culver City (Los Angeles), Dallas, Denver, Detroit, Newark, Seattle
TUNG-SOL makes All-Glass Sealed Beam Lamps, Miniature Lamps, Signal Flashers, Picture Tubes, Radio, TV and Special Purpose Electron Tubes and Semiconductor Products.

Servicemen!

Field Strength Meter

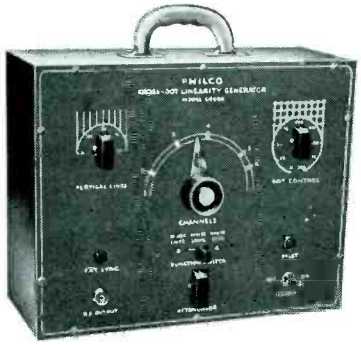
Model M-8104. More new features than any other unit at this popular price. Reads signal strength directly from the dial from 10 to 100,000 microvolts. A serviceman's time saver to measure actual TV picture signal strength.

CHECK THESE

PHILCO

TEST EQUIPMENT FEATURES

- ✓ New Low Prices
- ✓ New Ruggedness
- ✓ New Circuitry
- ✓ New Versatility
- ✓ New Styling
- ✓ New Accuracy



Cross Dot Linearity Pattern

Model G-8004. Philco's new unit for the finest possible linearity adjustments when a station pattern is not available. It provides extreme versatility of performance and design at amazing economy of operation. Light, rugged and portable it's the new leader in test equipment.

NOW YOURS ON NEW EASY PAYMENT PLAN

VHF to UHF Signal Generator Adapter

Model G-8000. The most economical system yet designed to produce UHF signals for TV receiver tests. Through a conversion process using any VHF meter this unit produces from an input VHF signal, UHF signals having the same characteristics as the VHF signal.

Mutual Conductance Tube Checker

Model 7052. Tests more different type tubes than any unit on the market, from subminiature to acorn low power transmitting tubes. Shorts on tube elements can be easily determined, employs roll chart instead of cards, for use as a portable or counter top unit.

Dynamic Signal Tracer

Model 7031. An extremely versatile instrument . . . this unit is designed for fast diagnosis of radio trouble by audibly monitoring RF and AF circuits. Can be used to accurately check P.A. systems, microphones and phonograph pick-up circuits, also localizes distortion.

5-inch High Gain Oscilloscope

Model S-8202. This outstanding scope is built to the very highest standards of test instruments... It features the highest gain 10 millivolts/inch, and widest frequency range at its popular price. Wide sweep ranges allow extreme flexibility in sweep circuit trouble shooting.

3-inch TV Oscilloscope

Model S-8200. The most practical portable unit available for bench or field servicing. Preset horizontal and vertical sweep rates take the guesswork out of trouble shooting, aligning and measuring. Ideal for television because of its high sensitivity and wide response.

Philco Circuit Tester

Model 8102. A general purpose volt-ohmeter that challenges comparison. Utilizes 1% resistors throughout to insure maximum accuracy. Tests AC voltage ranges of audio and high impedance AC circuits where a vacuum type voltmeter would normally be required.

Philco Circuit Master

Model 8100. Designed to the most rigid of engineering specifications, this rugged metal-cased vacuum tube voltmeter is by far the finest in its price class. Provides unmatched accuracy for measuring and aligning where plus and minus indications are required.

UHF Auto-Level Sweep Generator

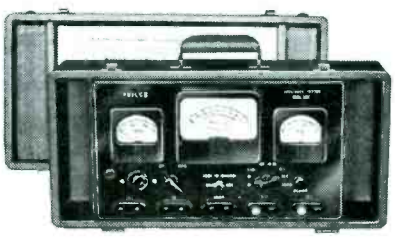
Model G-8002. The most modern, most inexpensive UHF sweep generator on the market. Checks sweep alignment with *any* test oscilloscope. Its output is controllable and leakage is negligible ... makes possible over-all trouble shooting and testing of low level units.

Cathode Ray Tube Checker

Model 7053. Will accurately test *all* picture tubes used in home TV receivers. Special cathode-ray tubes are easily checked by using plug-in adapters. Eliminates trouble shooting guesswork. Neon lamp indicates shorts and open elements in the electrodes of the gun.

Visual Alignment Generator

Model 7008. Combines in *one* economical instrument functions that can be approached only in a cumbersome collection of costly devices. No special scope connections are required for the most accurate visual alignment and calibration that is possible to achieve.



Appliance Tester

Model 5007. The ultimate in versatility. A one package, all purpose, portable appliance service unit. Permits over-all analysis of refrigerators, ranges, air conditioners and household appliances. With "pick-up" elements to determine temperature and built-in volrmeter.

MAIL THIS COUPON FOR NEW FREE BOOKLET
or see your Philco Distributor

PHILCO CORPORATION
Accessory Division
Allegheny Ave. & "A" St., Phila. 34, Pa.

☐ I am interested in the Philco Test Equipment shown here. Please send me details of your SPECIAL PURCHASE PLAN for obtaining these units.

☐ Please send FREE copy of your new booklet on Philco Test Equipment.

NAME .....
ADDRESS .....
CITY ..... STATE .....

DECIDE ON DU MONT

on the basis of...

Product Superiority

Exclusive construction of the Teletron Heater virtually eliminates heater-cathode shorts resulting from ruptured heater coating as shown above.

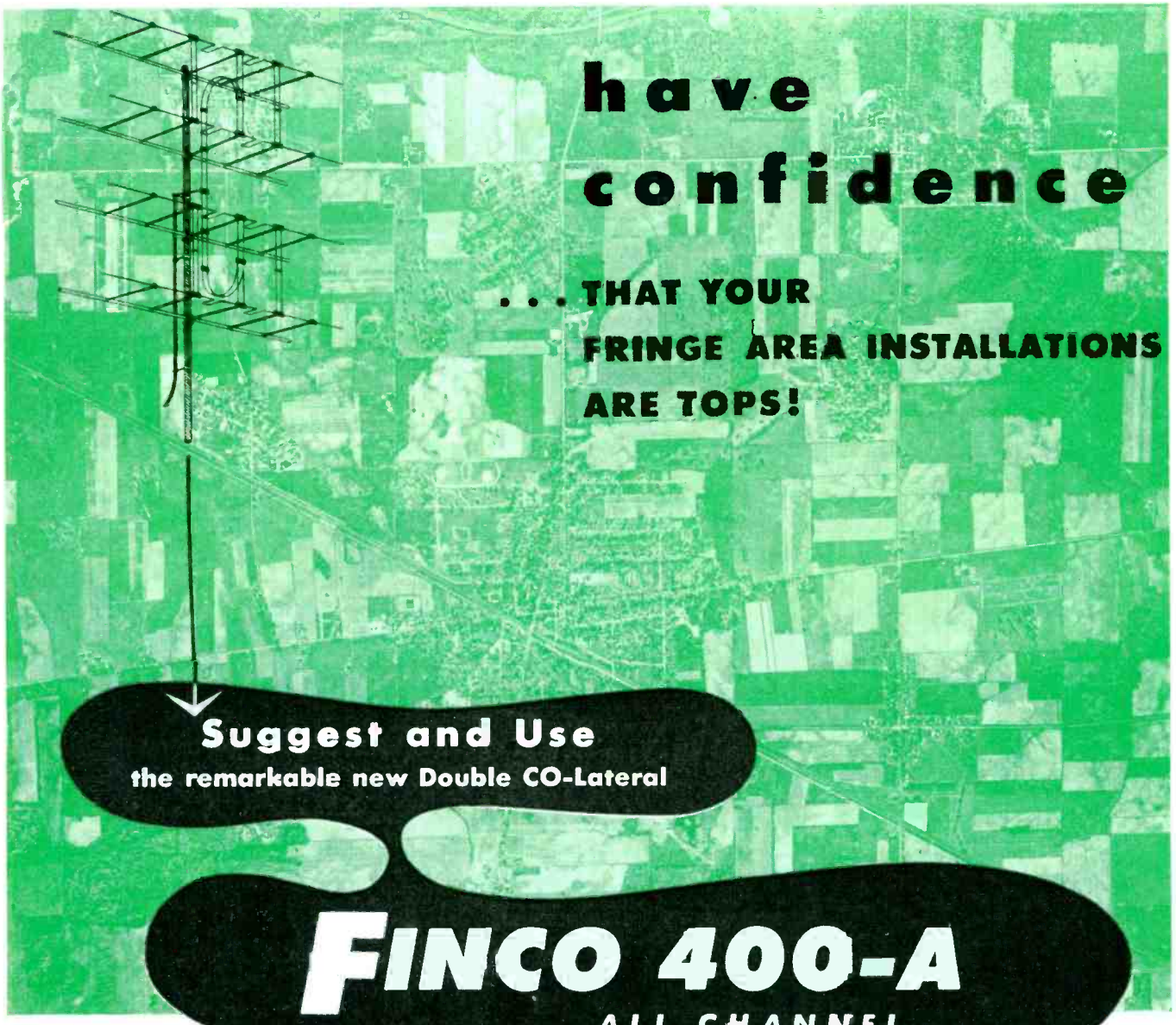
By accurately centering the heater helix within the cathode of the Bent-Gun, the Teletron heater-ceramic assembly avoids abrasion of the delicate heater coating against the cathode wall.

Only when you decide on Du Mont for your replacement needs, do you get this extra insurance against costly call-backs due to heater-cathode shorts.

FREE—For your copy of the 8th edition of the Picture Tube Data Chart send a postcard with your address and the name of this publication.

*TRADE MARK

REPLACEMENT SALES, CATHODE-RAY TUBE DIVISION • ALLEN B. Du MONT LABORATORIES, INC., CLIFTON, N. J.



FINCO IS A NAME YOUR CUSTOMERS KNOW BECAUSE OF THIS POWERFUL *NATIONAL ADVERTISING PROGRAM!*

LIFE
TELEVISION
LOCAL NEWSPAPERS
RADIO
FARM MAGAZINES

FINCO is acknowledged as the First and Foremost fringe area antenna

Fringe area buyers more and more ask for the FINCO by name. Let them know you handle the best — advertise the low cost way with Finco co-op ad mats — tie-in with LIFE – – watch your sales soar! Get the complete story from your jobber or write direct

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Dept. 2S9, 4612 St. Clair Ave., Cleveland 3, Ohio

The Finney Co.
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4612 St. Clair Ave.
Cleveland 3, Ohio

RUSH
- ☐ information on the new 400-A and UHF Conversion Kit No. 12.
- ☐ FREE LIFE merchandising display material.
- ☐ Co-op newspaper ad mat brochure.

YOUR NAME .....
COMPANY NAME .....
ADDRESS .....
CITY ..... ZONE..... STATE.....
YOUR JOBBER .....

12 reasons why it pays to replace with SYLVANIA PICTURE TUBES

Independent laboratory tests show these 12 outstanding qualities of Sylvania Picture Tubes

1. No tube failures (after 1500 hours).
2. No trend toward slumping emission or low light output.
3. No excessive leakage.
4. No excessive gas present.
5. Excellent grid control.
6. Excellent emission characteristics.
7. No stray emission.
8. Low electrical breakdown.
9. Very good color control.
10. Excellent spot centering.
11. Low screen burning (no rejections).
12. Excellent physical conditions.

Only Sylvania showed no tube failures

Here is proof that Sylvania Picture Tubes are *first* in long life and *finest* in all around performance of all tubes tested.

The above record was established in comparison tests of the tubes of 9 different manufacturers. All tests were conducted under identical conditions by an outside testing agency.

Set owners everywhere are being told again and again about Sylvania's superiority on the big, nation-wide TV show "Beat the Clock."

The Picture Tube for Reliable Replacement

Of course, the name Sylvania has always stood for highest quality. Now, more than ever before, Sylvania Picture Tubes mean better business for jobbers and service-dealers alike. If you would like the full story of these recent tests to show your customers how Sylvania Picture Tubes won over all others tested, simply mail the coupon now.

Send for this report

Sylvania Electric Products Inc.
Dept. 3R-2409, 1740 Broadway, N.Y. 19, N.Y.

Please send me the official report of the tests made on Sylvania Picture Tubes in competition with other makes.

Name_____

Company_____

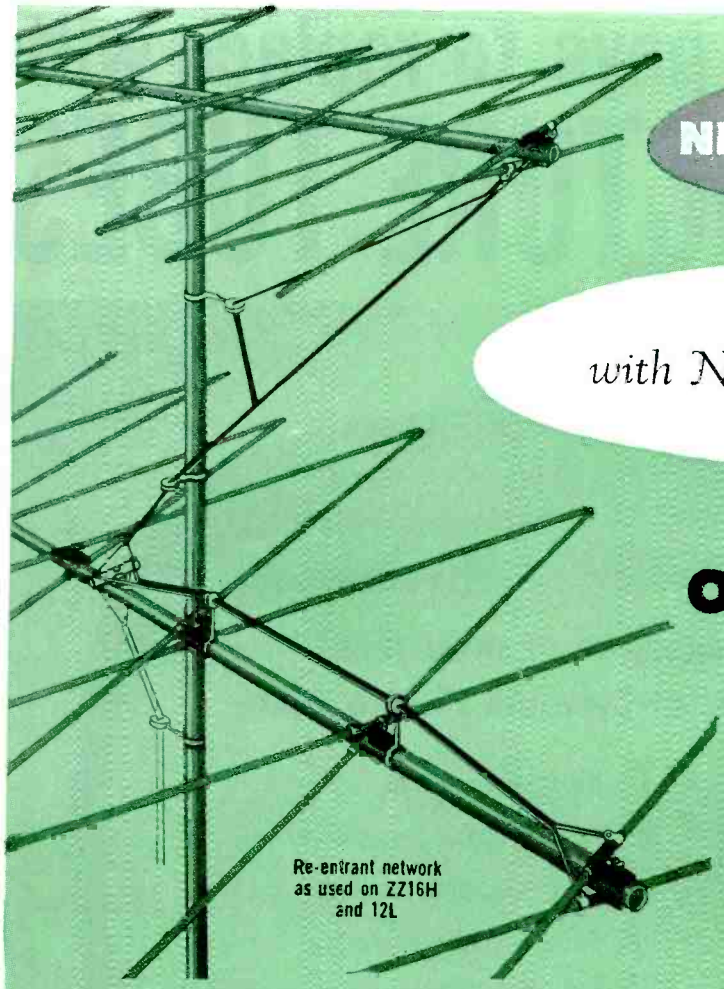
Street_____

City_____ Zone_____ State_____

SYLVANIA

LIGHTING • RADIO • ELECTRONICS • TELEVISION

In Canada: Sylvania Electric (Canada) Ltd., University Tower Bldg. St. Catherine St., Montreal, P. Q.



Re-entrant network as used on ZZ16H and 12L

NEW IMPROVED ZIG-ZAG

with New Re-entrant Network

OUTPERFORMS ON ALL CHANNELS

(Using Single Lead-in)

The sensational, radically new TRIO ZIG-ZAG antenna, introduced less than a year ago, has enjoyed the greatest acceptance of any TV antenna ever made!

NOW — TRIO introduces a radically new improvement that makes this great antenna even greater than before! It consists of a new re-entrant type impedance matching network for ZIG-ZAG antennas which now provides an almost perfect impedance match to the feedline on EVERY channel!

UNIFORMLY HIGH GAIN

There is no measurable difference in gain on ANY channel whether operating stacked high-band and low-band ZIG-ZAG antennas from a *single feed-line* or using them separately. There is no insertion loss such as found in isolation networks. For example, the ZZ12L and ZZ16H now provide 3 to 6 DB. more gain than elaborate, stacked cut-to-channel arrays. This additional gain is often the difference between a good picture and a poor one.

Elaborate tests conducted all over the country under every conceivable type of terrain and in locations where ten out of the thirteen VHF channels were available, proved conclusively that TRIO ZIG-ZAG ANTENNAS OUTPERFORM ANY and EVERY colinear, conical, or broadband multi-element Yagi on the market today — AND ZIG-ZAG does it on ALL VHF channels. Whether its a new installation or a replacement, INSIST ON TRIO ZIG-ZAG TV ANTENNAS, with their EXTREMELY HIGH GAIN, SHARP DIRECTIVITY, SUPERIOR LINE MATCH, MULTI-CHANNEL COVERAGE and RUGGED-LONG LIFE CONSTRUCTION

Illustrated above is the NEW re-entrant network developed by TRIO engineers for the model ZZ12L and ZZ16H combination. Current shipments will include the complete network. There is nothing else needed for single feed-line operation!

Used stacked — or separately — TRIO ZIG-ZAG antennas are the hottest ever designed!

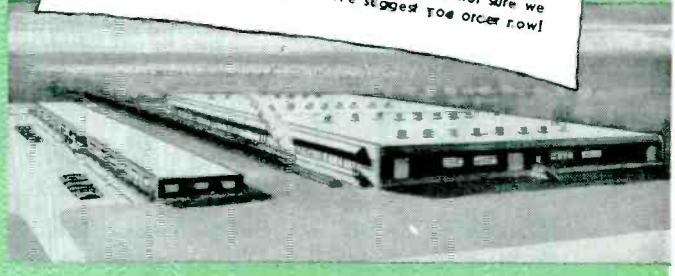
New descriptive literature available direct or from your supplier.

New network supplied with all high-gain Zig-Zag models

ANOTHER NEW TRIO PLANT TO SERVE YOU!

This modern, new addition to TRIO's present facilities adds 24,000 sq. ft. of manufacturing space. A new laboratory, not illustrated, has also been added.

Although TRIO has definite commitments for 60 cars of aluminum to meet increased demands, we are not sure we will be able to fill all orders. We suggest you order now!

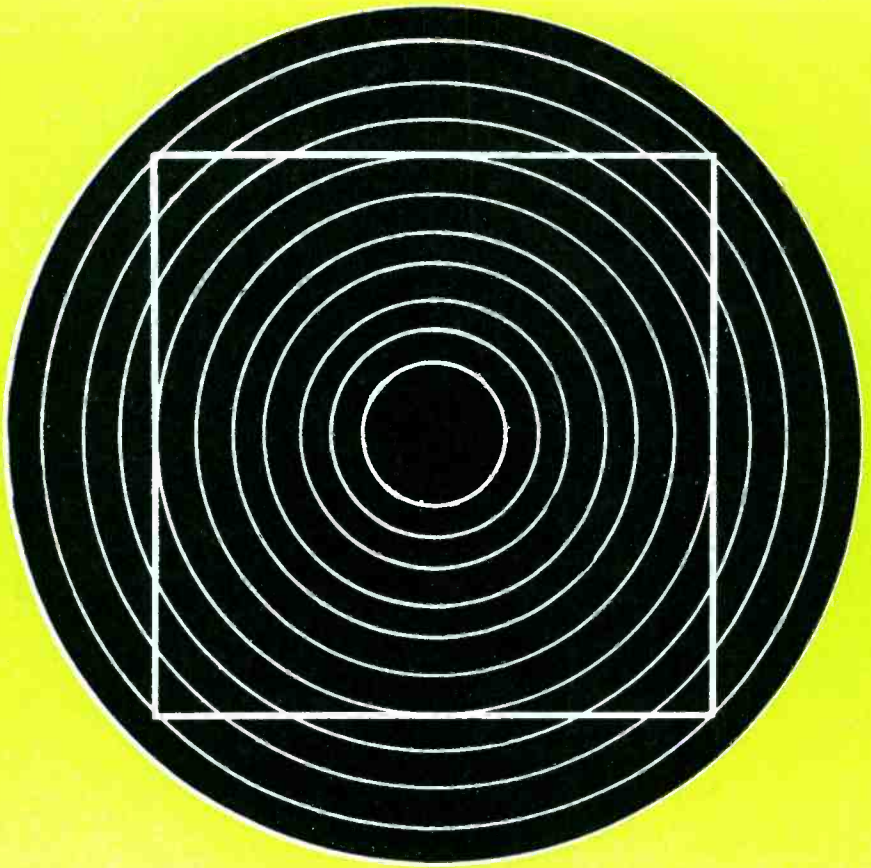


TRIO

Manufacturing Co.

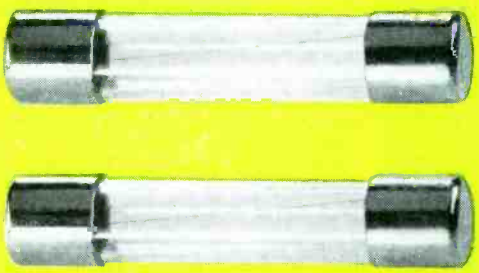
GRIGGSVILLE, ILLINOIS

Burton browne advertising

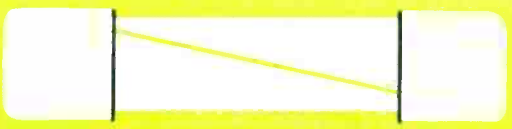


things are NOT as they seem . . .

This is a perfect square within the circle
—it is an optical illusion that the sides bend.



Things are not as they seem . . .
These two fuses look alike . . .
But they are not.



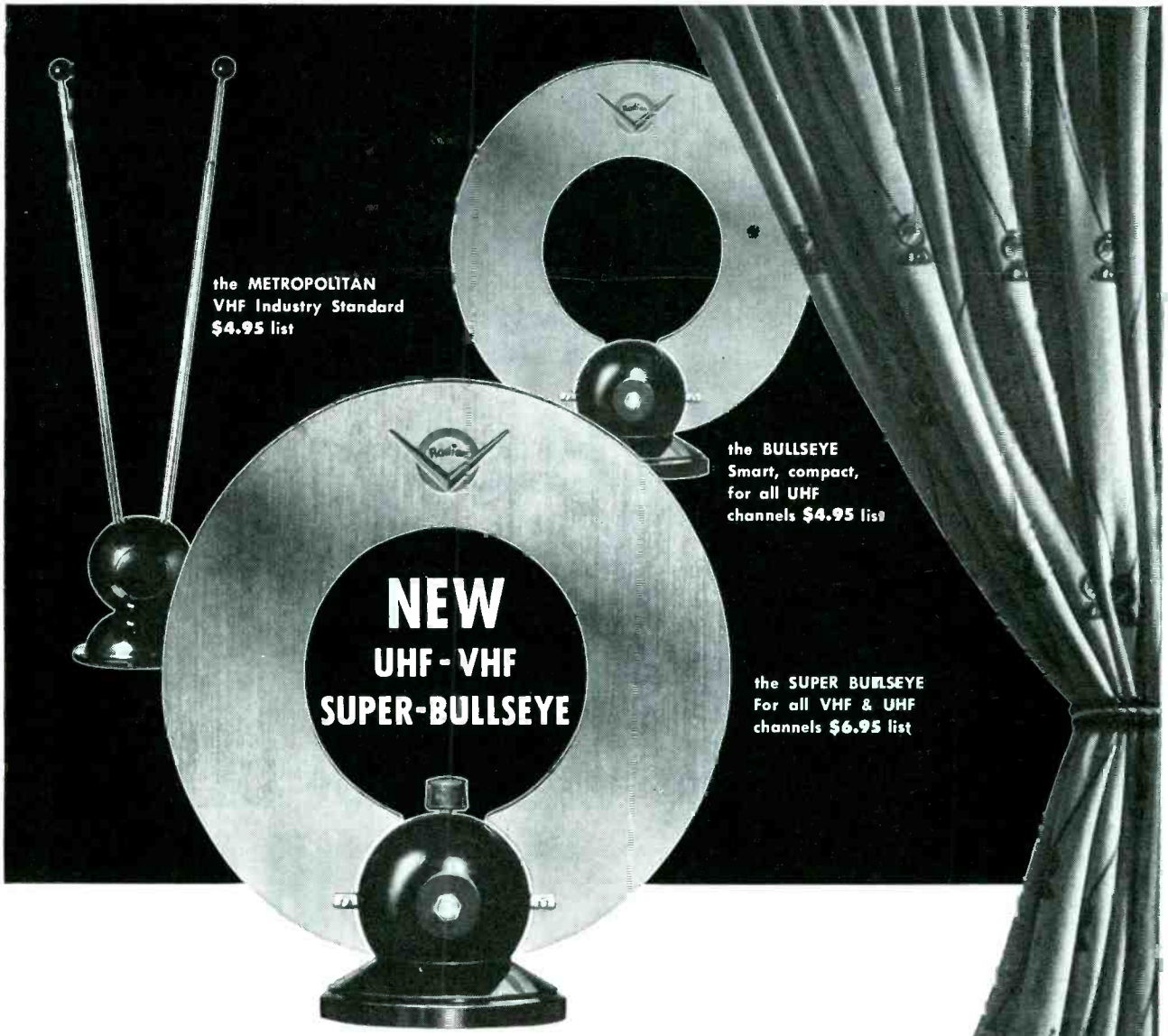
This fuse may burn out anywhere along the length of the filament even in the cap—this blown fuse is impossible to detect visually.

This Littelfuse has a controlled blowing point—the filament is plated throughout its length except in the very center—the fuse will always blow here. A blown Littelfuse can be detected immediately—a Littelfuse feature.

Littelfuse holds more design patents on fuses than all other manufacturers combined.

LITTELFUSE

DES PLAINES, ILLINOIS



SELL MORE TV SETS IN EVERY MARKET

If yours is a straight VHF city you know how the Radion indoor antenna has sold TV sets for you. One out of every six sets sold is installed with a Radion Metropolitan! Now, if your city has UHF or is adding UHF service to existing VHF there's a Radion to help you sell...to give you the advantages of low installation costs and manpower saved. Radion is THE quality name in the field...most popular for appearance and performance. Stronger signals and more sensitive sets make Radion indoor antennas more practical than ever for a majority of your installations.

Sell Radion and you sell the *best*...and the *best* way to sell TV in volume—in every market—is with Radion!

GET THE DETAILS ON ALL RADION ANTENNAS... SEND TODAY

Radion

THE RADION CORP. S-9
1130 W. Wisconsin, Chicago 14, Illinois

Please send information on the Metropolitan_____the Bullseye_____the Super Bullseye_____to:

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Firm_____

Address_____

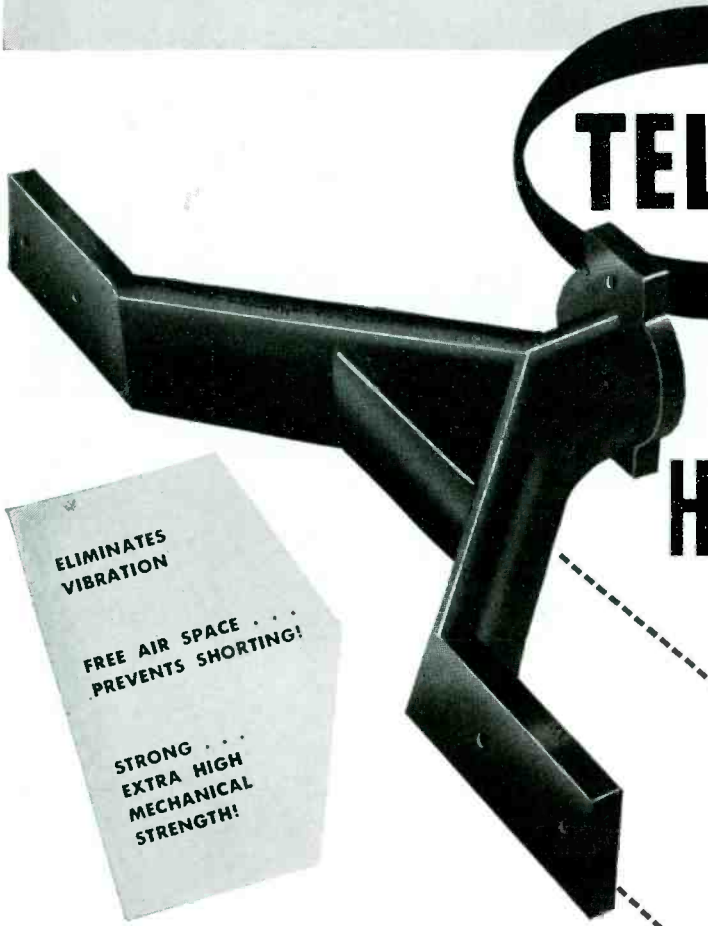
City_____ Zone___ State_____

Export Sales Div: Scheel International, Inc., 4237 N. Lincoln Ave., Chicago 18
In Canada: A. T. R. Armstrong Co., 50 St. Clair Ave., West, Toronto

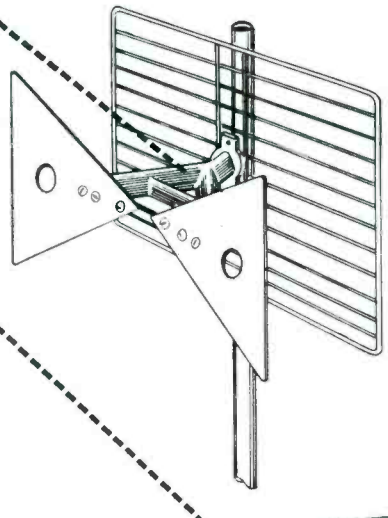
ONLY TELCO UHF ANTENNAS HAVE THE "WISHBONE"

TELCO

UHF "WISHBONE" HIGH DI-ELECTRIC INSULATOR

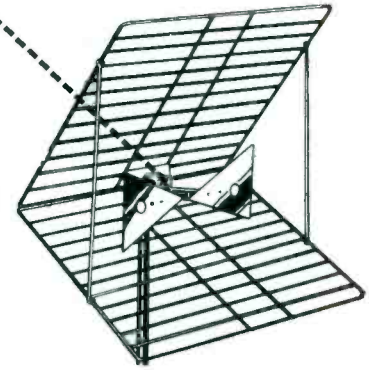


- EASY TO INSTALL
- ELIMINATES GHOSTS
- VERY HIGH GAIN



No. 8965—Butterfly Wishbone Antenna, complete with stacking bar. List $7.50

THAT'S RIGHT . . . Only TELCO'S got this remarkable new free air insulator . . . the "Wishbone" . . . that absolutely prevents shorting out under any conditions. Sturdy vibration-proof reflector and rugged aircraft aluminum elements are fastened to the "Wishbone" to prevent vibration and shaky pictures. Antenna performance is proved by actual UHF field testing . . . assures high gain on all channels. Better buy TELCO . . . your all-ways best UHF Antennas!



No. 8984 Wishbone Corner Reflector. List $14.50

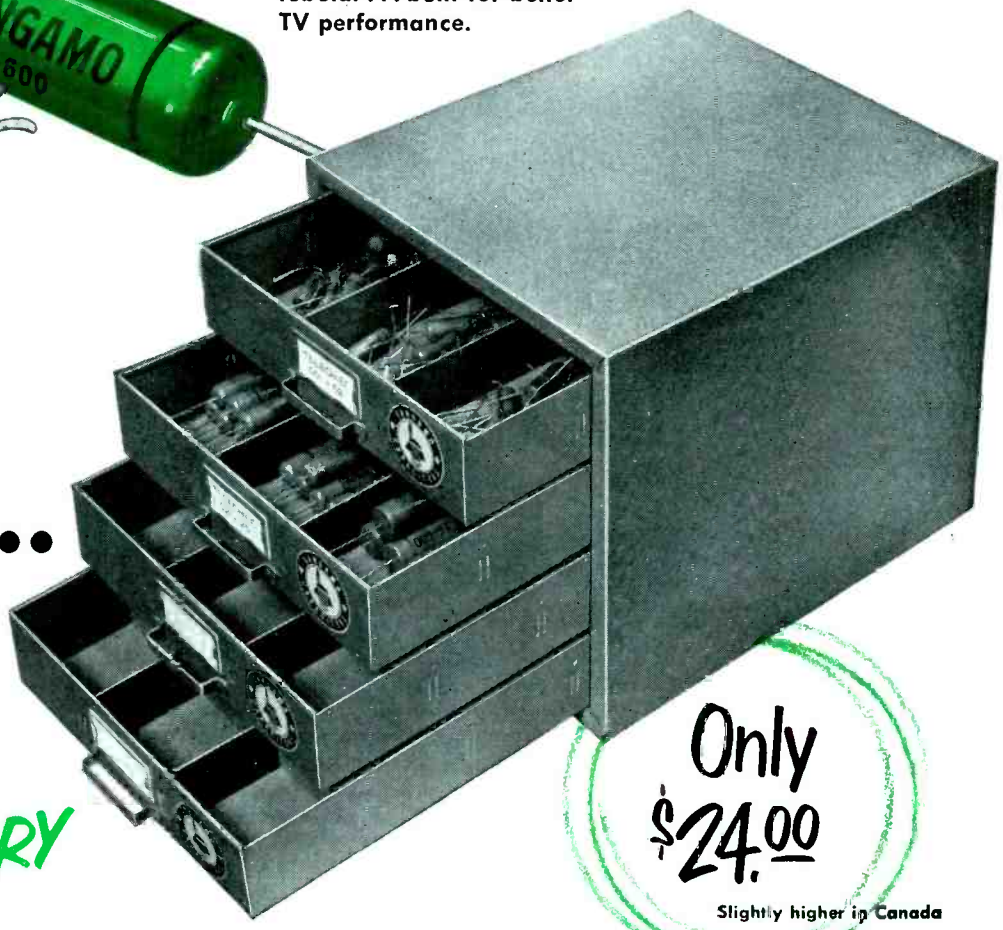
TELCO

FREE! WRITE TODAY **for all-new 32-page TELCO Catalog. Send Postcard.**

TELEVISION HARDWARE MFG. CO.
DIVISION OF GENERAL CEMENT MFG. CO.
901 TAYLOR AVENUE • ROCKFORD, ILLINOIS

YOU'VE HEARD ABOUT THE Telechief®

It's HERE—Sangamo's new premium molded paper tubular capacitor that will outlast and outperform any other tubular . . . built for better TV performance.



NOW...

see your jobber for this

SPECIAL INTRODUCTORY OFFER!

Only $24.00

Slightly higher in Canada

Here's a deal you can't afford to miss. You get a basic balanced inventory of fast-moving "Telechiefs"—assortment based on national popularity—*PLUS* a heavy gauge steel chest with two extra drawers for small parts—*PLUS* 100 attractive folders of your choice to promote your business. You get all this for only $24.00—the dealer net price of the capacitors alone. (They list at $40.00.)

Get acquainted with the Telechief today—your Jobber has these kits in stock.

You can have 100 of any of these business-building folders without extra cost—a sample of each is enclosed in the kit.

Those who know...choose Sangamo

8C53-12

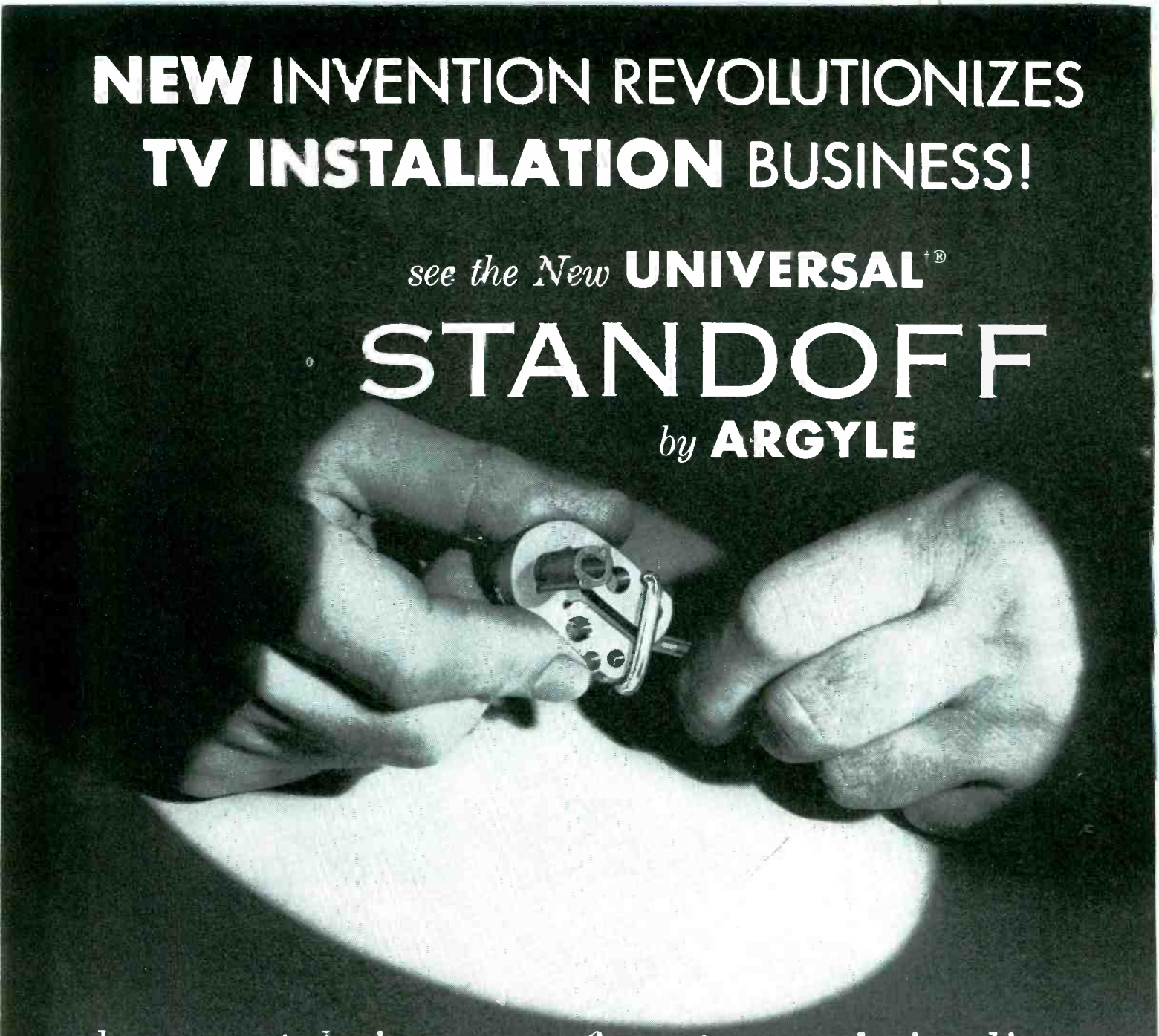
SANGAMO ELECTRIC COMPANY MARION ILLINOIS

NEW INVENTION REVOLUTIONIZES **TV INSTALLATION** BUSINESS!

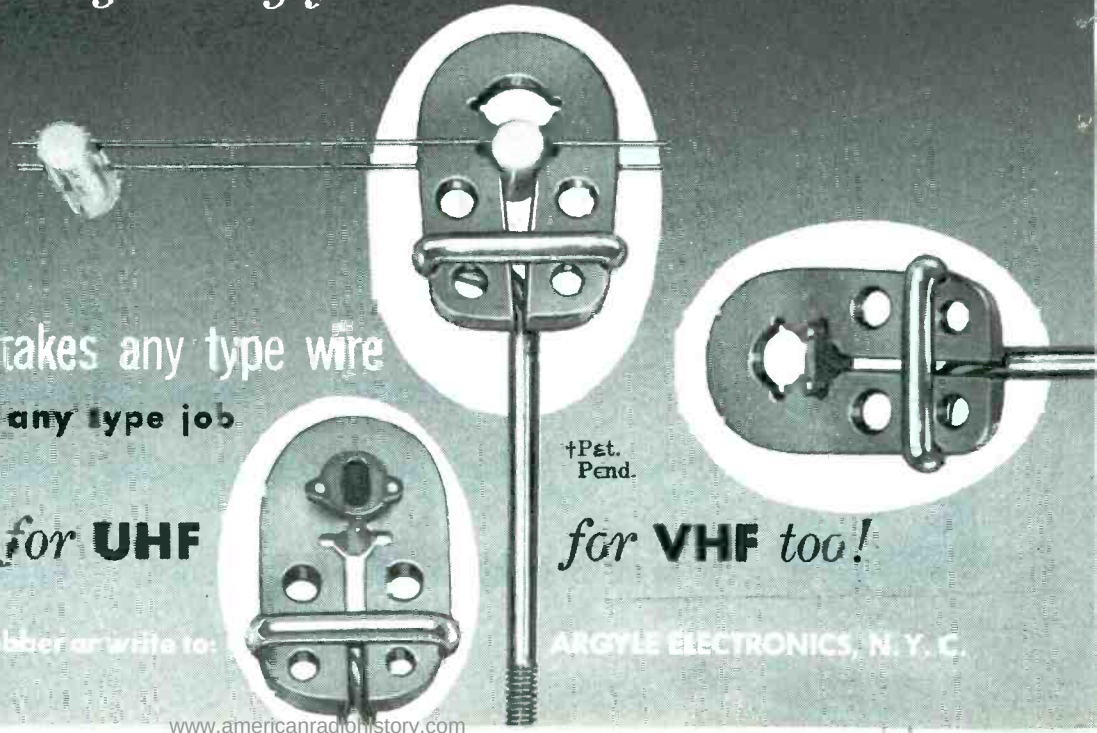
see the New **UNIVERSAL**†®

STANDOFF

by **ARGYLE**



keeps metal ring away from transmission line



ONE INSULATOR takes any type wire

in all models to fit any type job

†Pat. Pend.

a must for **UHF** *for* **VHF** *too!*

stocked by your regular jobber or write to: **ARGYLE ELECTRONICS, N. Y. C.**

Britain's GREAT CONTRIBUTION TO HIGH FIDELITY

It is more than coincidence that Britain and the United States both have gained distinction for accomplishment in the field of sound recording and reproduction. More likely, it is because of the common objectives and understanding shared by members of the great engineering fraternity on both sides of the Atlantic. Each has strived to score over the other, but with a characteristic sportsmanship in the interchange of know-how and experience.

Britain already has scored well with the Collaro record changer. In England and on the European continent, the Collaro is more widely used than any other record player in the world. Having won the acclaim of Europe's most discriminating audio devotees, Collaro record changers are now well on their way to repeating this experience in America.

The new Collaro record changers are truly a great contribution to high fidelity. Rumble, wow and flutter have been reduced to levels previously considered impossible in changer design. In all respects, the Collaro establishes a new standard of performance . . . and brings high fidelity reproduction a long way toward its ultimate goal of perfection.

THE **NEW**

Collaro

AUTOMATIC

3-SPEED RECORD CHANGER

FOR 7, 10, AND 12 INCH RECORDS

Model 3/532 Intermixes 10 and 12 inch records. List Price..... **$65.00**

Model 3/531 Non-intermix. List Price..... **54.50**

Model 3/534 Single record player. List Price..... **33.60**

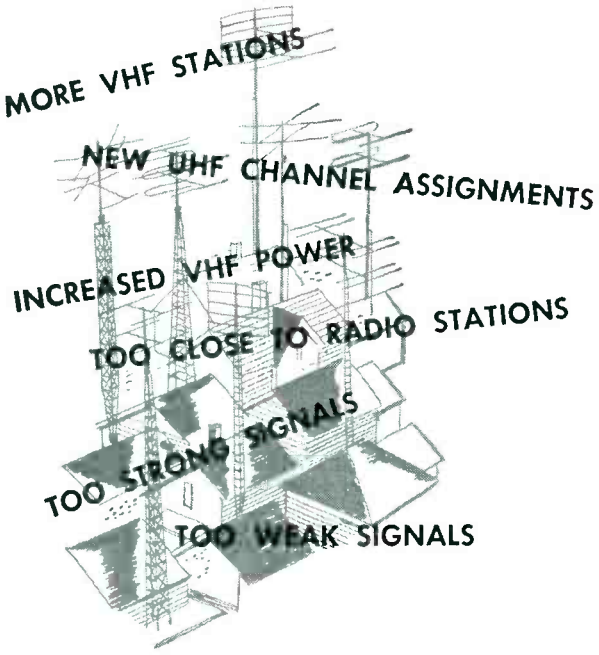
Available at radio parts jobbers, distributors, and hi-fi dealers.

Write for complete details to:

ROCKBAR CORPORATION

211 EAST 37th STREET, NEW YORK 16, N. Y.

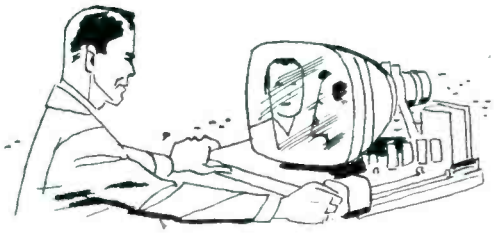
NOW...more important than ever!



New service tool...PCH-4 TV ATTENUATOR assures best reception in multi-station areas

IF you're in the thick of all the new channel assignments, both VHF and UHF, you know what a job it is to install H-pads for proper attenuation. Ordinary "cut-and-try" methods take too much time and there's always danger of overloading.

Even if you don't have attenuation problems now — *you will later on!* That's why it's smart to get the low-down on this brand-new Centralab TV Attenuator.



The switching arrangement makes it possible to attenuate each station as much or as little as necessary depending on daily conditions such as weather or existing interference, and allows for proper attenuation to balance two or more stations. It shows you the proper attenuation merely by turning a switch. You instantly match signal strength to requirements of receiver. Four different H-pads are mounted permanently to the attractive metal case. All you do is hook up to the 300-ohm antenna twin lead and turn dial to the H-pad that gives you the proper attenuation. Then unhook leads and install the proper H-pad. Checking and installation takes only a few minutes.

If customers want permanent selective attenuation installation, this handy unit makes the job easier. And it's another sale for you!

Your Centralab distributor has these TV Attenuator Switches in stock for immediate delivery. Also ask him for a demonstration and complete data on dependable Centralab H-pads.

Always use Centralab H-pads —you'll prevent overloading, eliminate tearing of image . . . improve both audio and video results. Available in 10, 20, 30 and 40 db. Install in series with 300-ohm antenna.

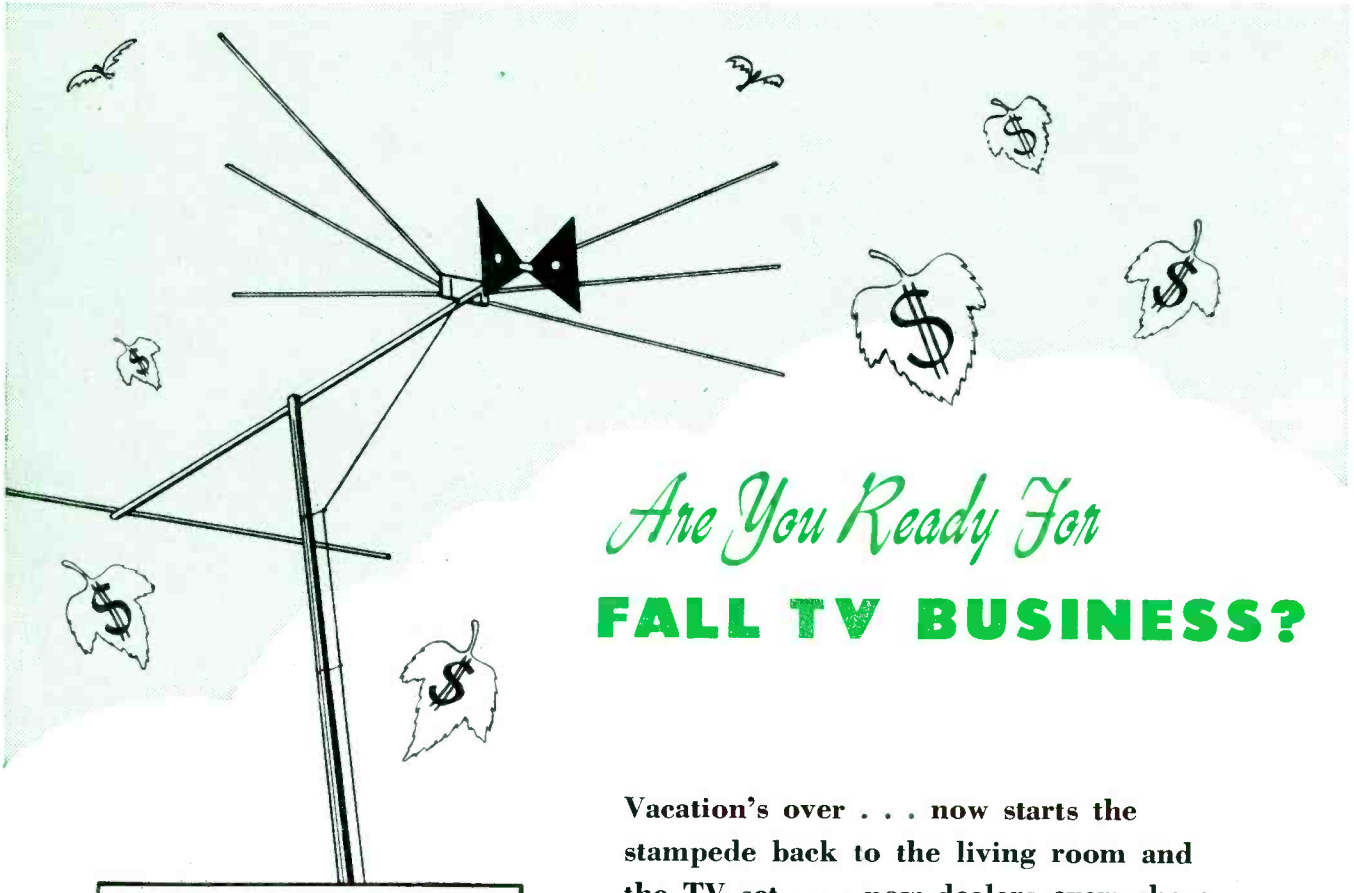
Centralab

A Division of Globe-Union Inc.

908-I East Keefe Ave. • Milwaukee 1, Wisconsin

In Canada, Box 208, Ajax, Ontario

94-5523

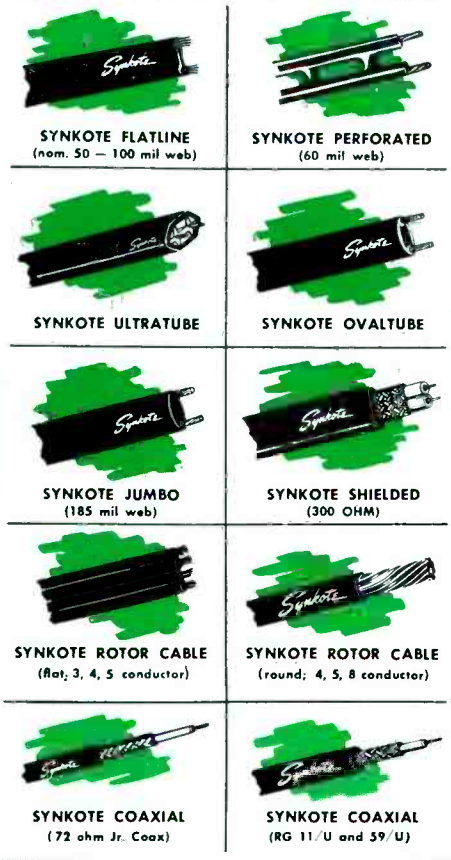


Are You Ready For
FALL TV BUSINESS?

Vacation's over . . . now starts the stampede back to the living room and the TV set . . . now dealers everywhere are getting set for a record fall season!

Don't get caught short. *Now's* the time to lay in your requirements for SYNKOTE wire and cable. Ask your Plastoid representative to show you the complete SYNKOTE line—*now.*

SYNKOTE DEPENDABLE TV WIRE
for every purse . . . for every purpose

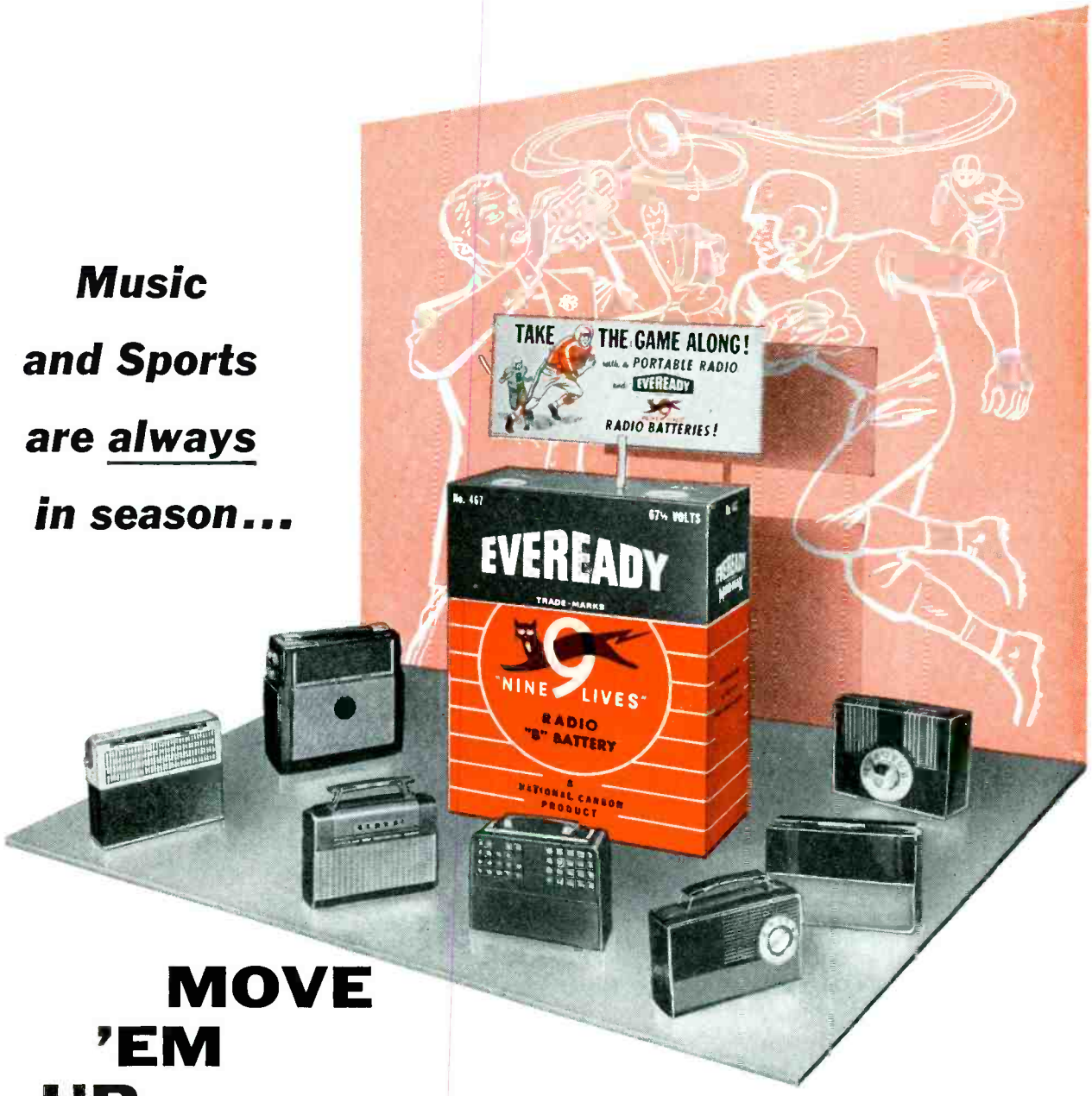


Synkote® DEPENDABLE Wire and Cable

"Manufactured by the mile . . . tested by the inch"

PLASTOID Corporation

42-51 24th St., Long Island City, N.Y.



Music and Sports are always in season...

MOVE 'EM UP FRONT FOR BIGGER SALES!

New "Eveready"
No. 437 "B" Battery

- Far longer life than any other complement its size!
- Higher initial power output!
- Balanced service life, when used in complement with . . .
- Famous "EVEREADY" No. 964 "A" BATTERIES.

WITH the world series under way...footballs flying...back-to-school partying...camp-fires lighting the crisp autumn air—it's *your* cue to get portables and batteries UP FRONT for BIGGER SALES!

Now's the time to cash in on the terrific eye and ear appeal of smart, new portable radio receivers, powered by long-lasting "Eveready" batteries—your best-selling battery brand!

Remember, too, that portables are *really portable* only when they are supplied with fresh, dependable batteries. Sell the portability feature, use your "Eveready" battery display kit, enjoy the profits of repeat "Eveready" battery sales...big and growing *bigger!*

The terms "Eveready", "Mini-Max", "Nine Lives" and the Cat Symbol are registered trademarks of Union Carbide and Carbon Corporation

NATIONAL CARBON COMPANY

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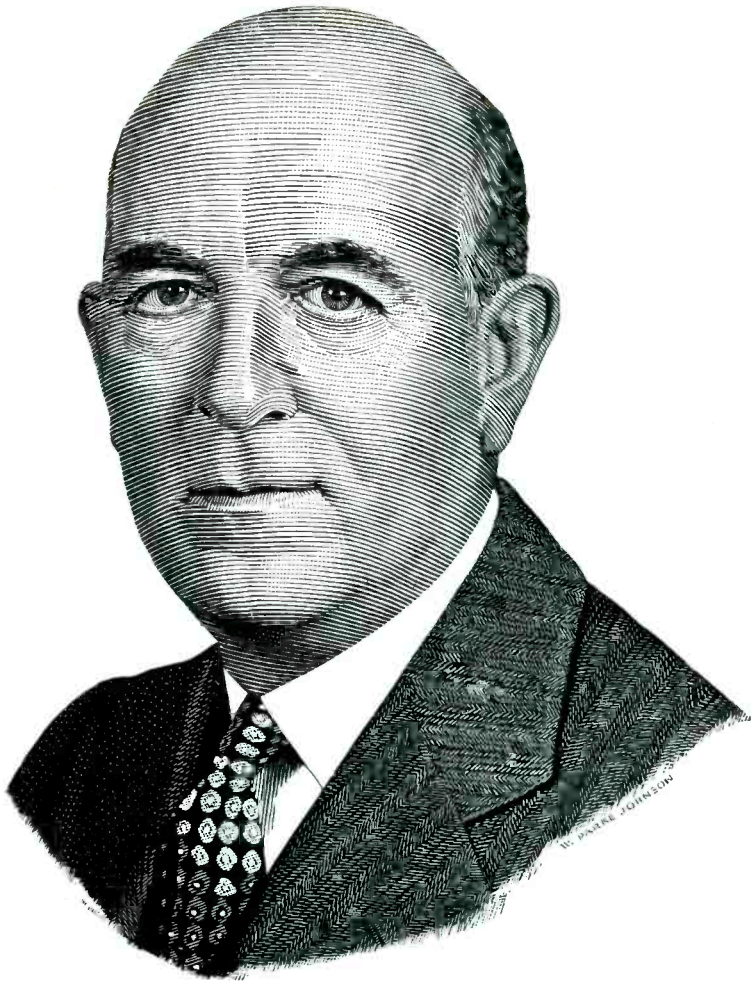
District Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco
IN CANADA: National Carbon Limited—Montreal, Toronto, Winnipeg

". . . helping to keep the business cycle on an even keel . . ."



HARRY B. HIGGINS
President, Pittsburgh Plate Glass Company

"The employees of Pittsburgh Plate Glass Company since 1946, have purchased $9,488,510 in United States Savings Bonds through the Payroll Savings Plan. This accumulation of assets will be of inestimable value in helping to keep the business cycle on an even keel by maintaining purchasing power for the future."

Payroll Savings—the plan that protects—pays the employer *triple* benefits:

- it makes a good employee a better one—a serious saver with a definite plan for personal security.
- as enrollment on the plan goes to 60%, 70% employee participation, productivity increases, absenteeism decreases and accident records go down.
- and as Mr. Higgins points out, the systematic purchase of Defense Bonds through the Payroll Savings Plan is building a tremendous reserve of purchasing power.

Let's point up the third employer benefit with a few figures:

- On September 30, 1951, individuals held Series E Bonds totaling $34.6 Billion—more than $4.6 greater than on V-J Day.
- During the five calendar years (1946-1950) Defense Bonds sales provided:

—*Cash* to retire $3 Billion A-D Savings Bonds (maturing Series).

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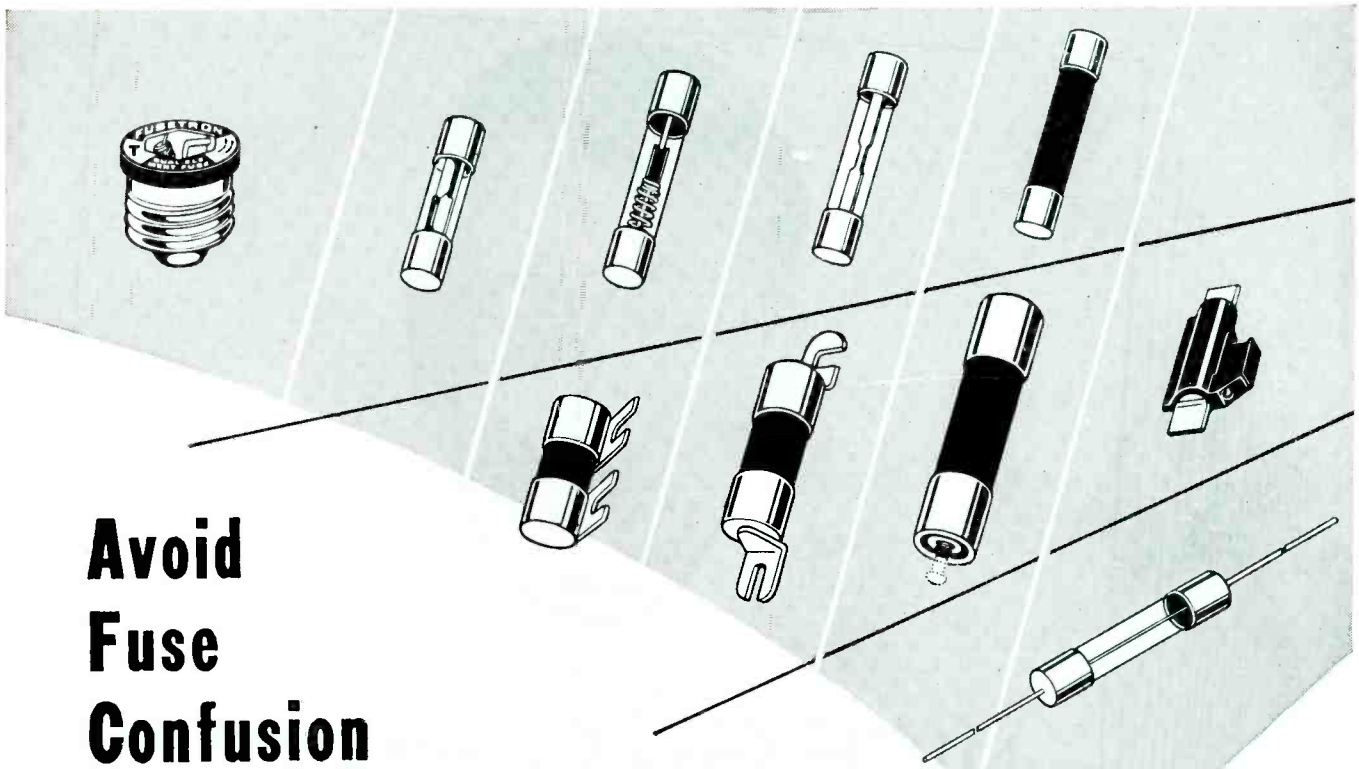

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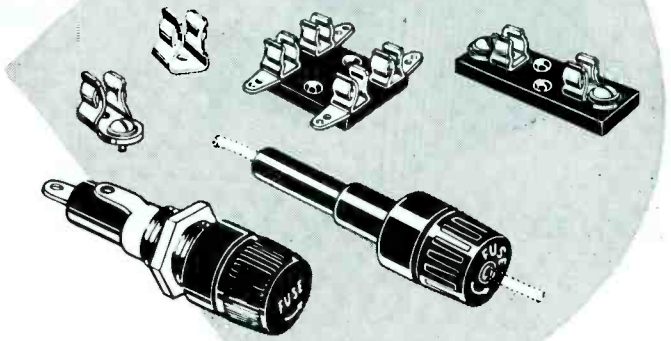

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5. Keep labor charges at a reasonable level.
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Patient Improving!

SERVICING, for quite a spell a weary and chronic problem on most setmakers' agendas, no longer wears a frightening cloak of horror; it has been ripped away. So have scores indicated recently in their promotional plans.

Whereas in the past, service was rarely mentioned in receiver ads or public relations material, for fear that it might scare customers, the term will now be mentioned freely, and boldly, too. Many chassis makers will proclaim that *service* has received prime consideration in the design of their chassis. Yes, many of the set producers have become fully aware of the value of this type of design, and Service Men are pretty happy about the turnabout.

In the new trend, receiver makers have begun to provide *looker* points on the front ends to facilitate tests from the top of the chassis. Some receivers are featuring terminal strips so that measurements of *agc* voltage can be made *tube-side*. And, the majority of receivers now have tubes all topside; no longer are front-end or *hv* tubes under the chassis, a condition quite frequent heretofore. In addition, most chassis have the tubes so mounted that it will no longer be necessary to remove or loosen the picture tube in order to replace the local oscillator tube.

To eliminate marginal sync buzz, and avoid an endless stream of complaints, more and more manufacturers are using limiters ahead of the ratio detectors. And it will no longer be necessary, in most receivers, to select special horizontal oscillator tubes. Tubes for local oscillators will still have to be selected, but practically all of the newer front ends now have suitable alignment screws, accessible from the front of the chassis.

Manufacturers are also tending away from running of the sound through the video amplifier, which eliminates a potential buzz source and a provoking headache, too.

Many forward-looking manufacturers are considering the mounting of key components so that the terminal studs will come through the top of the chassis to facilitate voltage, resistance and waveform observations from this point. Receivers already have most of the alignment screws on top so that chassis do not have to be pulled for alignment touch up to eliminate buzz and maximize picture quality.

The cascode tuner is becoming a feature of more and more chassis, too, providing improved results in marginal areas, where signal strength can fluctuate from day to day, and serving to reduce local oscillator radiation.

Service Men have found, and will find, more and more receivers with power and flyback fuses removed from the maze of wiring underneath chassis, and mounted at a convenient servicing point .

Except in a few cases, it is no longer necessary to remove the speaker, before the picture tube will slide out, to *pull* the chasiss.

Plug-in sections, for *if, rf* and video, adopted recently, have been found to simplify servicing, provided suitable jigs are used on the bench. Some manufacturers have also indicated that they will use horizontal-output transformers with plug-in provision to simplify installation and repair.

The standardization of *rf, if* and trap slugs, is also being considered. This move would eliminate one of the worst nightmares, and put a stop to damaged slugs and split coil forms.

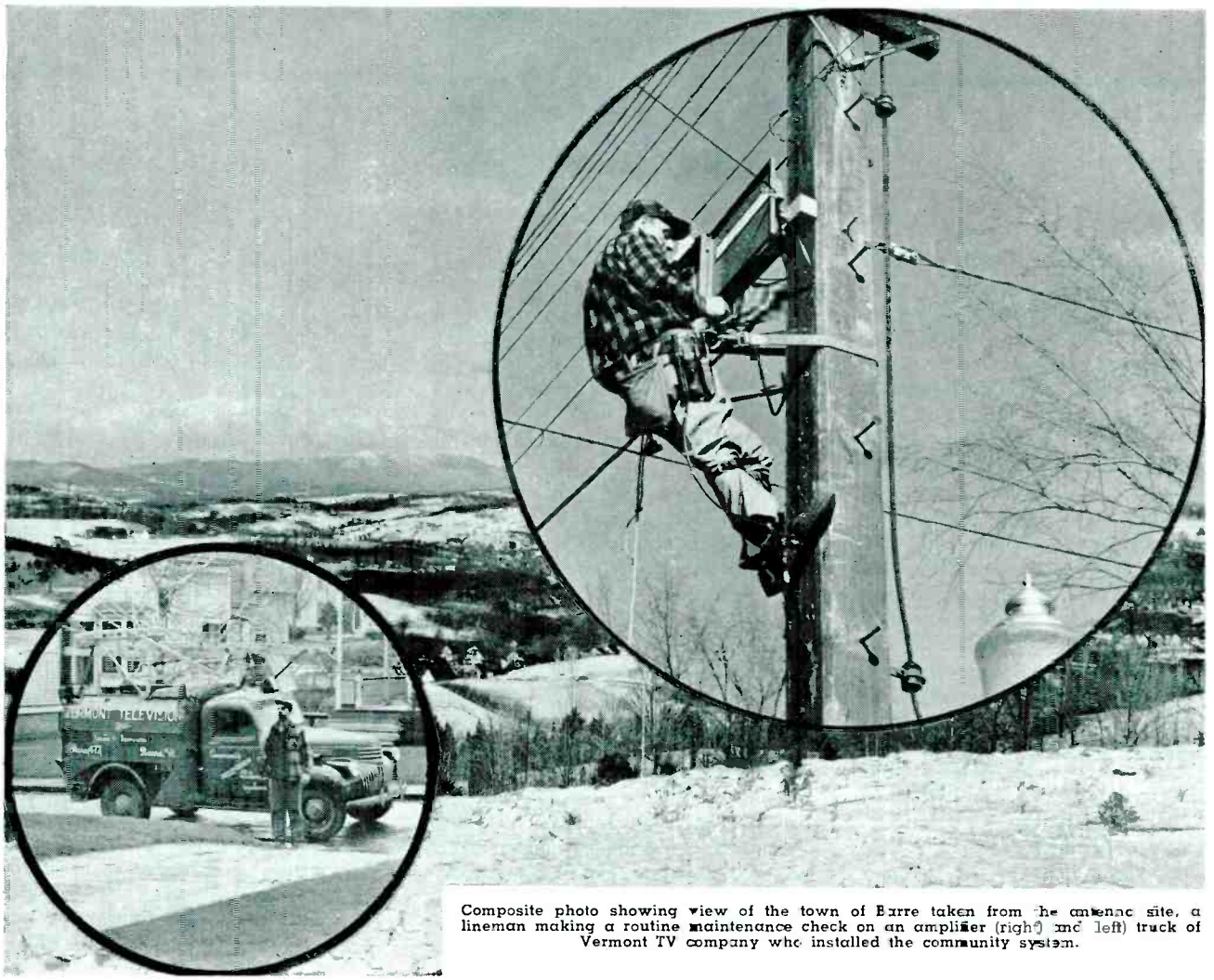
Some setmakers have also begun to consider the application of techniques employed in the design of military equipment, in which servicing plays an extremely important role. Some of the features under consideration are: mounting of the chassis vertically so that they are easily accessible from the front or the rear; pivoting of the chassis so that it can be revolved to hasten servicing; securing of the chassis to the cabinet by front-mounted instead of bottom-mounted screws; and the installation of automatic line-voltage regulating transformers in receivers that will be used in rural or heavily industrialized areas.

Manufacturers are also beginning to campaign for the proper use of replacement parts and accessories to assure results they claim sets are capable of delivering. It is important, they say, to watch closely the tolerances specified, and the voltage breakdowns indicated in the parts lists. Conservative design, practiced in most plants, involves the use of quality materials, operating within specified ratings. To illustrate, there are many types of 600-*v* capacitors, some of which are notorious for early leakage or breakdown, and others which are well designed and well rated, and can be reasonably expected to operate efficiently for a long time.

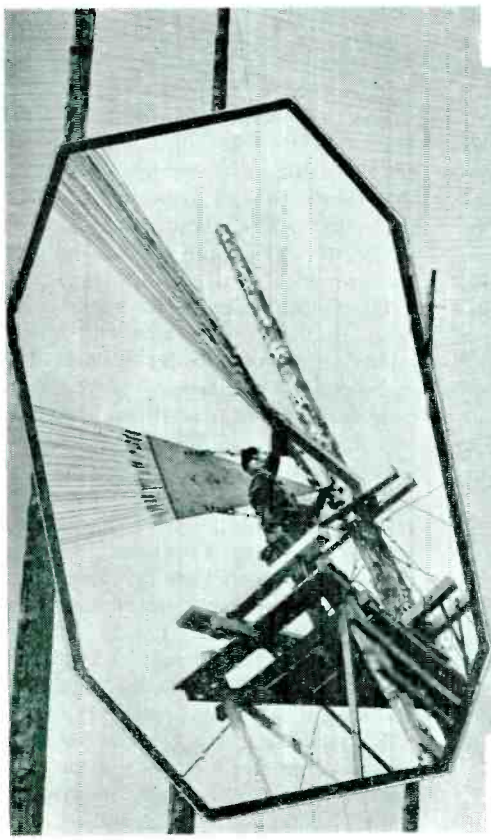
To expedite servicing and insure better results, setmakers are also warning Service Men that they should use vacuum-tube-voltmeters to measure *dc* voltages in TV receivers: the 20,-000-per-ohm voltmeters are extremely inaccurate for measurement work in high-impedance, tuned, and high-frequency circuits. A surprising number of Service Men, manufacturers have reported, are not aware of the value of this tool, and thus are plagued by frequent callbacks, because of inaccurate measurements made during calls.

One manufacturer has introduced an extremely novel service-aid feature, directed to both consumers and Service Men, and revolving about the use of keyed faults, as revealed on picture-tube screens. Noting that Service Men have learned to interpret into circuitry what appears on the face of the picture tube when sets are not functioning properly, this manufacturer declares that it has thus been possible to compile 40 basic problems and convert them into typical tube-face results. Each of these tube-face conditions are numbered; viewers have been told to relay these numbers to Service Men when trouble occurs, so that they'll be well aware of the basic problems before they come and be ready to service the chassis quickly and properly.

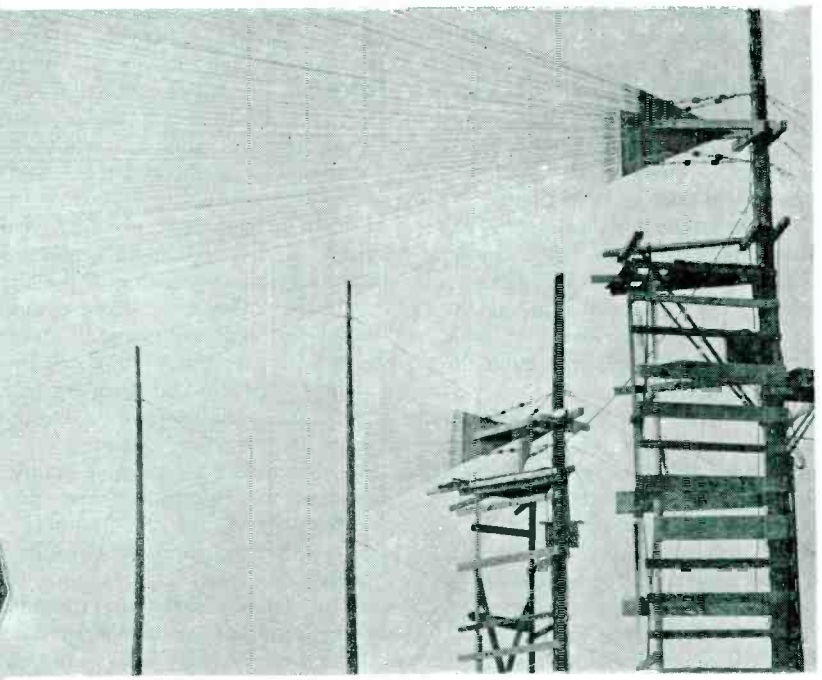
Of course, Utopia has not as yet been reached; there are still many knotty problems to be solved: too many chassis still lack adequate color-code leads, wires are still wrapped up in confusing nests, capacitors and resistors are still buried in hot-box areas, *pc* units are hidden, and those vital revised schematics, with *all* production changes, are still absent from the rear of the chassis housing. But if the present pace and marked interest continues, perhaps it may not be too long before it will be possible to announce that solutions have been found for all of the difficulties. In the meanwhile it is gratifying to report that striking progress has been made and the patient, the chassis, is really improving. That, is definitely good news!—L. W.



Composite photo showing view of the town of Barre taken from the antenna site, a lineman making a routine maintenance check on an amplifier (right) and (left) truck of Vermont TV company who installed the community system.



Installing Horn TV antenna (left) and completed antenna setup (right) atop mountain site in Barre.



Right: Circuit of chain amplifier used in Barre community TV system, which has a coverage of 49 to 225 mc, for up to twelve vhf channel service. Tube failure in amp is said to result in loss of 1.6 db gain, and no loss of entire picture. Untuned circuit design is claimed to eliminate loss of picture resolution, because of inadequate bandwidth and frequency drift. (Model 212A; Spencer-Kennedy)

Novel 3-Channel System, Using Horn Antenna and Chain Amplifiers, Installed Atop 1300-Foot Site, Now Provides Reception from Boston, Schenectady and Montreal, 180, 120 and 100 Miles Away, Respectively, From Receiving Point

COMMUNITY TV At Barre, Vermont

by GENE CLARK, *Spencer-Kennedy Labs, Inc.*

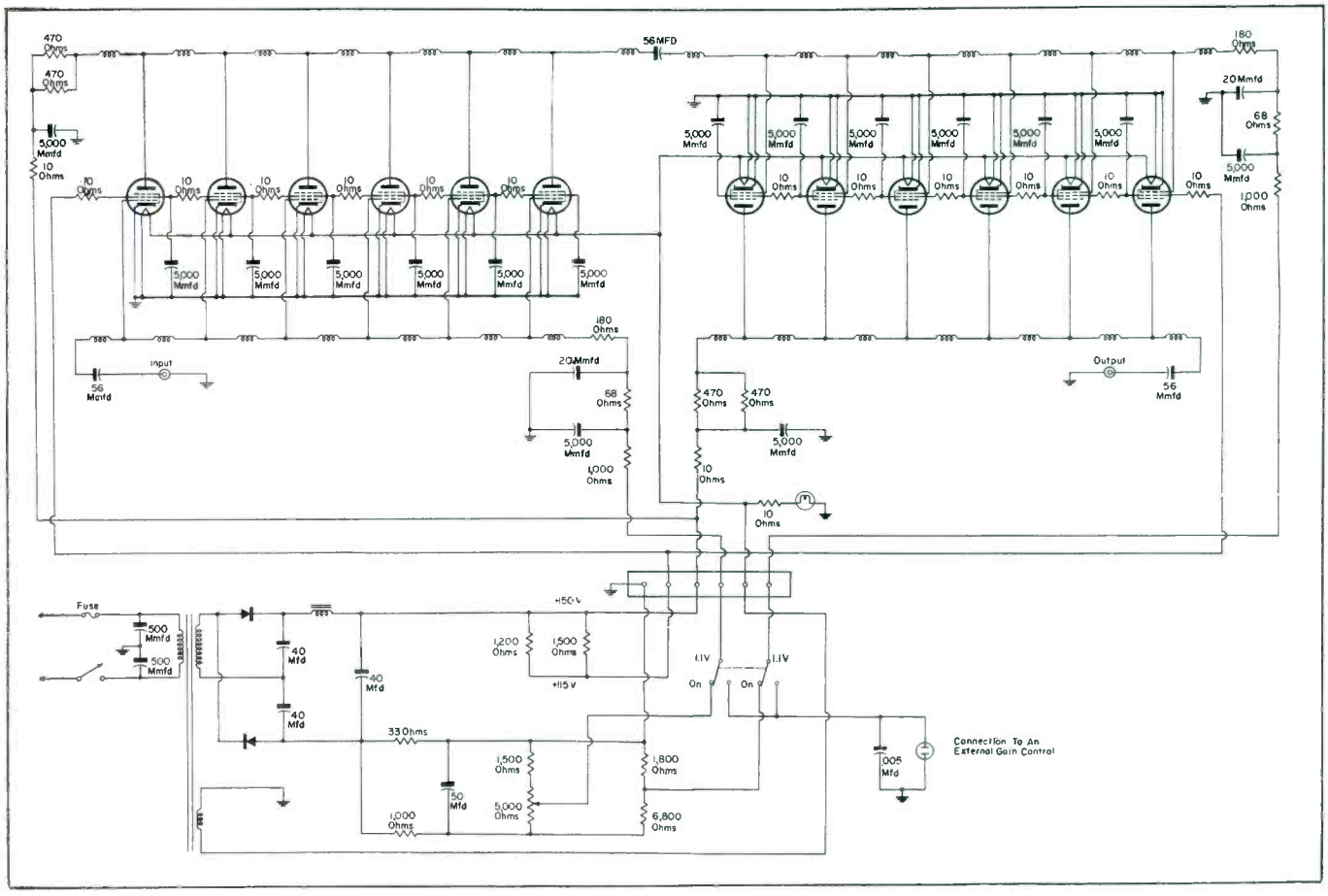
BARRE, one of the great granite producing centers of the world, is situated deep in a valley, surrounded by the lofty Green Mountains. In mountainous terrain such as this, TV reception in the valley is an impossibility as *line-of-sight* signals are simply cut off by the tall shafts of stone. Thus, to provide sight and sound reception here, either a station could be erected on a choice site in town or a community TV system installed.

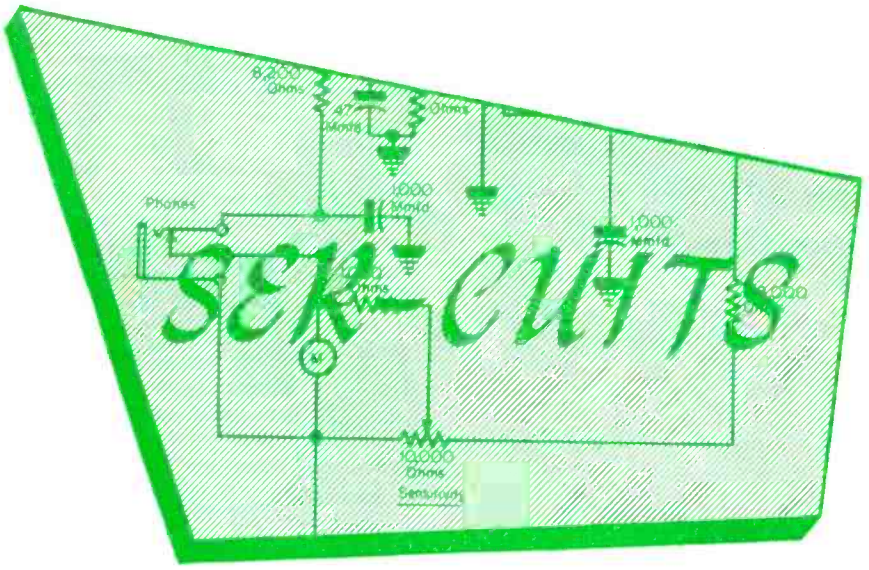
With a population of only 10,000, it was deemed impractical to even consider installing a station. But it was felt that a community setup might be the solution. However, since Barre is located over 180 air miles from Boston, 120 air miles from Schenectady, and 100 air miles from Montreal, the three nearest television transmission points, a major problem remained: Would good television signals be available on the surrounding hills? Preliminary tests were made on several hills surrounding the town and the results indicated that reception would be possible. Before selecting a final site several were tagged as acceptable, and negotiations were begun with the owners of these areas. Several of the sites had to be eliminated as the terms were unreasonable. Finally a lease was negotiated for a promising site 1300′ above sea level, where reception was available from Boston, Schenectady, and Montreal.

The distance from the antenna site to the nearest concentrated area of population was three miles. This distance did not seem excessive. In addition, the site was accessible by road, and electrical power would be available.

Naturally, because of the large distances involved, the signals available at Barre were found to be extremely weak. It was decided that before a final community TV company is organized extensive viewing tests would have to be made. For over a period of two months, such tests were conducted using two stacked 5-element *yagis* as the test antenna. The field strength readings were recorded on a

(*Continued on page* 90)





Amplified AGC . . . Sync Clipper Noise Gate Circuit Analysis‡

by M. W. PERCY

AN IMPROVED VERSION of keyed *agc*, which does not require exact synchronization between the peaks of the composite video pulses and the horizontal pulses of the conventional keyed *agc* circuit, has been developed and is now featured in the *Motorola TS-602 chassis*.

The tubes used for the development of the *agc* voltages are a 12AU7 (½) which serves as the first sync amplifier, another 12AU7 for *agc* detector, and pulsed *agc* and a limiter clamper (6AV6) for the *rf agc* voltage.

The first sync amplifier, being directly coupled from the second detector, amplifies the information for the *agc* as well as the sync information. For a peak *agc* system, the *agc* information is represented by the voltage relationship between the sync pulse tips and a *dc* reference level.

The *dc* reference level is zero, and the sync pulse tips extend away from zero in a negative direction. The amplitude of the negative going signal is determined by the signal received and the receiver gain. To keep the negative peaks at a constant level, it is necessary to reduce the gain of the receiver as the signal strength increases.

When the sync and *agc* information is amplified by the sync amplifier, the phase is reversed and the sync pulses extend away from zero in a positive direction, but the amplitude is still dependent on signal strength and receiver gain.

Before the *agc* information can be applied to control the receiver gain, it must be converted to a negative *dc* voltage. This is accomplished in the pulsed *agc* tube. The cathode of this tube is connected to a fixed reference potential, + 150 *v* derived from B +. The grid is supplied with the peak sync pulse information through the *agc* detector. Actually, this tube is a peak detecting cathode follower because the cathode can follow increases in grid voltage, but the 470,000-ohm and 2200-mmfd time constant (R_{78} and C_{74}) in the cathode does not allow it to follow the decreases. Thus, due to plate current flow, the cathode potential rises rapidly with the leading edge of the sync pulse and follows up to the peak. But when the grid voltage falls rapidly on the back end of the sync pulse and plate current drops, due to grid bias, the voltage on the cathode can only fall at the discharge rate of the *rc* (R_{78} and C_{74}) ground return circuit of the *agc* detector.

The plate voltage for the pulsed *agc* tube consists of a series of horizontal rate pulses coupled through a .001-mfd capacitor (C_{81}) from the horizontal output circuit. During the time the pulse is present on the plate of this tube, plate current will flow; provided *agc* information applied to the grid calls for conduction. This plate current is the discharge current of C_{81}. As this capacitor is discharged, it will draw charging current through R_{93} and R_{92} (39,000 and 330,000 ohms). The voltage drop across these resistors causes the average potential at the plate of the pulsed *agc* tube to become negative. The voltage across R_{93} is filtered by C_{82} to provide a negative *dc* voltage suitable for controlling receiver gain or *agc*.

It should be noted that the action of the pulsed *agc* tube would be sub-

(*Continued on page* 84)

‡From notes prepared by Motorola service department.

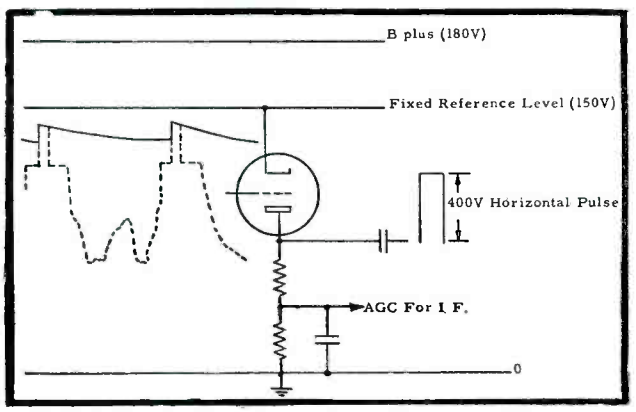
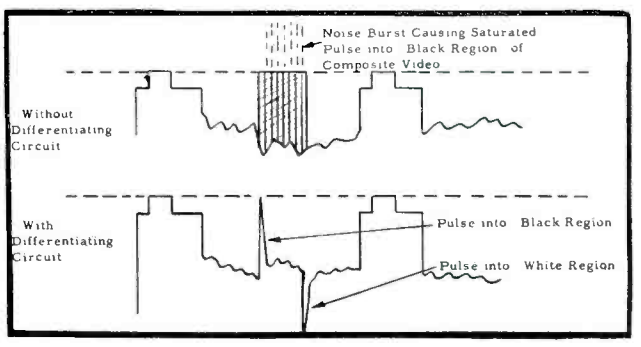


Fig 1. A filter circuit which would be sufficient in a TV receiver if the same agc voltage could be used for rf as well as if bias.

(*Below*)

Fig. 2. Waveforms illustrating noise burst and its control, through noise-dissipating circuit which differentiates high-amplitude noise pulses.



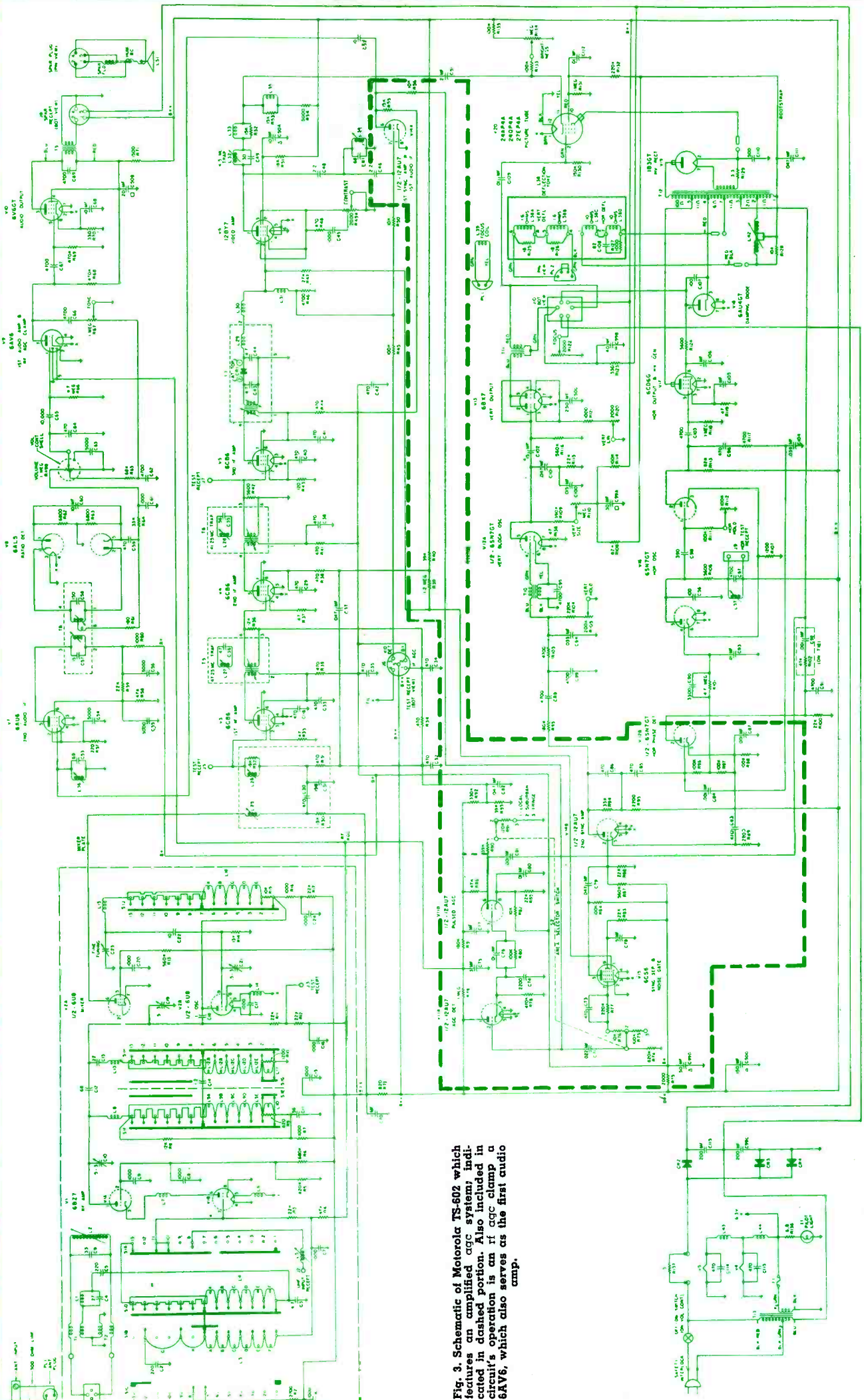
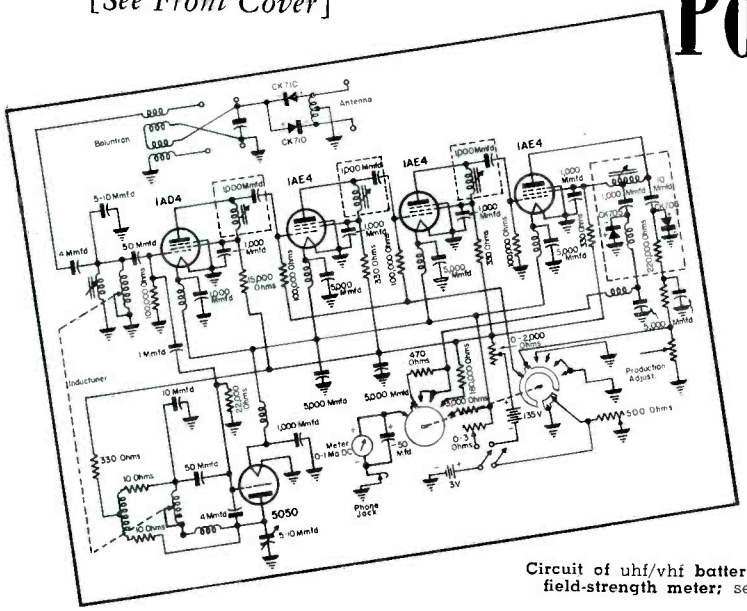


Fig. 3. Schematic of Motorola TS-602 which features an amplified agc system; indicated in dashed portion. Also included in circuit's operation is an rf agc clamp a 6AV6, which also serves as the first audio amp.

[*See Front Cover*]

Portable UHF/VHF



Circuit of uhf/vhf battery portable field-strength meter; see cover.

THE FIELD STRENGTH meter has always been an extremely useful instrument, particularly in TV. It can be used to obtain optimum antenna positioning and orientation, check adequacy of an antenna installation, determine if a *TV* receiver or its antenna is at fault, select the best antenna for a given location, locate the direction and frequency of a source of TV interference, check receiver oscillator radiation, and troubleshoot TV receivers.

Possibly the most important and time-consuming of all these operations appears in optimum antenna positioning and orientation. Unfortunately, this work must almost, of necessity, be done while a Service Man is atop the roof of a building. The need for this type of work has increased with the expanding use of *uhf*.

Two phenomena become of increased importance at *uhf* which make the proper installation of antennas more complicated: The more apparent effects of diffraction, and the fact that narrower beamwidth antennas are essential and easier to obtain than at *vhf*.

At *vhf* it has been assumed that increasing the antenna height always makes the received signal increase. This is not always true at *uhf*. Diffraction [1, 2] can cause, in a number of locations, the received signal to decrease as much as 6 db as the antenna is either lowered or raised by as little as two feet.

Since such an optimum antenna height can exist, it is important that the Service Man be able to find it quickly and easily. The same phenomena of diffraction can also cause the received signal to vary rapidly as the antenna is moved from side to side atop a roof, or forward and backward. To these four types of motion, or degrees of freedom, front to back, side to side, up and down, and antenna orientation in a horizontal plane can be added a fifth; antenna orientation in a vertical plane. This motion is important because many antenna manufacturers have found that it is economical to obtain increased antenna gain in the *uhf* band by restricting the vertical beamwidth, rather than the horizontal beamwidth. Particularly when transmitter and receiver are at greatly different elevations, the vertical orientation of the antenna is important.

Since the antenna should be optimized in position and orientation in five different ways, while the Service Man is atop a roof, it is desirable that he have an instrument with him to enable him to work rapidly.

A useful instrument for this purpose is a portable field-strength meter* shown on the *cover* and at left, which can be carried by a Service Man as he walks or climbs about the roof top. The instrument, covering both *uhf* and *vhf* bands, contains a tuner for low-drain self-contained, dry-cell battery operation. A 3-stage *if* amplifier provides enough power to drive both ear phones and an indicating meter; a 4" model calibrated directly in microvolts.

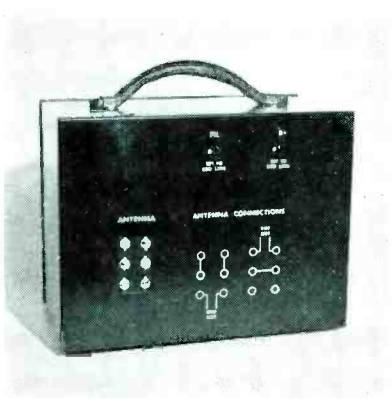
The selectivity of the unit has been found to be sufficiently high (.5 mc at 6 db down) so that TV sound and picture carriers can be measured individually.

Automatic gain control has been incorporated for ease of tuning and scale compression. There are two amplitude ranges for measurement of *absolute* field strength and a third range with an expanded input-output characteristic, and manual gain control for accurate measurement of *relative* field strengths.

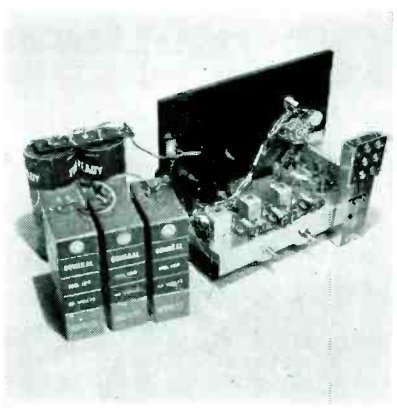
Frequency coverage is continuous in each of two wide bands. All tubes in the instrument have been designed specifically for battery operation.

Carrying instrument with case open.

Rear view of field-strength meter.



Field-strength unit with batteries.



Field-Strength Meter

by GUY HILLS

When receiving a 50,000-*uv* signal the total *B*-battery drain has been found to be 17 ma; the total *A* battery drain being 0.6 ampere.

Theory of Operation

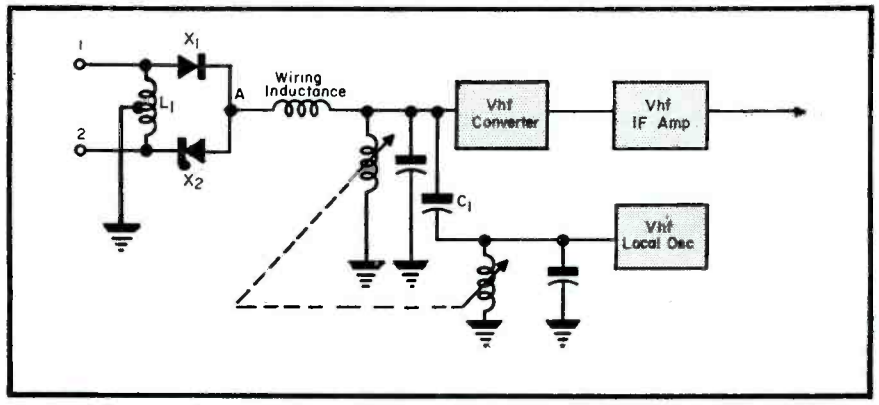
The most unusual feature of the instrument is the *uhf-vhf* tuner[3] designed for battery operation. Present *uhf* tuners for TV usually use oscillators that work in the *uhf* band and always use one or more tuned circuits that must be tuned to the frequency of the received *uhf* station for purposes of adjacent channel selectivity and image rejection. Two of the chief problems encountered in designing *uhf* tuners appear in the building of these oscillators and tuned, frequently-ganged, selector circuits.

The present tuner is a combination *uhf-vhf* unit having neither a *uhf* local oscillator nor any *uhf* tuned circuits; yet it has been found to have good image and spurious response rejection, as well as low oscillator radiation in the *uhf* band.

Balanced Modulator

This has been accomplished by a unique balanced modulator working in conjunction with a high-pass filter and a double-superhet circuit in which the first *if* frequency is different for each *uhf* frequency received. This causes all possible image frequencies to lie outside of the TV band capable of being received by the tuner at any one time (with the exception of the narrow range from 200 to 216 mc).

The same tuning control is used in both the *uhf* and *vhf* bands, but the antenna connections are made differently to the antenna terminals for the two bands. As shown in the circuit diagram, there are six antenna terminals. For *vhf* reception the antenna is connected to the lower two terminals, while the middle two terminals are shorted together with a jumper. The antenna signal is therefore fed through a 1:1 ratio balance-to-unbalance transformer (baluntran) to the grid circuit of the 1AD4 converter. A 5050-oscillator tube supplies local oscillator energy to the converter. The converted signal is amplified by three *if* stages, rectified by a CK706 crystal and applied to ear phones or indicating meter.



(Above)
Simplified schematic of the uhf portion of the tuner used in the instrument.

For *uhf* reception the antenna is connected to the upper two terminals, while the left-hand terminals of the middle and lower pairs are connected together, and the right-hand terminals of the middle and lower pairs are also connected together. A simplified diagram of the *uhf* portion of the tuner is shown above. Here the *uhf* signal from the balanced 300-ohm antenna is applied across the two terminals of coil L_1. This coil, together with the two crystal diodes X_1 and X_2, form a balanced modulator. The third harmonic of the *vhf* local oscillator is fed into the same balanced modulator by means of C_1. The output of the modulator, appearing between point *A* and ground contains the *uhf* signal, the local oscillator third harmonic, the sum and difference of these two frequencies, and some of the local oscillator fundamental. For a particular setting of the *vhf* tuner control which controls the tuning of the local oscillator and the *vhf* converter, a particular frequency in the 50 to 220 mc range may be received, if it appears at point *A*. For this same dial setting the third harmonic of the local oscillator can heterodyne with both a *uhf* signal and its image, so as to produce the one frequency that the *vhf* portion of the tuner can receive. If the *if* frequency of the *vhf* intermediate-frequency amplifier were chosen to operate at 9⅓ mc or lower it would become impossible for the tuner to receive any signal in the *uhf* band (460 to 890 mc), unless that signal were above and not below the third harmonic of the local oscillator for any tuning of the *vhf* portion of the tuner. If the signal above this harmonic were considered the desired one, then it would not be possible to receive its image, with the image lying in the *uhf* band. There would exist an image, but it would always be below the *uhf* band, only reaching 460 mc if the *vhf* tuner was tuned to 216 mc with an *if* frequency of 9⅓ mc. The high-pass filter formed by coil L_1 attenuates signals below 460 mc which might otherwise reach the crystals and be received.

It is a property of most balanced detectors that they do not contain in their outputs one of the two input signals, but do normally contain the other of the input signals as well as the sum and difference frequencies. With the crystals connected with the polarities shown, a signal entering the detector from conductor *A* cannot appear between terminals *1* and *2* or is balanced out. There can, therefore, be but little oscillator radiation from this detector, which is connected to the antenna, either at the local oscillator frequency or the frequency of any of its harmonics.

The *vhf* intermediate frequency of 9⅓ mc would be ideal for *uhf* reception, but it would reduce the image response for *vhf* reception; thus a compromise frequency of 20 mc was chosen for the instrument.

Automatic gain control has been included in the instrument not only to make tuning more easy to accomplish,

(*Continued on page* 120)

*Radion FSM 5000.

[1]Epstein, Jess, and Peterson, Donald W. *An Experimental Study of Wave Propagation at 850 mc*, Proc. IRE; May, 1953.

[2]Peters, Ralph G., TV Antenna Digest, *Report on 850-Mc Reception Tests*, SERVICE; June, 1953.

[3]The tuning element used in both *uhf* and *vhf* bands is a two-section *vhf* Mallory Inductuner.

TVI Causes . . . Effects . . . Solutions

1. Diathermy, industrial heaters, etc.

Solution: High pass filter, ac line filter. If these measures are ineffective contact owner of interfering equipment and recommend manufacturer be advised.

2. Radiation from local oscillator of nearby TV and FM broadcast receivers.

Solution: Realignment of offending receiver.

3. Strong signals from nearby radio stations, including FM broadcast, amateur, police, taxi, government, airways and military services.

Solution: Install high-pass filter, line filter, or in extreme cases install an absorption filter tuned to the interfering signal. If these measures are ineffective locate and contact owner of equipment.

4. Cross modulation external to the receiver, but possibly including external rectification sources such as corroded antenna and transmission line connections.

Solution: Check leadin or antenna for broken or corroded connections. Additional possibilities are poor connections in house wiring, plumbing, stovepipes, etc.

5. Multiple images.

Solution 1: Reorient or relocate antenna or leadin.

Solution 2: May be caused by standing waves due to an impedance mismatch between antenna, transmission line and receiver impedance. This condition can be detected by wrapping a piece of metalized paper around leadin, watching for variations in reflections and signal strength while sliding metalized paper along leadin.

6. Direct if pickup.

Solution 1: Shield section responsible; shielding must be complete.

Solution 2: Realign if; see section C for more detailed information.

Solution 3: Check lead dress, particularly of long leads.

7. Image interference. (This situation exists when a strong signal occurs at the oscillator frequency plus or minus the if.)

Solution: Use appropriate stub or tunable trap. (Refer to section B. High-pass filter is ineffective in this specific application.)

8. Signal operating in normal receiver pass band.

Solution: Find offending source and if unable to obtain cooperation, report to FCC.

9. Misadjustment of if traps, if tuned circuits, or misadjustment of TV receiver controls (traps may be faulty).

Solution: Correct misalignment or replace, or repair, defective component.

10. Faulty neutralization, particularly in triode or triode-connected pentode cascade type tuners; may cause cross-hatch pattern on picture tube.

Solution: Locate defective component and replace.

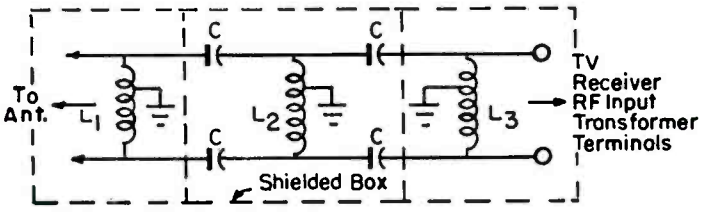
11. Audio rectification characterized by audio from other than TV stations, such as police broadcast, taxi, utility, amateur stations, etc.

Solution: Since this rectification normally occurs at the grid of the first audio amplifier it can be eliminated by insertion of an RC filter placed as close as possible to the grid of the first audio tube (100,000-ohm resistor in series with the audio grid lead and 500-mmfd capacitor direct from grid to cathode. It may be necessary to increase the value of the inserted bypass to as much as 1000 mmfd. and in the case where the manufacturer has used an extremely high value grid resistor in the order of 10 or more megohms, it may also be necessary to decrease this value. It is not usual for the audio signal to be degraded by changing the value of the grid resistor, for example, from 10 to 5 megohms).

12. Ignition (pulse) type interference sources including electric motors and other power equipment, household appliances, thermostatic devices and fluorescent lighting and fixtures.

Solution: Line filters, change location of antenna, more directive antenna, use of coax in place of flat line. If these measures do not correct the condition locate the source and contact owner for his cooperation in eliminating the interference at the source.

A

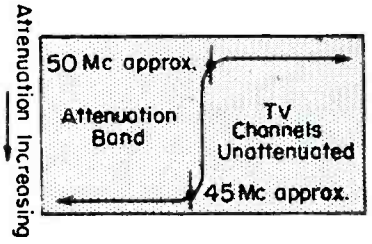


High-pass filter for 300-ohm input.

C = 15 mmfd ceramic

L1, L3 = 1.2 mh (21 turns No. 24 enamel wire close wound on ¼" diameter polystyrene rod)

L2 = 0.6 mh (15 turns No. 24 enamel wire close wound on ¼" diameter polystyrene rod)



Caution

No. 1. Be certain to supply a good electrical ground with an obsolete minimum of lead, preferably to set ground. Where receiver has ac/dc chassis, ground through 0.001-mfd, 600-volt mica.

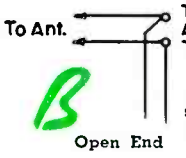
No. 2. Place filter as close as possible to rf input transformer.

Commercial filters are available in the following ranges, both fixed and tunable:

0-30 mc | 0-50 mc | 20-30 mc | 40-50 mc | 88-174 mc

B

STUB WITH 300-OHM TWIN LEADIN

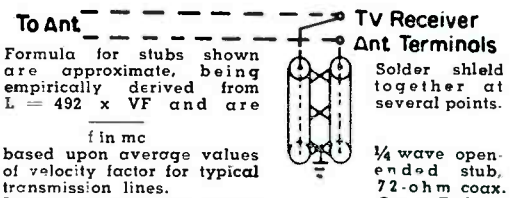


¼ wave open-ended stub, 300-ohm twin leadin.

Length of stub in inches = $\frac{2450}{f \text{ in mc}}$

Example:
For an interfering signal at 75.5 mc = $\frac{2450}{75.5}$ = 32.5 approx.

¼ WAVE OPEN-ENDED STUB WITH 2 PARALLEL LENGTHS OF 72-OHM COAX FOR USE WITH 300-OHM INPUT



Formula for stubs shown are approximate, being empirically derived from L = 492 x VF and are $\frac{}{f \text{ in mc}}$ based upon average values of velocity factor for typical transmission lines.

Length of stub in inches = $\frac{1945}{f \text{ in mc}}$

This type of stub has several advantages over 300-ohm type.

1. It can be moved or rolled up with negligible change in characteristics.

*Refer to Caution No. 1 on High Pass Filter (Above).

2. It is completely shielded, and it will not reradiate, nor itself pick up signals.

Table of lengths of ¼ wave open, 300-ohm line covering the FM band:

Frequency in mc	L in inches
88	27.8"
95	25.8"
108	22.7"

C

When a TV receiver is in a strong field of rf close to the intermediate frequency of the receiver, direct pickup in one or more of the if stages is likely. For example, a signal on 21.9 mc would probably be picked up in the if of a television receiver using a 21.9 audio if channel. If a high-pass filter is ineffective in eliminating the interference the if should be realigned to a frequency different from the interfering signal by a few hundred kc (As an example, in this case, to 22.2 mc).

D

RF OSCILLATOR SETTINGS, NOMINAL FOR 20 to 30 Mc AND NOMINAL FOR 40 to 50 Mc.

Channel	Channel Frequency	Pix Carrier	Sound Carrier	Rcvr. rf Oscillator (21.9 mc if) Low	Rcvr. rf Oscillator (21.9 mc if) High	Rcvr. rf Oscillator (41.25 mc)
2	54-60	55.25	59.75	37.85	81.65	101
3	60-66	61.25	65.75	43.85	87.65	107
4	66-72	67.25	71.75	49.85	93.65	113
5	76-82	77.25	81.75	59.85	103.65	123
6	82-88	83.25	87.75	61.85	109.65	129
7	174-180	175.25	179.75	157.85	201.65	221
8	180-186	181.25	185.75	163.85	207.65	227
9	186-192	187.25	191.75	169.85	213.65	233
10	192-198	193.25	197.75	175.85	219.65	239
11	198-204	199.25	203.75	181.85	225.65	245
12	204-210	205.25	209.75	187.85	231.65	251
13	210-216	211.25	215.75	193.85	237.65	257

From a poster-bulletin prepared through the coordinated efforts of the Washington TV Interference Committee, RETMA and the FCC.

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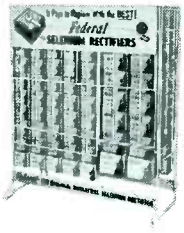
FEDERAL—the *original* miniature—is saying goodbye to *gray*. The new bloom is *"Rectifier Red"*... a striking color that instantly tells servicemen they're getting the rectifier efficiency and long life that created tens of millions of profit opportunities for radio-TV servicing . . . tells them they're getting the *quality* that keeps Federal miniatures the best-seller in America's vast and growing rectifier replacement market!



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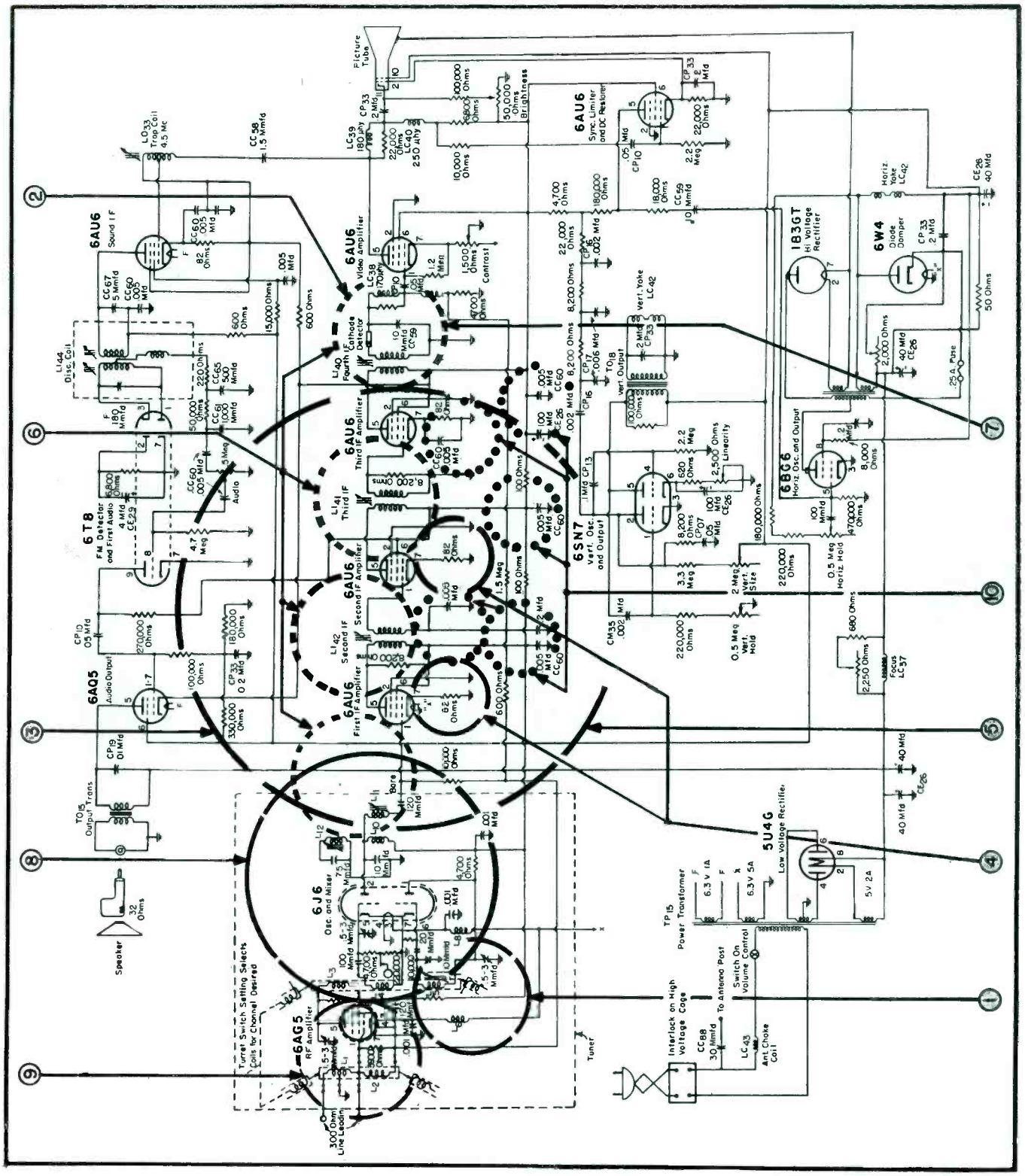
TV Chassis IF Performance Factors

Condition	Reason	Control Method
Low contrast in picture and poor quality of picture structure. **(1)**	Picture carrier too low on response curve.	Local oscillator should be adjusted so that the picture carrier is half-way up the side when the fine-tuning control is at the mid-point of its range: **See circuit at right; circle (*1*).**
Frequency-response curve appears satisfactory, but response to square-wave modulation is poor. **(2)**	Diode detector impedance is non-linear and presents a varying load to last *if* stage.	Receiver should be aligned for best square-wave response over normal range of operating voltages, rather than for a specified frequency-response curve: **See circuit at right; circle (*2*).**
Noticeable buzz in sound (intercarrier receivers only). **(3)**	Sound carrier too high on response curve.	Bandwidth of *if* amplifier should be reduced, if required, to place sound carrier at 10% or less, when picture carrier is at 50%. Sound traps (if used) must be properly adjusted: **See circuit at right; circle (*3*).**
Picture quality satisfactory at high signal levels, but poor at lower signal levels. **(4)**	Regeneration in *if* amplifier causes response curve to change shape at low signal levels.	Values of unbypassed cathode resistors in *if* stages must be checked. Cathode degeneration should balance exactly regeneration due to *Miller Effect*: **See circuit at right; circle (*4*).**
Artificial ghosts present in picture, accompanied by poor picture quality. **(5)**	The *if* amplifier is peaked excessively with narrow bandwidth; *if* circuits are ringing.	The *if* response curve should be checked with a sweep and marker oscillator, and 'scope. Check should be made at operating value of *if* grid bias: **See circuit at right; circle (*5*).**
IF amplifier is dead, and *vtvm* at picture-detector output measures 5 or 6 volts. **(6)**	*IF* amplifier is oscillating.	Individual stages should be peaked to recommended frequencies. Bypass capacitors and ground returns should be checked. Start alignment with higher over-ride bias, if necessary: **See circuit at right; circle (*6*).**
IF amplifier produces interference in picture when signal is tuned in. **(7)**	Harmonic of *if* amplifier falls in an *rf* channel.	Output of picture detector is richest in *if* harmonics. Better shielding usually eliminates the trouble. If necessary, *if* must be realigned to non-interfering frequency: **See circuit at right; circle (*7*).**
Poor picture quality and changing picture structure, as hand is brought near first *if* tube. **(8)**	Regeneration between plate and grid circuit of mixer.	Components in *if* input circuit and grounding of coax cable braid, if used between mixer and *if* input, should be checked: **See circuit at right; circle (*8*).**
Interference is experienced on all *rf* channels. **(9)**	Direct feed-through to *if* amplifier.	A trap must be used in antenna circuit or a better tuner having less *if* feed-through: **See circuit at right; circle (*9*).**
Specified response curve cannot be obtained. **(10)**	Component tolerance variations.	New *if* tubes should be tried. A check should be made for open bypass capacitors. Loading resistors should also be checked: **See circuit at right; circle (*10*).**

Right: Schematic of a TV chassis illustrating if performance factors analyzed in chart above. (Numbers in circle serve to identify portion of circuit similarly numbered and discussed in table.) Note: Antenna coil should not be connected to rf coil. (Courtesy Muntz TV)

Chart-Circuit Analysis of Operational Characteristics of IF Amplifiers Employed in Most TV Receivers

by CLARK R. ALISEN



by PAUL M. REINHARDT

Sylvania Electric Products, Inc.

PICTURE-TUBE Fundamentals

Design Features of Tubes for TV Chassis and 'Scope Applications: Reasons for Use of Ion Traps... Focusing Techniques . . . Analysis of Faceplates (Cylindrical, Spherical and Flat)... Characteristics of Metal Backed or Aluminized Tubes

PICTURE TUBES or *crts* as used in TV sets or 'scopes consist of three main items: (*1*) The electron gun which produces a stream of electrons, the position and intensity of which is controlled by the various deflecting, scanning and video signals. (*2*) A screen containing a fluorescent material usually called a *phosphor* which emits visible light when bombarded by an electron stream. This permits conversion of the controlled electron beam into the desired picture. (*3*) The bulb (either metal or glass) with a glass faceplate and a base for connections. The bulb must be of sufficient strength to withstand great amounts of pressure, since the finished tube will be exhausted to a very high degree of vacuum. The faceplate must be of high quality glass, free from any marks or blemishes since the picture is to be viewed through the faceplate. Incidentally, in *crt* classifications, the first number of the type designation represents the largest dimension of the face of the tube to the nearest inch; for round tubes this is the face diameter, and for rectangular tubes it is the face diagonal. Thus, we may speak of the *size* of a given tube.

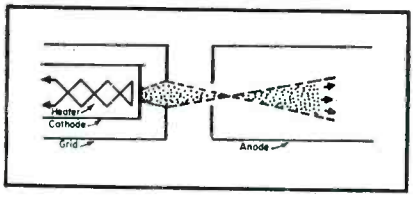
Let us now consider these various parts in greater detail.

The electron gun includes a heater and a cathode which perform the same function as in a radio tube; namely, to produce an emission of electrons. The cathode of a picture tube is, however, cup shaped, and the emission is from the flat top or end, of the cathode cup; Fig. 1. The current is drawn off this surface of the cathode through an opening, or aperture of the control grid, by a positive voltage applied to the anode. The amount of current in the beam, which determines the brightness of the spot on the screen, is controlled by the voltage on the grid. To provide a small, well-focused spot on the screen additional gun elements are required.

In the older *triode* electrostatic focus types, two disadvantages obtain. First, as the focusing anode voltage is varied to focus the spot, the strength of the field drawing the current from the cathode also varies, thus changing the beam current and the spot intensity. In addition, the focusing element draws considerable current from the high voltage supply.

The *tetrode* type gun eliminates this variation in spot intensity with focus adjustment, since the field at the cathode is produced by the second anode, rather than by the focusing anode. It still has the disadvantage of having the focusing anode drawing considerable current. A variation of this tetrode structure, shown in Fig. 2*c*, avoids both disadvantages present in

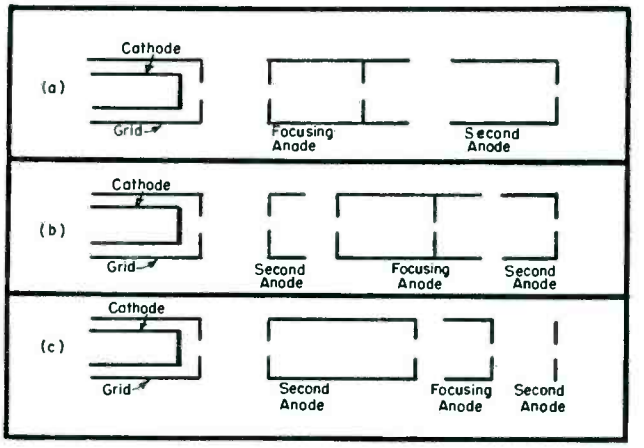
(*Continued on page* 98)



(*Above*)

Fig. 1. How a beam is formed in a picture tube.

Fig. 2. Design features of three types of picture tubes. In *a* is a triode electrostatic-focus type. A tetrode type is shown in *b*. In this instance, field at cathode is produced by second anode rather than by focusing anode. A variation of the tetrode structure appears in *c*. This is known as a zero-first current-anode type; the focus-anode current is practically zero in this tube.



Simplified Explanation of Compatible-Color Receiver Operation . . . Troubleshooting Techniques and Equipment That Will be Necessary in Color Set Servicing

COMPATIBLE COLOR-SET SERVICING

Problems Ahead‡

by W. KAY BROWNES

COMPATIBLE COLOR receivers will feature several unique controls. To illustrate, there will be a gain control in the color amplifier which will actually control the amount of color.

For instance, advancing this control on a predominantly red signal would cause the picture to change from light pink to dark red. Actually, this control must be adjusted to provide a *naturalness* of color in the picture. The output of the bandpass filter is connected to the *B-Y* and *R-Y* demodulators and the burst amplifier. The burst amplifier is gated on by a horizontal retrace signal, so that it operates only during the presence of horizontal sync pulses; thus its output consists of bursts of the color subcarrier frequency at 3.579545 mc. It must be remembered that the back porch of the sync pulse carries a short burst of this signal. The output of the burst amplifier is shifted in phase to correspond exactly to the phase of the subcarrier. This phase-corrected signal is used as a phase and frequency reference for a subcarrier *afc*, which controls the phase and frequency of the signal generated by the subcarrier oscillator to correspond to the subcarrier generated in the transmitter, but which is not transmitted with the color information because it is suppressed in the transmitter subcarrier modulators. The requirements of the subcarrier *afc* are quite exacting, since the subcarrier reinserted in the receiver must correspond exactly in both frequency and phase to that generated in the transmitter to recover faithfully the color information.

Although suppressed-carrier transmission may be recognized as a technique used in radio communication systems to overcome fading and reduce carrier heterodyne interference, it is logical to ask why it is used in the color TV system since it adds considerable complication to the receiver. There are two reasons: First, it helps to reduce the visibility of the subcarrier which would appear as a high-frequency interfering signal, which would be more noticeable because of its strength and constancy than would the color sidebands. Second, the subcarrier reinsertion provides a reasonably straightforward way of separating out the two color signals which are carried as modulation on different phases of the same subcarrier frequency.

The subcarrier is reinserted into the *B-Y* signal by connection of the subcarrier oscillator output directly to the *B-Y* demodulator. The subcarrier must be reinserted into the *R-Y* signal, in phase with the *R-Y* subcarrier in the transmitter, and thus must be advanced in phase 90° with respect to the *B-Y* subcarrier before being applied to the *R-Y* demodulator.

The output of each color demodulator is fed through a low-pass filter to remove unwanted signals generated by the demodulation process, leaving the desired *R-Y* and *B-Y* signals. The *R-Y* filter has a 1.5-mc cutoff frequency, while the *B-Y* filter cuts off at the much lower frequency of 600 kc. It is now appropriate to explain why the two color signals are transmitted over channels of different bandwidths.

The position of the color subcarrier is such, in relation to the overall bandwidth of the transmitter output, that the lower subcarrier sidebands fit into the bandwidth. However, all upper subcarrier sidebands greater than about 500-kc will be out of the transmitter bandwidth and will not be transmitted. The nature of the modulation process is such, that removing one sideband from an amplitude-modulated signal generates new signal components 90° in phase from the original sideband frequencies. Since in the NTSC system the second color signal is carried as modulation on the subcarrier shifted 90° in phase, any such newly generated signals would constitute an interfering signal in the other color channel. If, then, both color signals were allowed a 1.5-mc bandwidth the upper sidebands of both signals above 500 kc would be eliminated, 90° phase signals would be generated and both channels would cause interference in the other. In other words, high-frequency color crosstalk would be experienced.

To prevent color crosstalk only the *I* signal which results in *R-Y* is transmitted with a 1.5-mc bandwidth. The *Q* signal, which results in *B-Y* is limited to a bandwidth of about 500 kc, so that all its sidebands are transmitted. In this way the *B-Y* signal causes no 90°-phase interfering signals. The interfering signals generated by removing the upper sidebands above 500 kc from the *R-Y* signal do not cause interference in the *B-Y* channel because the *B-Y* filter in the receiver eliminates all signals in that channel above 500 kc. In other words, to get the maximum color bandwidth with the minimum interference, *B-Y* is transmitted as a double-sideband carrier-suppressed signal, while *R-Y* is transmitted as a vestigial-sideband carrier-suppressed signal.

To follow through the operation of the remainder of the receiver, let us consider first, color signals below 500-kc. The *R-Y* and *B-Y* signals are

‡*Based on an exclusive report prepared by* **J. C. Geist.**

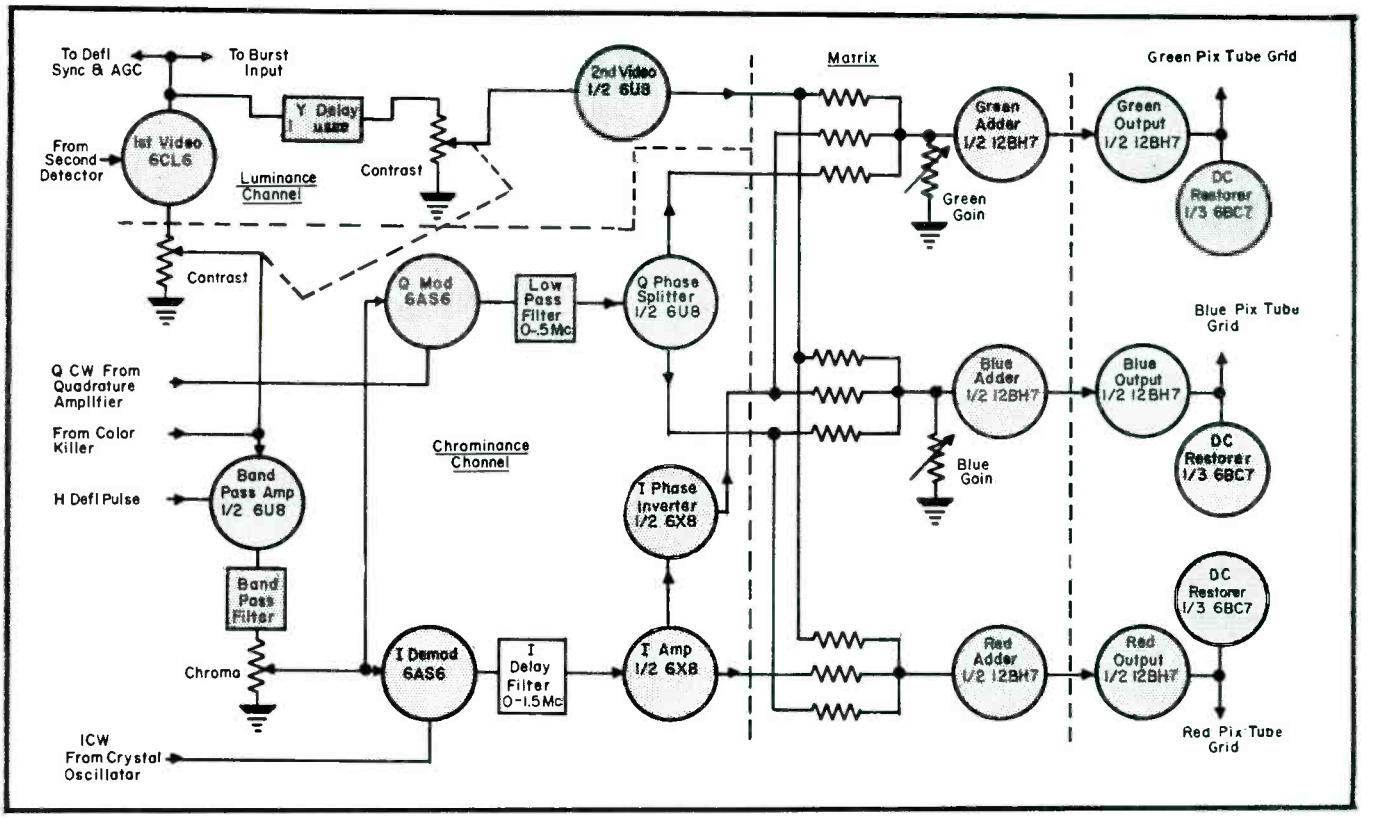


Fig. 1. Block diagram of video section of RCA compatible color chassis reviewed in petition to the FCC. Video here consists of three separate functions: luminance channel, chrominance channel and the matrix which combines the two channels. The luminance Y channel serves a purpose substantially similar to that performed in black and white sets; it serves to amplify the luminance information to a level satisfactory for application to a picture tube. The only difference is that the information is applied to the picture tube via a matrix. The chrominance channel recovers the color difference information contained in the color subcarrier and its accompanying sidebands. (Matrix combines the red, green and blue signals, via a fixed resistive mixing type of feedback amplifier.)

amplified and fed to the *blue* and *red* cathodes of the picture tube, respectively. Since the color signals at the input of the video amplifiers represent different percentages of R-Y and B-Y, the B-Y video amplifier must have a gain 1.8 as great as the R-Y amplifier to provide a true representation of R-Y and B-Y to the picture tube. The amplified B-Y and R-Y signals are also combined in the color mixer in such a way that the output of the mixer is a signal corresponding to G-Y. It must be remembered that the Y signal is made up of all three colors and therefore the B-Y and R-Y signals also contain all three colors.

That is: $Y = .6G + .3R + .1B$

Therefore: $B\text{-}Y = -.6G + .3R + .9B$

and $R\text{-}Y = -.6G + .7R - .1B$

also $G\text{-}Y = .4G - .30R - .1B$

It is therefore possible to combine the B-Y and R-Y signals in the proper proportions so as to result in the G-Y signal. G-Y can be obtained from $-.51\ (RY) - .19\ (B\text{-}Y)$. The proper combination is obtained in the color mixer and a negative polarity is obtained by the 180° phase shift (polarity reversal) in the following video amplifier. The G-Y amplifier must have unity gain to provide a true representation of G-Y to the picture tube.

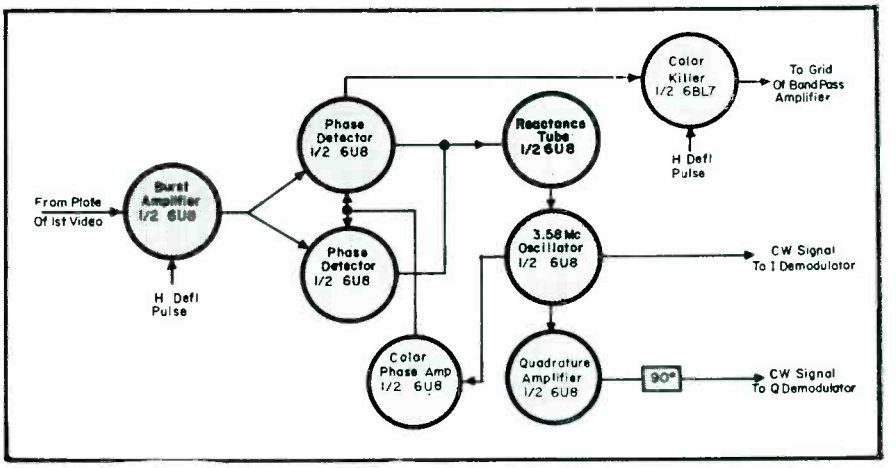
The G-Y signal is fed to the *green* cathode of the picture tube. Since the Y signal is applied to the common grid, the resulting signals applied between the grid and cathodes are: $Y + (B\text{-}Y) = B$; $Y + (G\text{-}Y) = G$; and $Y + (R\text{-}Y) = R$.

The blue, green and red primary colors then result in a full-color picture.

For color signals above 500 kc the operation is somewhat different. Since the Q channel is limited in bandwidth to 500 kc, no Q signal subcarrier modulation will be generated. The I signal will modulate the subcarrier as before, and this signal when demodulated in the receiver, amplified by the R-Y video amplifier and combined with the Y signal in the picture tube will produce a signal which consists largely of a *red* component, but with traces of *green* and *blue* signal distortion. The

(*Continued on page* 106)

Fig. 2. Color sync channel system in compatible receiver developed by RCA. To recover the color information contained in a NTSC type signal, it is necessary to generate a local subcarrier of proper frequency and phase. To do this, phase reference information is transmitted as a component of the composite color video signal. This color sync information is transmitted in the form of a burst of approximately 8 cycles of the color subcarrier frequency and appears immediately following each horizontal sync pulse in the composite signal. This burst is separated from the composite video signal and is used in establishing two continuous-wave signals of color subcarrier frequency, having a 90° phase displacement from each other. These two signals are generated by a quartz crystal oscillator whose exact frequency is controlled by a reactance tube.



PICTURE TUBE Circuit Faults, Checks and Cures

by J. C. GEIST

Tabulated Data on Possible Faults and Corrections Prepared to Facilitate Troubleshooting

Possible Fault	Verification and Correction
1—*Vertical sync lost:*	
(*A*) No sync pulse being delivered to vertical oscillator.	(*A*) Check signals with 'scope from point at which horizontal pulses are removed to output of vertical pulse integrator.
(*B*) Insufficient integration allowing horizontal sync pulses to trigger vertical oscillator.	(*B*) Remove connection from vertical sync integrator to vertical oscillator and check integrator output on 'scope. Insufficient integration will be apparent as two separate traces with an abnormally high level of horizontal pulses.
(*C*) Hum on vertical oscillator grid circuit. (Will cause loss of sync if transmitter and receiver vertical sweep frequency are not locked together through a common power source.)	(*C*) Check sync amplifier and vertical oscillator tubes for heater cathode leakage and check for presence of hum with 'scope.
2—*Horizontal sync lost:*	
(*A*) No sync pulse being delivered to horizontal *afc* circuits.	(*A*) Check signal with 'scope from point at which horizontal pulses are removed to input of *afc* circuits.
(*B*) Improper operation of horizontal *afc* circuits.	(*B*) Check operation of horizontal *afc* circuits in manner depending on which of many circuits are used. Generally the overall operation of the circuit can be checked by measuring the *dc* frequency-controlling signal as the horizontal oscillator frequency is adjusted. By disconnecting the circuit which feeds back a sample of the horizontal deflection voltage to the *afc* circuits, the *dc* output to the oscillator can be monitored to determine whether or not drift is occurring ahead of the oscillator.
3—*Horizontal tearing* (only part of picture loses horizontal sync) in receiver using line-by-line sync:	
(*A*) Improper amplitude limiting in sync circuits allowing noise or video signals to trigger horizontal oscillation.	(*A*) Reduce contrast control. If picture holds, fault is not in sync circuits but after the sync pickoff point so as to cause the contrast control to be too far advanced. Check sync circuits with 'scope for proper limiting and sync separation.
(*B*) Improper differentiation of horizontal sync pulses.	(*B*) Check sync pulse input to horizontal oscillator with 'scope. Pulses should have sharp leading edge and should decay completely in a fraction of the space between pulses. If pulses are rounded or stretched, values of parts in derivative circuit should be checked; resistors and capacitors feeding sync pulses to horizontal oscillator.
4—*Horizontal waving* (part or all of picture moves back and forth sideways):	
(*A*) Improper operation of horizontal *afc* circuits usually due to some form of overloading.	(*A*) Check grid bias and *agc* voltage in video *if amplifiers.* (See item (*5*) for more detailed procedure which is also applicable to this fault.)

Possible Fault	Verification and Correction
5—*Horizontal picture pulling* (vertical bending in picture as opposed to complete loss of sync, known as horizontal tearing):	
(*A*) 60-cps video modulation due to heater-cathode leakage.	(*A*) This fault is usually accompanied by 60-cps hum in the video output which is evident as a broad, dark bar in the picture. The *rf, if* and video tubes should be replaced. . . . If no video hum is evident, sync input should be removed from *afc* circuits and right-hand edge of picture observed for pulling with horizontal oscillator running free but adjusted to hold picture. If pulling is eliminated, the trouble is ahead of *afc* circuits; if still present, trouble is in *afc* circuits. . . . Replace tubes in appropriate portion of receiver.
(*B*) Relative amplitude of sync pulses too low due to poor low-frequency response. Poor low-frequency response may be due to the picture carrier being too low on the *if* response curve or to faulty video amplifiers.	(*B*) Check *If* response by observing vertical blanking bar. Signal representing sync pulse should be darker than darkest picture elements. . . . Adjust frequency of local oscillator or realign video *if* stages to put picture carrier in correct position on response curve. . . . Check for open coupling capacitors or lowered plate load resistors in video amplifiers.
(*C*) Sync pulses being limited at too low a level.	(*C*) Replace video amplifiers and sync tubes to check for defective tube. . . . Check voltages on video amplifier and sync tubes.
(*D*) Excessive signal level.	(*D*) Reduce contrast control to see if pulling disappears.
(*E*) Bending at top of picture may be caused by phase shift in *afc* circuits due to some interaction with vertical deflection or sync pulses.	

(*Continued on page* 123)

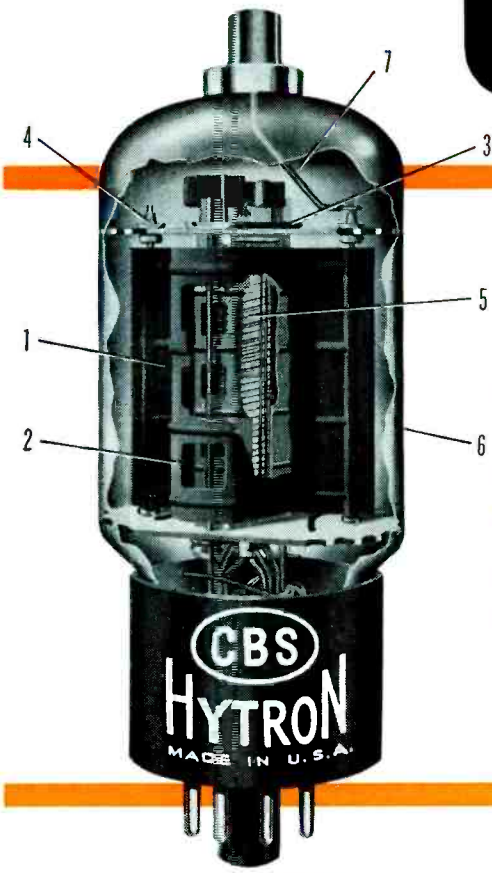
ANOTHER CBS-HYTRON CTS-RATED* FIRST

*CTS-RATED: Rated for Continuous Television Service. In TV receivers, five tubes work . . . like transmitting tubes . . . *hard!* You know them: rectifiers, deflection amplifiers, damper diode. Larger-screen sets aggravate the problem. CBS-Hytron recognizes your need for huskier tubes for these sockets. Brand-new designs, not just improved tubes. CTS-Rated 5AW4 already answers your 5U4G low-voltage rectifier problem. Here is your new replacement for the 6BQ6GT: The new CTS-Rated 6CU6. Yes, more CBS-Hytron CTS-Rated tubes are coming. Watch for them.

FORGET: RUN-AWAY PLATE CURRENT
HIGH-VOLTAGE ARC-OVERS
SHRINKING TV PICTURES

Replace 6BQ6GT with New Work-Horse

CBS-HYTRON 6CU6



MECHANICAL FEATURES OF 6CU6

1. Heavier-gauge plate with large radiating fins.
2. Vents in beam plates and plate aligned for maximum radiation of heat from grids.
3. Anti-arc rings for uniform distribution of electrostatic field.
4. Anti-arc mica eyelets.
5. Gold-plated control grid to kill primary emission.
6. T-12 transmitting-type bulb.
7. Plate connection: "hard-soldered" and positioned to reduce heat conduction and arcing.

Cut your call-backs by up to 40 per cent with CBS-Hytron 6CU6. It's directly interchangeable with the 6BQ6GT. It's rated the same as the 6BQ6GT. *But* the new CTS-Rated 6CU6 will *live* under 6BQ6GT maximum ratings. How? The 6CU6 has generous *margins of safety* for: plate dissipation . . . plate current . . . high-voltage insulation . . . and high-line protection.

The older 6BQ6GT is a good tube. But remember it was originally designed for 10- and 12-inch TV sets. Today it carries the load in 21-inch sets. Furthermore, it must combat the accumulated dissipation caused by: line-voltage variations . . . faulty receiver adjustment . . . and shifting values of components due to age and overload. Result: the 6BQ6GT may actually be operated well above its maximum ratings in many TV receivers.

In the new CBS-Hytron 6CU6, you have a tube that takes this rough treatment. And continues to ask for more. High voltage and heat meet their match. The weakest link in the TV tube line-up becomes the strongest. And your call-backs plunge downward. Bet you can't wait to try the CTS-Rated 6CU6. We couldn't. It's a honey! Watch for it soon at your CBS-Hytron distributor's.

CBS HYTRON

Manufacturers of Receiving Tubes Since 1921

CBS-HYTRON Main Office: Danvers, Massachusetts

A Division of Columbia Broadcasting System, Inc.

RECEIVING . . . TRANSMITTING . . . SPECIAL-PURPOSE AND TV PICTURE TUBES • GERMANIUM DIODES AND TRANSISTORS

In The Field‡

Problem

WHY DOES a square-wave check of a video amplifier show a *stepped* corner?

Analysis

A STEPPED CORNER, shown in Fig. 1, is the result of the combination of two separate distortions in the amplifier. One distortion process is producing a rounded corner in the square-wave response, while the other distortion is producing a lesser degree of overshoot and ringing. The combination of the two distortions make it appear as if a step were present at the corner.

Fig. 1. Corner step distortion; a square-wave response which results from a combination of corner rounding, and some degree of overshoot and ringing in another circuit.

WHEN A square-wave generator is operated at low frequencies, and the output is applied directly to the 'scope-input terminals, there often appears an overshoot on one side of the wave. What causes this?

LARGE ELECTROLYTIC bypasses in the generator should be checked when this trouble occurs.

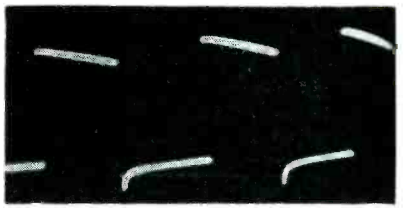


Fig. 2. Overshoot which appears in the reproduced square-wave, obtained when the output from the square-wave generator is applied to the vertical-input terminals of the 'scope, will throw suspicion upon the large electrolytic bypass capacitors in the generator.

WHY IS A SEMI-SQUARE wave used to calibrate a 'scope for measurement of peak-to-peak voltage values?

A SEMI-SQUARE WAVE (Fig. 3) is used, because a regulating circuit is commonly incorporated in the calibration network to maintain the calibrating voltage at a constant value, in spite of line-voltage variations. The regulating circuit limits the value of the sine-wave source voltage giving it the appearance of a semi-square wave.

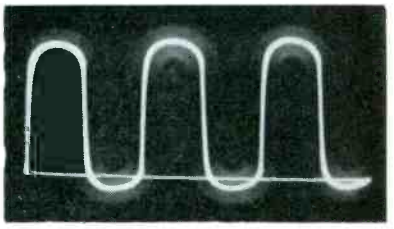


Fig. 3. Semi-square wave utilized as calibrating voltage waveform in TV 'scopes. The waveshape results from the action of a voltage-regulator circuit in the calibrating arrangement.

DOES IT make any difference in the accuracy of calibration if a fast or a slow sweep is used in the 'scope?

No. This point is illustrated in Fig. 4; showing the appearance of a calibrating voltage when displayed on 60-cycle sine-wave sweep. The wave looks more like a rectangle than a semi-square wave, but its peak-to-peak value is exactly the same as when displayed on sawtooth sweep.

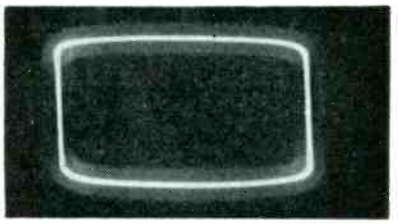


Fig. 4. A semi-square wave which looks approximately like a rectangle when displayed on 60-cycle sine-wave sweep; its peak-to-peak value, of course, is unaffected.

WHAT IS THE effect of hum in the calibrating voltage pattern?

Hum produces a tilt in the pattern as shown in Fig. 5.

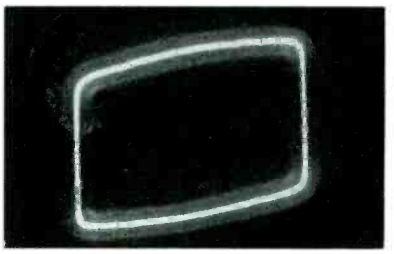


Fig. 5. The effect of 60-cycle hum in the calibrating voltage, which causes a tilt in the pattern. This tilt increases the apparent peak-to-peak voltage, and makes it difficult to calibrate the 'scope accurately.

Peak-to-Peak Voltage Value Measurement . . . Cyclograms . . . Hum Effects on Calibrating Voltage Patterns . . . Crosstalk Waveforms . . . Semi Square-Wave Integration Effects

Problem

WOULD IT BE impractical to use the calibrating voltage as horizontal sweep voltage in the 'scope during alignment procedures?

Analysis

IT WOULD BE QUITE impractical; not only does a semi-square wave produce severe horizontal non-linearity in the display, but the situation is aggravated when the semi-square wave is applied to the horizontal phase-control circuit.

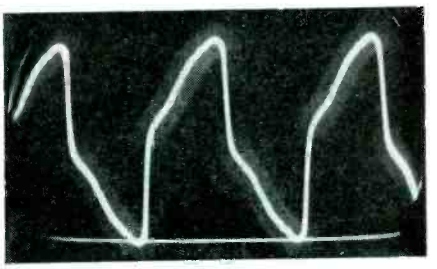


Fig. 6. Effect of integrating a semi-square-wave. In this instance, we have a semi-square wave integrated, displayed on a sawtooth sweep. A semi-square wave, although useful for calibrating, is impractical for sweeping, since horizontal non-linearity is excessive, and the waveform becomes even less desirable when passed through reactive circuits, such as horizontal-phase networks.

CAN CROSSTALK cause difficulty during circuit alignment?

YES, when it appears in the horizontal sweep circuit and feeds into the *if* or picture-detector circuit. Remove horizontal output tube to check.

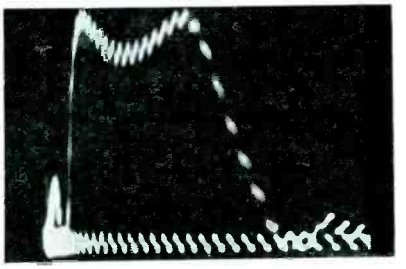


Fig. 7. Waveform illustrating crosstalk of horizontal sweep circuit.

WHAT DOES CROSSTALK of vertical sweep circuit cause?

SUCH CROSSTALK can produce sync and video disturbances, and can be checked by inspecting the bypass capacitors.

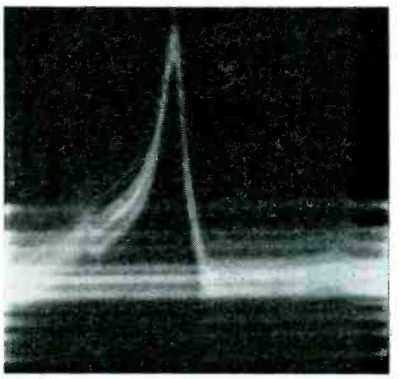


Fig. 8. Vertical sweep-circuit crosstalk waveform.

WHAT IS a cyclogram?

A CYCLOGRAM is a display of one signal voltage against another; that it, a pattern obtained by applying one signal voltage to the vertical amplifier, and another signal voltage to the horizontal amplifier. In the most general sense, every 'scope pattern is a cyclogram. A sawtooth sweep, commonly used in troubleshooting work, is merely a special case of a signal voltage in which the increase of voltage is directly proportional to time. Fig. 9 illustrates some key basic properties of cyclograms; triple exposures were used to process the waveforms. Either the horizontal or the vertical voltage may be regarded as the sweep voltage, and the other as the applied signal voltage. It will be noted that both *sweeps* divide the pattern into equal positive and negative portions, since any *ac* waveform has just as positive properties as it has negative properties.

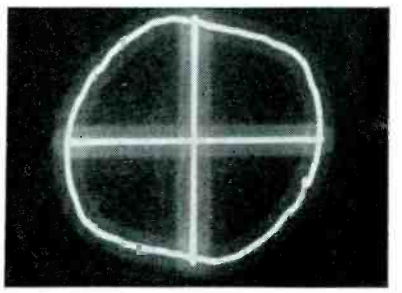


Fig. 9. Waveform illustrating a cyclogram. When a semi-square wave is displayed on a sine-wave sweep, either the sine-wave voltage or the semi-square-wave voltage can be regarded as the sweep voltage. When one sine-wave voltage is displayed with respect to a different phase of the same sine-wave voltage, either phase may be regarded as the sweep voltage. And when any pattern is displayed on a sawtooth sweep, the sawtooth voltage may be regarded as the signal voltage, or as the sweep voltage; Service Men prefer to regard the sawtooth voltage as the sweep voltage.

‡*Based on questions posed during meetings conducted by* **R. G. Middleton,** *senior engineer at Precision Apparatus Co., Inc., and author of TV Trouble-Shooting and Repair Guide Book, published by John F. Rider.*

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SERVICE...The National Scene

SIZZLING CAMPAIGNS TO ROUT TVI NOW UNDER WAY--About a year ago, SERVICE featured a series of articles describing a two-fisted attack that had been levelled against TVI by independent Service Men, amateurs and service associations in Washington, D. C. It was noted that video's arch enemy must be shackled, and could be, through a coordinated drive. Special clinics and a stream of explanatory bulletins were offered as one means of combating the problem. Now, the program has been supplemented by a new push to destroy TVI. In cooperation with RETMA, a TVI committee in Washington has issued a striking bulletin-letter and unique poster directed to manufacturers, dealers, Service Men, interfering services, and those at home. Detailed are problems, sources, equipment required for elimination, and to whom to turn for aid. Noting that the receiver itself, as well as external sources, might introduce TVI problems, the bulletin points out that it is thus important to pinpoint the area of interference. For instance, insufficient if rejection, insufficient image rejection, and insufficient rejection to strong local signals not operating in a normal receiver pass-band, most frequently are a cause of undesired response. And, there are many receivers now in use that do not have built-in filters or other circuit features of adequate selectivity to reject strong lf or 3-30 mc signals. It must also be remembered that, as certain TV components age, chassis can become more susceptible to interference.

THERE ARE MANY SOURCES OF TVI, such as diathermy, radiation from local oscillators from nearby TV and FM chassis, strong signals from nearby radio stations, including FM, ham, police, taxi, and from governmental and military services, plus ignition and cross modulation. Some of these troubles can be eliminated by simple means, but others require more involved changes. . . . The poster, a streamlined chart, offers a graphic analysis of most of the TVI problems and solutions. On page 44, this issue, you'll find a complete reproduction of this unique poster.

IN THE COLOR WORLD, TVI has also begun to concern many. It has been found that black and white sets receiving color can cause radiation in the 3.5-4 mc ham band. In addition, radiation from color and video circuits in color chassis have also been found to cause trouble in the 3.5-4 mc bands, with the maximum damage being done in the 7-mc region. At present, the color oscillator and color demodulator circuits, as well as the high-voltage (black and white) circuits, represent possible sources of interference. And such interference can be transmitted by direct radiation to the antenna, power line or metallic objects. . . . These revealing facts appeared in a complete report prepared by a special NTSC committee, who spent hundreds of hours testing typical color sets under field and controlled conditions. In their opinion, there are two possible solutions; the color subcarrier frequency can be shifted substantially outside the amateur band, and receivers can be designed to minimize radiation at the color subcarrier, its side-bands, and harmonics (and minimize, too, susceptibility to strong fields created by ham transmitters). The latter steps, it was said, represent the most effective means for cure. Undoubtedly, these important recommendations will be followed closely by industry when color sets are made for mass distribution.

SUBSCRIPTION TV DESCRIBED AS CHALLENGING SERVICE PROBLEM--If and when pay-TV becomes a reality, Service Men will be obliged to offer not only insured service, but maintenance, too. Thus declared a subscription-TV consultant recently. Viewers paying for their programs will demand perfect performance from their chassis. They'll want to be certain that the set is in perfect condition before the program is ordered. If it falters during a program, there'll be some mighty angry people around. To avoid such calamities, some service groups are already considering the adoption of a plan which would provide monthly maintenance check-ups, and subsequent service, if necessary, at either a per call or flat yearly payments. In addition, the boys are reviewing the possibilities of a manual of operational standards, describing all of the probable faults that might appear in subscription-TV systems, and cures that can be effected.

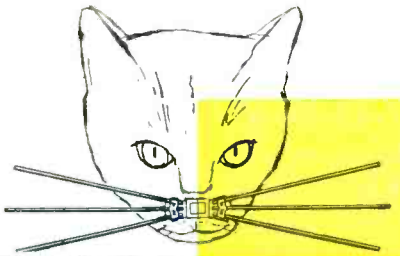
SERVICE...The National Scene

NOVEL AD-PR PROGRAMS BREAK IN ULTRAHIGH AREAS--Throughout the nation, where ultracasting has just begun, or is about to start, broadcasters, distributors, dealers and Service Men, are telling the folks at home just what is involved in this new business of uhf. They're telling them in page advertisements, brochures, and on FM and AM, too. . . . In Virginia, parts distributors recently told the uhf story in a full-page ad. Noting that TV is moving into this area, the distributors declared that the results of this big advance will obtain only if the TV sets are ready for it. And local Service Men, they stressed, are the men that should be contacted to insure topnotch performance. The ad continued with a description of the virtues of uhf, specific accessories (converters, antennas or rotators) that will be required, and the costs for various types of installations. Even the specific kinds of uhf antennas available were described and illustrated. . . . In Houston, Texas, the local Service Men's association (Texas Electronic Technicians Association) have joined hands with retailers, distributors and the BBB, to explain uhf to the viewers here. Booklets, recently prepared, are telling perspective uhf viewers to consult an authorized Service Man first, on any question concerning conversion, and . . . "not to . . . shop for price", for one will get, they warn, what they pay for. The booklet also points out that it is impossible to set up flat rate charges for conversion, because prices will vary sharply, depending on the type of TV receiver and converter required. In many instances too, it is said, most of the receivers will have to come to the shop for conversion. . . . In the midwest, a channel-25 station has begun to publicize the ultrahighs through page advertisements. In one ad, 22 popular brands of receivers were listed, and approximate prices for conversion were shown. The results have been intriguing: A survey disclosed that many viewers indicated that they will call in Service Men to convert their present set, and probably buy a second set equipped for u/v coverage, in the fall.

POWER BOOSTS STIR UP TROUBLE--Recent shifts to maximum outputs of up to 100 kw have created many zany problems for Service Men. In one area in the midwest, a fringe zone about 100 miles from a pair of stations, operating on the same channel and located north and south from the receiving point, power boosts at both stations have caused picture smears, washouts, and other peculiar results. Some resourceful Service Men found that they could resolve the problem by installing special reflectors to screen the images coming from either direction; others have found solutions in careful reorientation using reflected signals as sources; and still others have installed extremely directional high-gain antenna systems. . . . In another area in the south, power boosts from fringe stations, operating on alternate channels, have played havoc with local station reception. In this instance, sharply-tuned filters, of the type described last month,[1] have been found to be very effective. . . . This fall, with many more power boosts in the offing, Service Men will be faced with many similar odd problems. . . . To lend a hand, SERVICE will feature soon a series of power-boost area analyses, detailing practical answers to a variety of receiving difficulties. Watch for these timely reports!

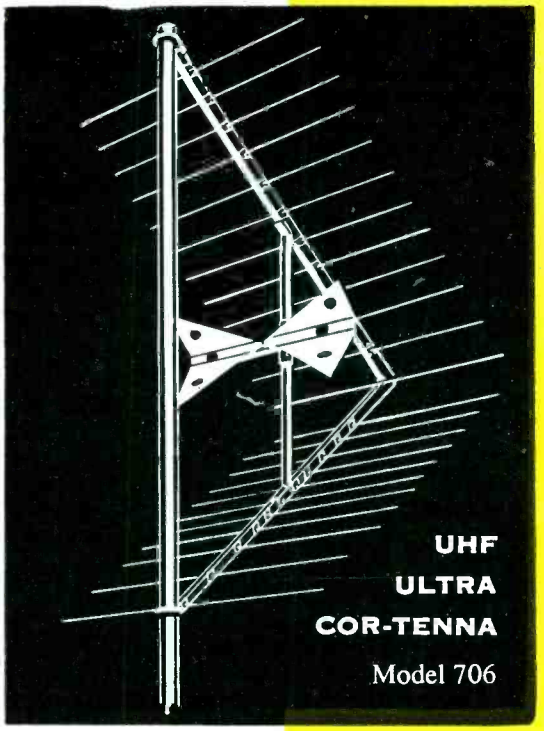
SERVICING OPERATIONS GRAPHICALLY DESCRIBED IN CONSUMER BOOKLET--Service Men received a strident helpmate a few weeks ago, in the form of a pocket-size booklet, telling viewers just what a Service Man has to know and has to spend to do a job today.* Noting that good service doesn't just happen, the booklet points out that the operation of a dependable service business requires organization, competent management, and a substantial capital investment. And, to support these views, consumers are told that a modern service business requires the following: expensive testing apparatus; trucks; a thorough education; complete stock of spare parts; and costly tools. In addition, Service Men must worry about office and garage rent, office equipment, taxes, insurance, and light, heat and phone expenses. It all adds up, says this booklet, to quite an investment! . . . The booklet also describes aptly the complexities of the average TV set, and notes specifically what a Service Man must do to make those pictures better. . . . Congratulations to those enterprising folks who conceived and published this enlightening brochure on the TV set and the Service Man.--L. W.

[1]TV Antenna Digest, SERVICE; August, 1953. *With apologies to the RCA Service Co.



Another First by

TESCO

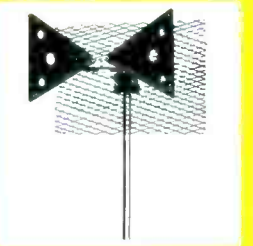


14.8 db gain! TESCO's Single Bay Corner antenna (Model 706) is one of the most powerful antennas known, with a gain of up to 14.8 db! Model 706 is the *all channel* UHF antenna that minimizes probing . . . gives remarkable performance in UHF fringe areas . . . completely eliminates difficulties in sections where noise or reflection prevail. What's the secret?—TESCO's unique and exclusive engineering principles that are applied in the construction of every antenna offered in this complete line where you see "It's the Cat's Whiskers". . . the slogan that has become the trademark of finest reception, rugged construction, easy "snap-in" assembly, quicker installation and stronger signal.

ALSO AVAILABLE STACKED — (Model 706-2)

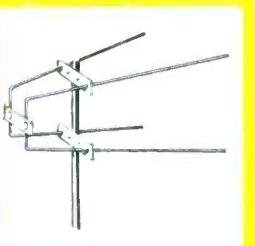
UHF ULTRA BOW-TENNA (Model 704)

Economical yet highly efficient UHF antenna that delivers high gain from channels 14 to 83. Expanded mesh reflector prevents vibration and eliminates open welds. Antenna is designed for minimum wind resistance. Embossed rib around edge of Dural Dipole Element prevents vibration. Units completely pre-assembled.



UHF-VHF ULTRA V-TENNA (Model 703)

Simplest possible antenna design, built to withstand wind, ice and snow in TV areas about twenty miles from transmitters. Maximum gain up to 11 decibels. Rugged aluminum construction. Receives VHF channels in addition to UHF.



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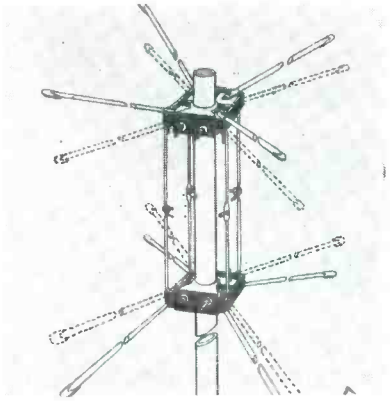
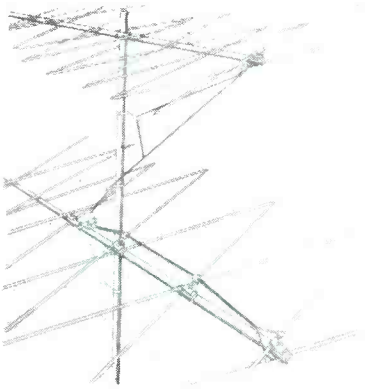


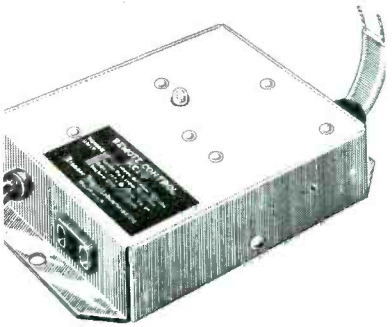
Redesigned, all-direction, uhf-vhf motorless antenna, featuring ten-inch spacing between bays, new low-loss phenolic insulators, and low-loss switch. Antenna is covered by patents 2,585,670; 2,609,503; 2,625,655; and 2,644,091. (Model 60; All-channel Antenna Corp., 70-07 Queens Boulevard, Woodside 77, N. Y.)

Transmission line wall entrance for house and trailer use which will accommodate either flat or tubular line and will, it is said, seal out rain and snow. Wall-feed permits entrance of wire directly under the eave into the attic. A neoprene gasket is supplied with each unit. (No. 626; Mosley Electronics, Inc., 8622 St. Charles Rock Road, St. Louis, Mo.)

Turretune uhf **converter, featuring turret-type band-spread tuning unit with a double tuned preselector. Tuning unit is said to have a constant lc ratio. A balanced line oscillator is claimed to keep frequency drift to a minimum. Input antenna terminals are provided for separate uhf and vhf antennas, but can also be used with combination antennas.** (Imperial; Walsco Electronics Corp., 3225 Exposition Place, Los Angeles 18, Calif.)



Zig-Zag **TV antennas featuring a reentrant network which, it is said, provides an almost perfect impedance match to the line on all channels. Reentrant network is claimed to show no measurable loss when stacking for all channel, single feed-line operation. Network consists of two paralleled quarter-wave transformer sections coupled to each antenna. One transformer operates throughout the upper channel coverage of antenna; the other transformer being resonant over lower channels.** (Trio Manufacturing Co., Griggsville, Ill.)



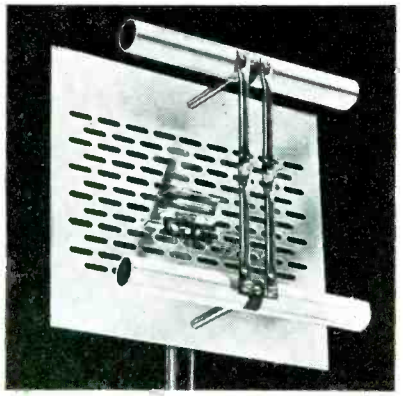
A 2-piece remote control unit, which contains thermo relay, indicator lite, and fuses. The remote portion at unit to be controlled, feeds power and accepts TV signals. For outdoor installations, the remote section may be mounted in a weatherproof housing, along with amplifier or other unit. A single 300-ohm line is used between the two parts to carry power out and TV signals back at the same time. Units can be operated at distances of 1,000' or more with remote control system. (Model RC-1; Blonder-Tongue Labs., Inc., 526-536 North Ave., Westfield, N. J.)

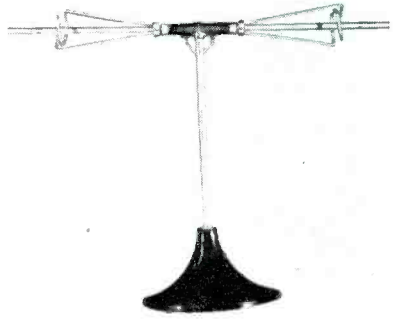
Two cavity front end for all-channel reception, which may be powered from TV chassis; vhf **channels 5-6 are used as if. Input is 300 ohms with high output impedance. Power requirements are B+ 100-130 volts at 20 ma; filaments 6.3 volts at 450 ma. Supplied with a 6AF4 uhf oscillator and 1N82 diode; if amplifier not included.** (Model UJ6; Granco Products, Inc., 36-17 20 Ave., L. I. City 5, N. Y.)

UHF **antenna, which it is claimed features low vertical radiation angle and low standing wave ratio. Has 300-ohm terminal impedance.** (Model 500-U; General Antenna Mfg. Co., 1652 Rockwell Ave., Cleveland 14, Ohio).

Indoor uhf antenna with twin arrows which can be adjusted for local areas. Model has gold upright and cross bar and brown plastic base. (Model 303; Hi-Lo TV Antenna Corp., 3540 N. Ravenswood Ave., Chicago 13, Ill.)

A uhf antenna with a parabolic dish reflector. (Pararay; Q-Line Manufacturing Corp., 1562 61 St., Brooklyn 19, N. Y.)





Standoffs and Standing-Wave-Ratios ‡

TV Antenna Digest

design..application..installation..service

by RALPH G. PETERS

MANY TV SERVICE troubles are not recognized as installation problems. To illustrate, there is the problem which develops out of excessive standing-wave-ratios on the transmission line. This difficulty can easily be the result of failure to take into account certain basic theories in seeking a solution for the problem.

The phenomena of standing waves must be carefully appraised in TV installations, especially in the *uhf* areas.

It is fairly general knowledge that an ideal installation is one in which there are no standing waves on the transmission line. The losses are then at a minimum for the particular line used; it acts only to carry the signal from the antenna to the receiver. To achieve this desirable end result, two conditions must be met. The line itself must have uniform characteristics, and its termination at the receiver must be equal to the line impedance. (It has been found that an impedance match at the antenna actually is not needed to hold down standing waves, since its only purpose is to permit a transfer of maximum energy.)

Of the two requirements named, the first is more important to a Service Man. The second is something one can do little about to correct since it is not possible to redesign the receiver.

The transmission line, though, is worth taking time to think about. The requirement, as noted, is that the transmission line have uniform characteristics. When it does, and it is matched properly at the receiver end, the signal has no choice but to travel down the line and be absorbed completely by the load circuit in the receiver. When the line is not uniform, it appears to have electrical *bumps* along its run. These *bumps* reflect part of the signal back toward the antenna and thereby set up standing waves. The worse the *bumps*, the more the reflection, and the greater the standing-wave-ratio.

The mere fact that reflection takes place in the line does not of itself produce loss or destroy the picture; but it creates a situation which leads to losses. Instead of having a uniform signal voltage along the line, the voltage *shrinks* at certain points and *bulges* at others. These points occur at regular intervals, being a quarter wavelength apart. The *shrinkage* points are low-voltage points or voltage nodes, while those where the voltage *bulges* or rises to a peak are voltage loops.

The line is relatively cold at the voltage nodes; that is, one can place a hand or metal near it, or even bunch it, and little disturbance will take place. That's because there is little voltage near. If one of these nodes happens to be near or at the end of the line where it is connected to the set, you may find very little signal getting in, and the picture will suffer from heavy snow.

The line is *hot* at the voltage loops. If a hand or any conductor is placed near the loop points, a pronounced reaction will be noticed. The signal level at the set may jump severely from weak to strong, and vice-versa; it won't stay put. Many factors can influence the operation of the set: The exact dress of the line, shifting of the line by wind, wetting by rain or condensed moisture, or a cat walking over the line.

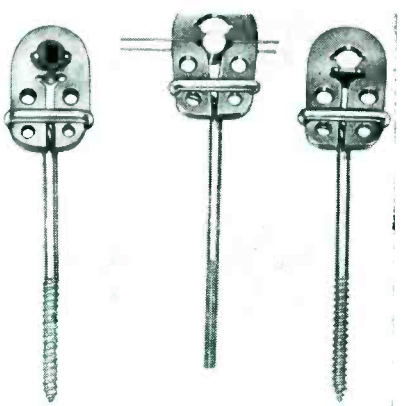
These standing waves not only produce instability, but they also act to increase losses in the transmission line. Thus, even if the instability is no great problem in some particular case, the loss of signal will be serious. There are several reasons why the losses go up with standing waves, but the most important reason is also the easiest to understand. Where the voltage rises to peaks, the greatest electrical stress appears across the line insulation, and therefore the dielectric losses go up greatly. If there is carbon deposit on the line, or if the line is wet, or uses only moderately good insulation, the losses may go up

(*Continued on page* 64)

‡*From a report prepared by* ***Gerry Gross,*** chief engineer of Argyle Electronics.

(*Left*)

Snapping support arm of Argyle standoff, with a tubular lead insert, into position.



(*Right*)

Standoffs with tubular, open line and flat lead inserted. (Argyle)

TV Antenna Digest

(*Continued from page 63*)

high enough to lose the picture completely.

To keep standing waves at a minimum, the line must therefore have uniform charasteristics. The line develops a field which extends into space around the line. That field around the line must be permitted to remain uniform; it must be free of any objects which are conductors, even such poor conductors as wood. Theoretically, these conditions can be met by stretching the line in space from the antenna to the receiver, without supports and without passing over or near conductors.

That condition is rare. It is necessary to support the line and to lead it neatly from antenna to receiver. The manner in which this is done makes all the difference between good and bad reception.

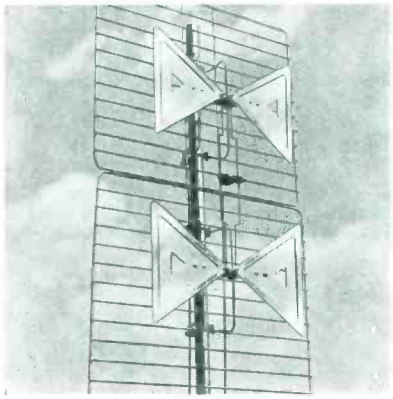
The rules governing good installation practice must be observed, if standing waves and signal losses are to be held down. This is especially true in *uhf* installations, equally important in fringe area *vhf* installations, and of more than just moderate importance in local and suburban *vhf* installations.

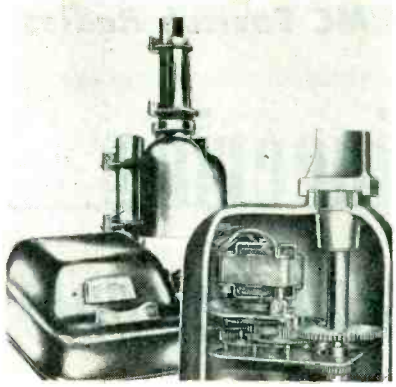
Standoffs, Major Problem

Anchoring of the line, with standoffs are high on the problem list. And since it is almost impossible to make an installation without standoffs, the problem is always present, in every installation.

Field experience has shown that ordinary standoffs are a common cause of transmission line headaches. Some-

Broad-band uhf antenna, which is said to feature an enlarged reflecting screen, full-wave spacing of stacked antennas, and 2-stage stacking transformers which it is claimed provide a broadband impedance match. Antenna can be fastened to the mast with a locking device which, it is said, prevents flutter, twisting, and vibration. (Model 408, Channel Master; Ellenville, N. Y.)





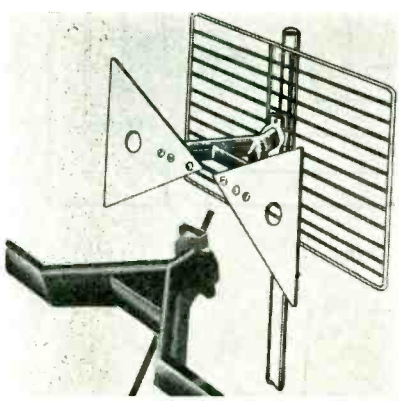
Antenna rotor with ¾" lamination, said to be capable of developing 40 foot pounds torque at the antenna mast. Electrical braking system used, it is claimed, results in instant stopping of the rotor, without drift. Rotor makes 1 revolution per minute through an arc of 365° and is stopped at the end of travel by means of electrically actuated switches. Upper vertical and horizontal thrust bearings are non-metallic. Housing for antenna drive is a streamlined umbrella-type aluminum casting, completely closed on its entire surface. Internal works are assembled from underside which is then secured with a moisture-tight gasket seal. Rocker arm switch stops or reverses the rotor. (Model Jeb-10; Jeb Sales Corp., 41 Wyckoff Ave., N. Y. 37, N. Y.)

times they react so severely that the picture is lost completely. These considerations have led to the development of a standoff* which employs a mechanical support member of heavy polyethelene, so constructed that the metal component is removed from the intense field of the transmission line. This construction, it has been found, more nearly acts to provide a line with uniform characteristics.

The polyethelene wrap-around idea serves to keep the line electrically in the clear. The standoff has been so designed that the same polyethelene member fits all types of lines: tubular, oval, flat, open line, and special types.

*Argyle Universal.

UHF butterfly antenna, with one stacking bar; has a wishbone insulator, which is claimed to provide a free air space sufficient to prevent shorting out the antenna under any condition. (Model 8965; Television Hardware Mfg. Co. (Division of General Cement Mfg. Co.), 919 Taylor Ave., Rockford, Ill.)



Servicing 2-Way 152-162 MC Taxicab Radios ‡

Service Engineering — field and shop notes

by THOMAS K. BEAMER

ONE OF THE MOST popular mobile 2-way radio units, five or six years ago, was a short range communications unit[1] designed specifically for use in taxicabs for the 152-162 mc band. By today's standards, this chassis, diagramed in Fig. 2, is virtually obsolete, because of new technical developments and the greater use of *vhf* channels.

The 2-way was a compact item featuring a sensitive, although not highly selective, FM receiver, an FM transmitter with a rated output of 2½ watts and a vibrator type power supply. Generally, the setup will be found mounted in the trunk of a car and in some cases on the firewall. A tiny control unit containing a small *pm* speaker, on-off switch, pilot light and a cradle for a telephone type handset will probably be found on the dashboard. The antenna was the conventional through-the-roof type of *vhf* rod, about 18″ tall.

The 2-wayer was intended for providing communication within a 5 to 7-mile range of a base station; although it has been known to talk back 60 miles to a base station. However, where a base station antenna is not ideally located and where higher power mobile units are operated on the same frequency, it was found that the range was definitely limited to a few miles at the most.

Exclusive of tube and component failures, most of the troubles encountered with this mobile radio stem from dirty relay contacts, misalignment of *rf* circuits, oscillator drift and loose connections. Because the case is ventilated, dust and dirt can reach the components, especially in areas where much pollution of the air is encountered. Where extreme variation of temperature are encountered, the receiver and transmitter crystal oscillators can drift sufficiently not only to reduce the receiving range by desensitization of the receiver, but the effective range of the transmitter. Loose connections develop because of the abuse the equipment receives in the trunk of a taxicab.

Tubes in Early Models

Early production models used an OZ4 cold cathode rectifier tube in the power supply. In later production, the OZ4 was replaced by a 6X5GT and the latest models used two 6X4s. Modification of the power supply permitting use of a 6X5GT tube in lieu of the OZ4 can be made by wiring the tube socket to provide heater voltage. The single buffer capacitor across the high voltage secondary should be replaced by two .02-mfd capacitors, one from each side of the secondary to the center tap. Retcifier tube protection can be afforded by adding a fuse in series with the power transformer secondary center-tap.

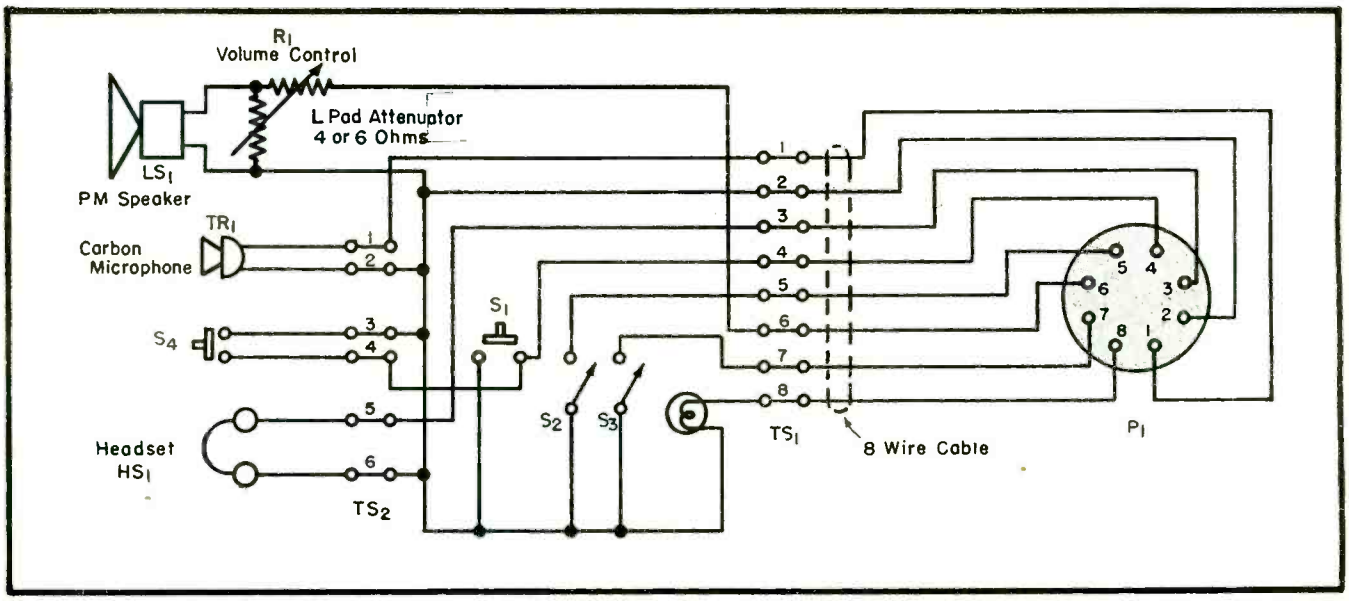
The vibrator should be replaced only with one which possesses the exact required characteristics. Replacement with a vibrator fitting the same socket and matching the wiring may perform, but not necessarily too long.

Failure of the set to operate at all, if not traced to blown fuses or open wiring, may be found to be due to poor or no contact at the power input receptacle. A permanent cure is the replacement of the plug and receptacle with a heavy duty industrial type.

Low modulation may also be encountered; caused by a weak transmitter cartridge in the telephone type handset, in which case the cartridge should be replaced. Short tube life may be due to improper adjustment

‡From notes prepared by Leo G. Sands.
[1]MRT-3B.

Fig. 1. A bench test jig for the two-way taxi system. P_1 = octal plug; T_{S1} and T_{S2} = barrier type terminal strips; S_1 = push button (to operate transmitter; S_2 = spst switch (to simulate handset cradle switch); S_3 = spst switch (on-off); S_4 = push button (part of microphone TR_1. Plug P_1 connects with J_{202} of the two-way chassis. A telephone handset with a push-to-talk button may be used in place of TR_1, S_4 and the headset.



of the vehicle's voltage regulator. This should be set so that the voltage across the battery at any vehicle speed does not exceed 7.2.

Proper test equipment must be used to service effectively this chassis. A special test meter (described later), simple field-strength meter and a dummy antenna are required for transmitter adjustment. For receiver alignment a vacuum tube voltmeter and a *good vhf* signal generator are required. (By *good* is meant one whose output can be adjustable to at least one microvolt. Many signal generators leak so much signal that they are inadequate for servicing mobile radio gear.)

The receiver can be aligned in the conventional manner. A pin jack permits connection to the signal generator for *if* alignment, without requiring an external blocking capacitor. With the signal generator output fed to the jack, and a *vtvm* connected to the jack to permit reading limiter voltage, the receiver will be ready for *if*, limiter and discriminator alignment. The output of the signal generator set at exactly 8.25 mc should be adjusted to produce limiter voltage between 5 and 10. The *if* stages are then peaked for maximum readings and when the limiter voltage exceeds 10, the signal generator output should be reduced. The *if* alignment should be made only with the 6J6 receiver oscillator-multiplier tube removed from its socket.

With the *vtvm* probe connected to the junction of the discriminator load resistors (R_{522} and R_{525}), the primary slug of the discriminator transformer should be adjusted for maximum meter reading. The meter probe can now be moved to pin jack J_{504} and the secondary of the discriminator transformer adjusted for zero meter reading, reversing the meter polarity to make sure zero is actually zero.

After the *if* section has been aligned, the 6J6 oscillator-multiplier tube should be reinserted in its socket. After a few minutes warm up, and with the signal generator disconnected and the *vtvm* connected to pin jack J_{502}, the oscillator tuning slug should be turned counterclockwise, as far as possible without forcing. The slug should then be turned clockwise slowly until oscillation ceases, as noted by the sudden drop in meter reading. Now, the slug should be turned back in a counterclockwise direction about one third turn beyond the point, where oscillation again commences. Slug L_{514} should be adjusted for maximum meter reading.

The *vtvm* should then be reconnected to J_{503} to read limiter voltage. The

(*Continued on page* 68)

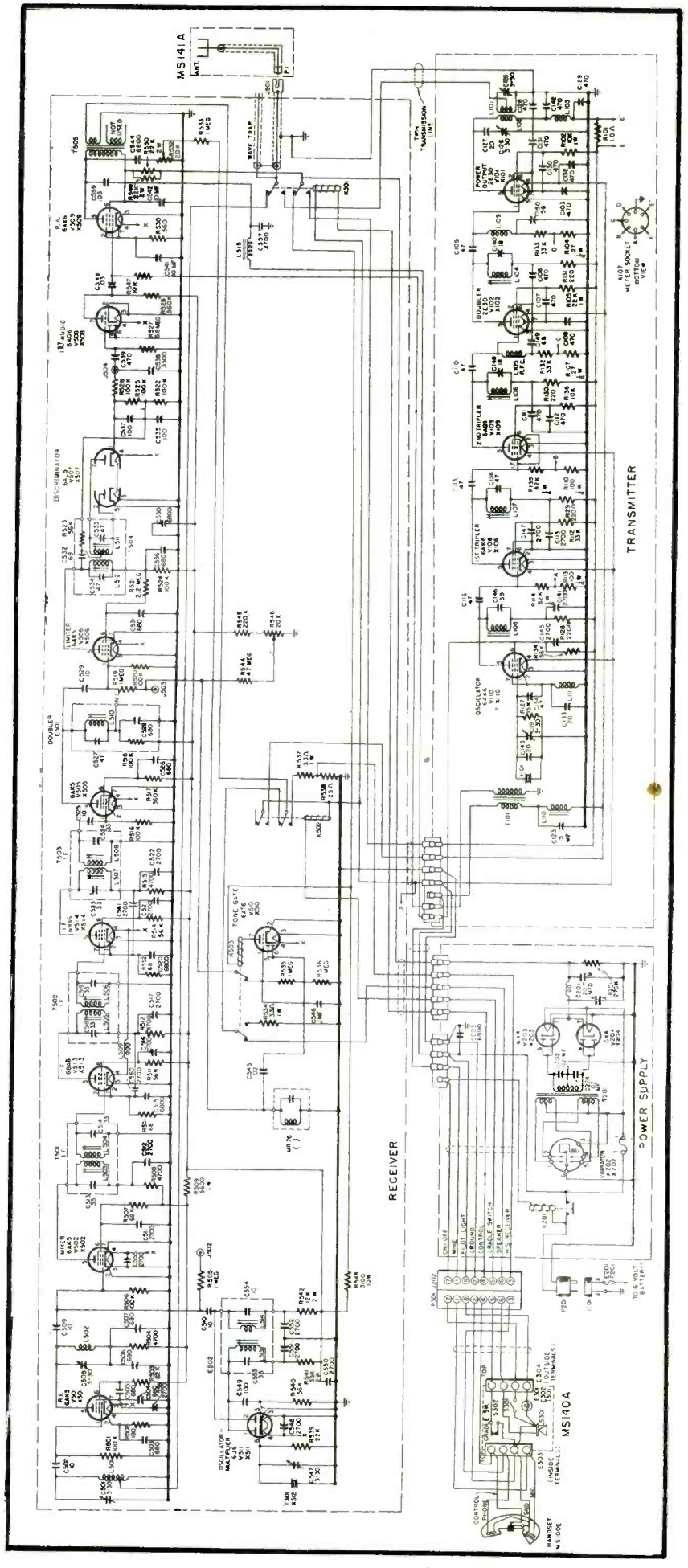


Fig. 2. Schematic of (MRT-3B) taxicab receiver-transmitter designed to cover 152 to 162-mc band.

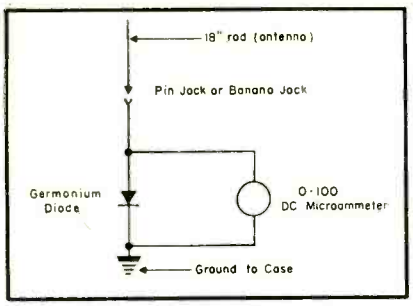


Fig. 3. Simple field strength meter which can be used to adjust the 2-way transmitter.

signal generator output can then be fed to the antenna jack and the signal generator tuned to the frequency at which the receiver is intended to operate, as determined by the receiver crystal. Again the generator output must be reduced to keep limiter voltage between 5 and 10. The *rf* stage and mixer trimmer capacitors should then be adjusted for maximum meter reading. It is necessary to keep the input signal as feeble as possible when aligning the front end. After the set has been connected to an antenna, the *rf* trimmer should be reset for maximum performance on a received signal.

The 2-way unit can be used with or without the *instant call* feature, which is a tone-controlled gate for the squelch circuit. In practice, the loudspeaker remains quiet until a signal is received; the signal carries a short tone burst initially and at the proper audio frequency. The dispatcher at the base station sends out this tone when he wants to call a specific cab. All of the radio-equipped cabs in his fleet hear the tone, followed by the spoken call. When the desired cab driver replies, the base station answers without sending the tone. The loudspeakers in all of the cabs then are silent. The base station can only be heard by picking up the handset which is not squelch-controlled. The tone opens the squelch and the base station carrier, if uninterrupted, holds it open.

Potentiometer R_{xxx} is used for setting the squelch threshold. Another potentiometer R_{546} is provided for adjusting the bias on the tone gate tube for optimum performance. The *instant* call feature is not employed by all users and can be easily omitted by strapping together the contacts of relay K_{503} to connect permanently the limiter circuit to the grid of the tone gate tube. Under these conditions the tone filter (MR_{76}) may be removed from the circuit by pulling it out of its socket. The receiver then will operate in the same manner as most other mobile radio units with the squelch operated by the received carrier.

Tuning of the transmitter is simple when the proper test meter is used. This test meter consists of an 0 to 1 *dc* milliammeter, a two-pole fire-position wafer switch and a small *rf* bypass capacitor. The meter should have an internal resistance of 100 ohms. If a meter with a lower internal resistance is used a resistor should be connected in series with the meter. This resistor should have a value (in ohms) equalling the difference between the meter resistance and 100 ohms. For example, a 60-ohm meter will require a 40-ohm series resistor.

The meter, when switched through its five positions, will measure quadrupler grid, tripler grid, doubler grid, power amplifier grid and power amplifier plate currents.

Before attempting to align the transmitter, a dummy antenna should be connected to the antenna receptacle. This may be a No. 47 brown bead panel lamp with a suitable adaptor to fit the antenna receptacle, a 50-ohm dummy antenna or an actual mobile *vhf* antenna as used in car installations. If an actual antenna is used, it should be mounted on a sheet of metal to serve as a ground plane and the channel should be monitored before putting the transmitter on the air to avoid interfering with others. Also, the transmitter should be turned on for very brief periods, again to avoid causing unnecessary interference.

All of the tube shields should be in place. (The 2E30 power amplifier tube does not require a shield.) After the transmitter tube filaments have been allowed to warm up for a few minutes and with the dummy antenna connected, the test meter should be set to quad.-grid position, push-to-talk button on handset should be pressed, and the oscillator plate tuning slug L_{108} should be tuned for maximum meter reading and then backed off to a point about 10% below maximum reading.

At trip.-grid position, quadrupler plate tank L_{107} should be tuned for maximum reading. At doub.-grid position, tripler plate circuit (L_{106}) should then be tuned for maximum. At position in which the meter reads power amplifier grid current, the doubler plate circuit is also adjusted for maximum reading.

To read power amplifier plate current, the meter switch should be set to next position anad the power amplifier plate circuit adjusted for minimum dip on the meter. The dip may be small and hard to note. Therefore, it is a good idea to use a field-strength meter for this adjustment, tuning for maximum output. The antenna tuning adjustment (C_{125}) should also be set for maximum indication on the field-strength meter. After the 2-way unit has been installed in a vehicle and connected to its antenna, both the power amplifier plate circuit adjustment (C_{126}) and antenna trimmer (C_{125}) should be reset for maximum field strength.

When tuning the transmitter, the push-to-talk button should only be held closed for very brief periods, not exceeding 10 seconds until the power amplifier stage has been adjusted. If power output falls off rapidly when holding the button down, the 2E30 power amplifier tube may need replacement.

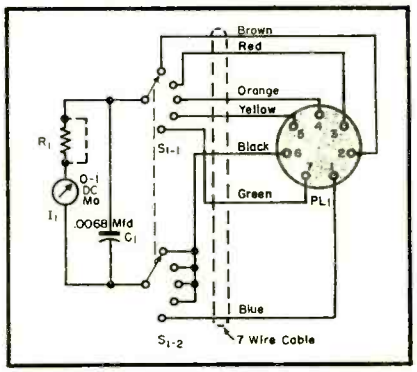
For bench testing, the control unit supplied may be used. However, unless one has a spare it is not easy to remove the control unit from the vehicle for use as a bench test jig. A test jig which may be used for bench test and adjustment is shown in Fig. 1 (p. 66). A telephone type handset with a push-to-talk button can be used in lieu of the hand microphone and headset shown in the diagram. However, with a headset, the Service Man has both hands free for adjustments. A six-volt storage battery or a rectifier power supply can be used as a source of power.

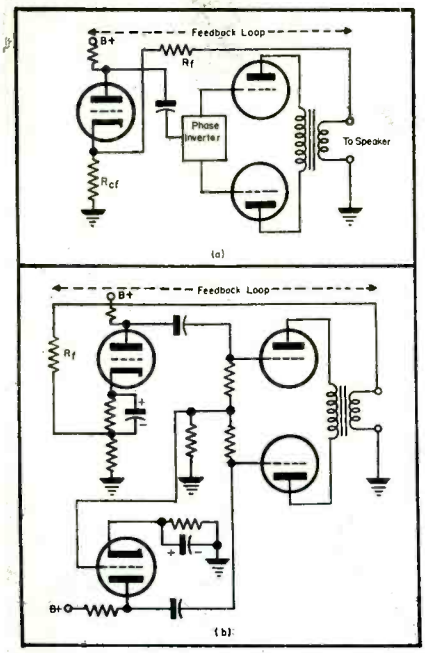
When replacing defective components, parts which have similar electrical characteristics must be used. For example, a ceramic capacitor in one of the critical high frequency circuits should always be replaced with a ceramic capacitor. A mica or paper dielectric capacitor, even of the same capacity, may not function.

The audio reproduction from this model is intentionally high pitched. However, some might prefer to hear more low frequencies. This can be accomplished by utilizing a larger *pm* speaker. More volume and wider frequency response can also be obtained

(*Continued on page* 108)

Fig. 4. Test meter for two-way: P_{11} = miniature 7-pin male plug with color-coded cable. S_1 = 2-pole 5-position wafer switch. R_1 = resistor, which is not necessary if the meter resistance is 100 ohms. If less, it will be necessary to use a resistor that will make the combined resistance of the meter and the resistor equal to 100 ohms.



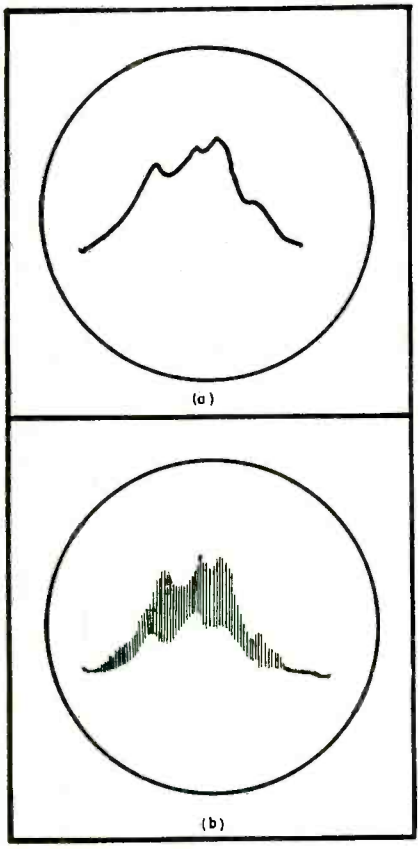


(Above)

Fig. 1. Two methods of introducing negative feedback into the amplifier. If the phase inverter cathodes of (b) are connected together in the original circuit, they should be disconnected and provided with separate cathode resistors of double the original single resistor value.

(Below)

Fig. 2. A trace of a complex wave on a 'scope screen is illustrated in (a). The same wave, with supersonic oscillation breaking out and disappearing again, appears in (b).



HI-FI Results Via Audio Conversions

by MARK VINO

IMPROVED AMPLIFIER characteristics can be achieved by the introduction of inverse or negative feedback. Two common ways in which this feedback can be inserted are illustrated in Fig. 1. In both cases part of the signal voltage across the output transformer secondary is applied to the unbypassed cathode of a preceding voltage amplifier. The following precautions must be observed prior to connecting the feedback circuit:

(*1*) There must be no output feedback circuit in the original amplifier.

(*2*) There must be no tone, volume, selector or any other type of control within the feedback loop.

(*3*) There must be no fixed tone-compensating networks within the loop. If the output transformer has resistance - capacitance elements strapped across its primary, these must be removed.

(*4*) All coupling capacitors within the feedback loop should be large; .1 mfd for a 250,000-ohm grid resistor, .05 mfd for a 500,000-ohm grid resistor, etc.

(*5*) The bypass capacitor of the cathode resistor to which feedback is applied must be removed. If the amount of surplus gain is limited, the circuit of Fig. 4*b*,* in which the cathode resistor is divided into bypassed and unbypassed sections, can be used. The value of the two resistors must add up to the original bias resistor value, and the unbypassed section can constitute about one-fourth of the total resistance.

Import of Transformer-Lead Polarity

After the foregoing conditions have been checked, the feedback resistor, R_F, is inserted, and one end of the transformer secondary grounded. There is a correct polarity for the secondary transformer leads, which can only be determined experimentally. If the leads are reversed from their proper position the feedback will be positive instead of negative; the output volume will increase rather than decrease, and the amplifier will probably go into self-oscillation. In such a case the speaker howl will rattle the window-panes, and the correct polarity should first be established by temporary connections before soldering.

The smaller the value of R_f the more feedback is introduced. Starting with a resistance of about twenty times the value of R_{cr}, the value of R_f should be reduced until the maximum volume of the set has been reduced as much as can reasonably be afforded; that is, until the point is reached where further reduction

*SERVICE; August, 1953.

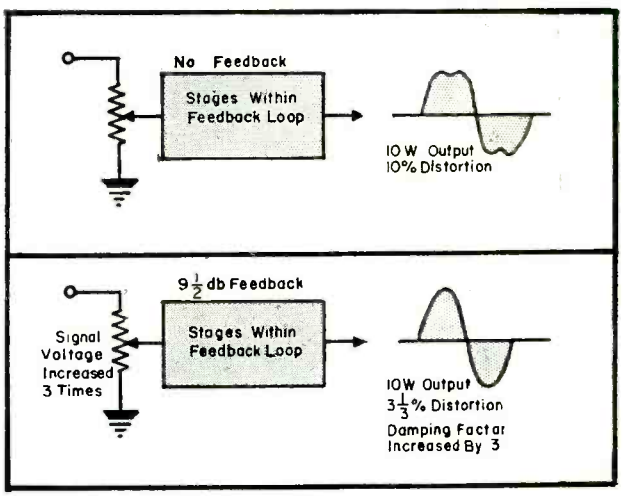


Fig. 3. Relation between feedback, amplifier sensitivity, distortion, and damping factor.

Concluding Installment: Inverse or Negative Feedback Application...Replacing Output Transformers . . . Adding Components to Old System (FM Tuners and 3-Speed Players) . . . Cost and Performance Considerations

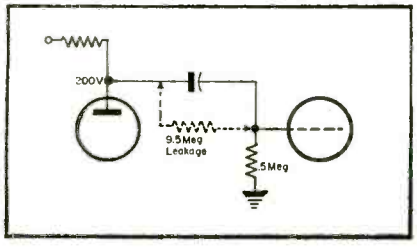
would mean insufficient volume on weak stations or low level records.

There is one danger in this procedure. Too much feedback in a circuit of given construction introduces a tendency towards motor-boating at low frequencies, and toward high-frequency or supersonic oscillation in the top ranges, with correspondingly poor transient response in these regions. It is not likely that the surplus gain of a commercial chassis will allow the amount of feedback to approach this danger point, but one should be on guard anyway. Supersonic oscillation, although it is inaudible, is detrimental to amplifier performance indirectly, and may be checked for on a 'scope connected across the speaker voice coil. It may appear as a steady signal, or as a temporary phenomenon only accompanying sudden bursts of sound, as in Fig. 2.

The use of negative feedback does not reduce the power output capabilities of the amplifier, so long as the driving signal voltage can be increased, but it does reduce the voltage gain. The factor by which this gain is reduced is the index of how much feedback has been applied, and can be determined by measuring the voltage output at the speaker terminals (with a given applied input signal), with and without the feedback resistor R_F connected. Since it is not necessary to know the actual numerical value of these output voltages, but only their values relative to each other, a 'scope as well as an *ac* voltmeter can be used for the test.

When the feedback circuit reduces the signal voltage to one-third of its original value, for example, the amount of feedback is rated as the equivalent of the voltage ratio 3: 1, or 9½ db. If the volume control can now be turned up so that the signal driving voltage is tripled, the output power will be restored to its original level, but harmonic distortion, hum or noise within the feedback loop, and amplifier source impedance will all be reduced by the same factor of three; Fig. 3. Where the amplifier originally created 10% harmonic distortion at rated power (a common distortion characteristic for commercial radios), the feedback-converted circuit will generate only 3⅓% harmonic distortion at the same power, and distortion at lower output levels will be reduced in the same ratio. Speaker damping and bass transient response will also be improved by the lowered source impedance, and frequency response will be made more uniform.

Fig. 4. A dc voltage divider formed by a leaky coupling capacitor and grid resistor: 1/20 of the plate voltage is applied to the grid.



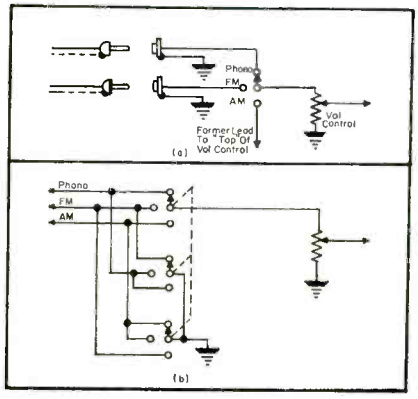
Replacing the Output Transformer

The danger of instability with negative feedback arises because of the phase shift within the feedback loop, and the component which is usually most responsible for this phase shift is a low-quality output transformer. Replacement of this transformer with a quality unit will allow the full benefits of feedback to be applied. In addition, such an installation will correct other defects introduced into the audio system by the old transformer. Such defects include harmonic distortion originating in the non-linear characteristics of the transformer core, and poor bass and treble-frequency response. The original system may not have needed a better unit because of the limited frequency range and quality of the speaker to which the output transformer was connected.

Most transformer manufacturers include a line of output transformers specifically designed for high quality audio circuits. The replacement transformer must, of course, have the same impedance ratings as the original, to match correctly the speaker to the output tubes. When the required ratings are not known, and cannot be obtained from the set manufacturer, a tube manual will supply the desired data. The plate-to-plate load impedance for a given pair of tubes in push-pull will be found listed for given circuit conditions. This impedance represents the correct rating for the transformer primary.

Replacement of a low- or medium-quality output transformer is well worthwhile, since the output transformer is the most critical component of the modern audio amplifier, and is often the quality bottleneck of an otherwise excellent amplifier.

Fig. 5. In (a) is a simple selector switch circuit while in (b) appears a selector circuit with the unused channels grounded out to prevent crosstalk.

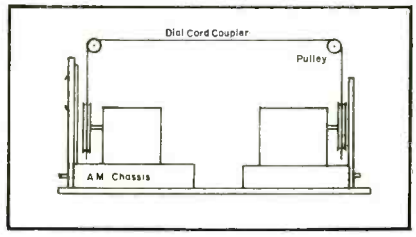


Replacement of Other Amplifier Components

When the amplifier is fairly old it is a good idea to replace the coupling capacitors between stages. If these become even slightly leaky for *dc*, the plate voltage of the preceding stage will be applied to the voltage divider formed by the capacitor-leakage re-

(*Continued on page* 110)

Fig. 6. Method of coupling FM tuner to original AM tuning mechanism. This operating convenience can cause a maintenance headache later on.



Report on Transistor Developments: Tetrodes and Pentodes . . .

TUBE News — by E. A. TEVERSON

Modulator, Mixer, Amplifier and Test-Oscillator Circuitry for Point Contact and Junction Transistors

IN THE EARLY DAYS of radio the galena crystal detector, fitted with an adjustable wire known as a *catwhisker,* truly ruled. For it was the only practical means of detection. Today, the crystal has returned, and while it does not now reign, it occupies quite a lofty post, whose import is destined to grow, thanks to crystal diodes and particularly, *transistors.* Today, modern sealed-in-glass *germanium*[1] crystals, factory adjusted for permanent high sensitivity, serve as detectors in radio and TV chassis. Radar equipment uses *silicon* crystals as detectors for microwave signals. Both germanium and silicon diode crystals employ a single wire *catwhisker.*

These crystals are semiconductor devices which detect electrical signals because they have the unique property of permitting current to flow readily in one direction and of restricting the flow of current in the other. The heart of any semiconductor device is a small piece of a substance that is neither a good conductor like copper, nor a good insulator like glass; hence the name, *semiconductor.*

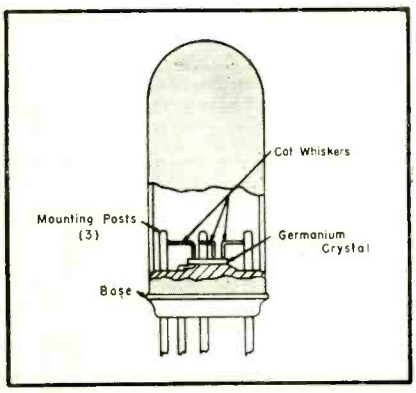
When a pointed wire is placed in contact with a piece of germanium,

(*Continued on page* 124)

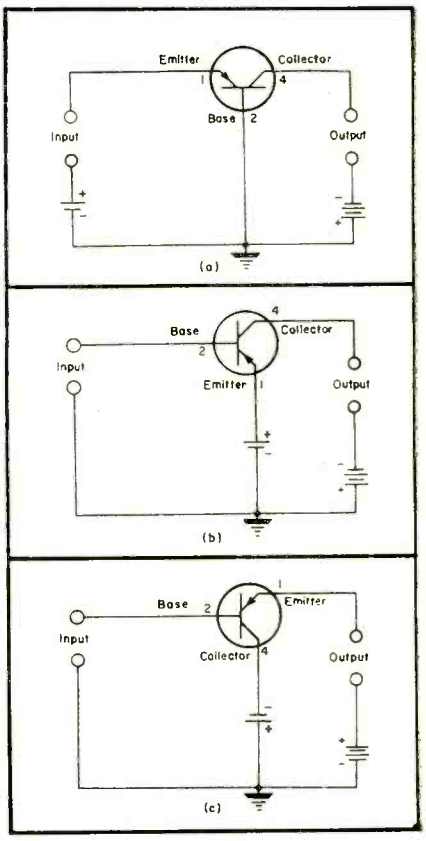
‡Based on notes appearing in transistor booklet published by *Sylvania.*

(*Below*)

Construction of tetrode transistor. (Sylvania)



[1]Germanium is a rare dull-grey metallic element. Heretofore, its most common use has been in making special optical glass and in the amalgam used by dentists in filling teeth. It was relatively unimportant commercially until physicists learned to control the properties that affect its electrical behavior. . . . The germanium used in transistors is a by-product of the refining of lead and zinc. Only a few pounds are found in a carload of zinc ore. The production of pure germanium from the light fluffy germanium oxide powder is a painstaking process. After several hours of treatment under controlled temperature and atmospheric conditions, a germanium ingot is obtained. The ingot is purified many times to leave less than one part of impurity per million parts of germanium. . . . The highly purified material thus obtained is processed to establish a homogeneous crystalline structure. This is sliced into thin wafers and diced into small pieces for mounting in transistor.

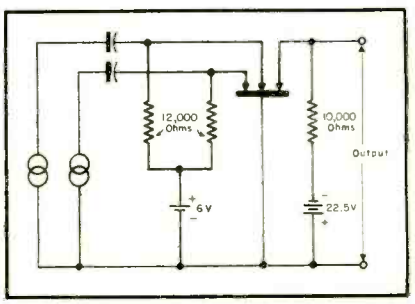


(*Above*)

Fig. 1. Typical amplifier circuits indicating possible ways of connecting point-contact and junction transistors. (Courtesy RCA)

(*Below*)

Fig. 2. Modulator or mixer circuit using a tetrode transistor. (Sylvania)



by KENNETH STEWART
and PAUL EDWARDS

Tracking Down Amplifier Troubles at the Input End* . . . Pitch in Audio Design . . . Capacitive Pickups

A NUMBER OF difficulties encountered with amplifiers appear at the input end.

It is known that the output end requires matching (optimum load to voice-coil impedance, etc.) and line matching is important, too. But input matching?

Let's assume that we have a dynamic microphone or pickup, with an impedance of 50 ohms. It is, of course, possible to connect this directly in the grid circuit of the first tube. But it would be found that the gain of the average amplifier is quite inadequate, to such an extent that one would probably conclude the microphone or pickup wasn't working at all. This has often happened to the uninitiated.

Another high-gain pentode stage on the front end would supply the gain, but the tube hiss, and probably hum, as well, would be much too high. A better solution would be an input transformer, with a ratio of, say, 100:1. This will multiply the signal voltages from the microphone or pickup by 100 before they are applied to the grid, and thus provide as much stepup as the pentode stage, but without so much tube hiss or hum trouble.

One might now ask this question: Since the tube grid only wants a voltage, why not use a transformer with a step-up of 1000:1, or even more, and perhaps dispense with another stage? For some purposes this might be possible, but for reasonable quality reproduction such a move is definitely out of order. The reason apears in the popular formula used in connection with output matching; impedance ratio is proportional to turns radio squared.

When a 100:1 transformer is employed the actual impedance of 50 ohms is stepped up to 50 x 100^2, or 500,000 ohms in the grid circuit. Now, whether or not a leak resistor is used, the grid circuit possesses a substantial input capacitance, due to the tube input and strays. A reactance chart study will reveal that these capacitance values, working out of an impedance of 500,000 ohms will result in a rolloff at the upper end of about 30 to 100 kc, which is satisfactory for our purpose.

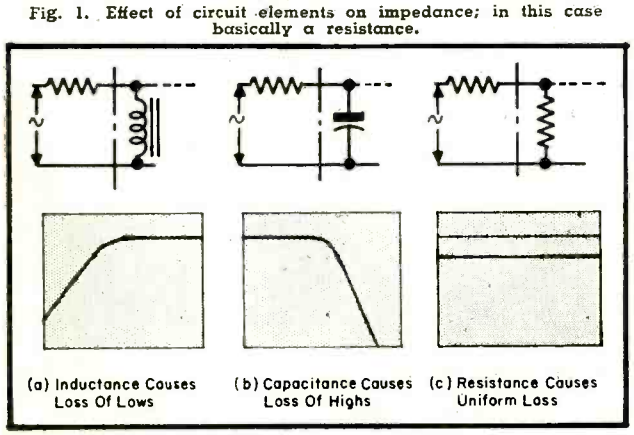
But, by using a 1000:1 transformer, the 50 ohms (actual impedance) is stepped up to 50 x 1000^2, or 50 megohms, bringing the 3 db rolloff point down to from 3 to 10 kc, according to input capacitance.

That's only part of the story. To get a ratio as high as 1000:1, the transformer would need either a very large number of turns on the secondary, or not very many on the primary. And a really large number of turns on the secondary would result in quite a huge component; there is a limit to the fineness of a wire gauge that can be wound. Also, a big transformer would have a large capacitance swamping the total grid-input capacitance. The alternative of a small number of turns on the primary, keeping size and capacitance small, would mean a low primary inductance and cause a loss of low frequencies.

Either way then, the use of too large a stepup transformer will restrict frequency response. There is greater tendency to cut the high end, and by using a transformer with too few turns on the primary, the low end wil suffer, too.

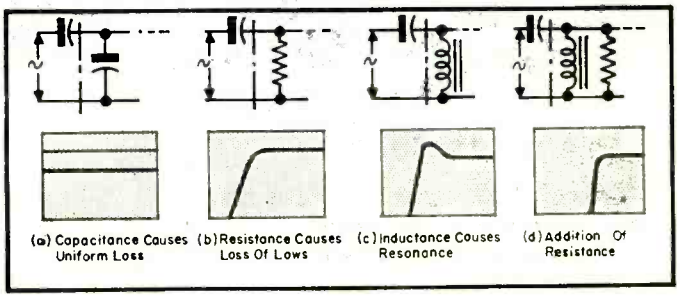
Thus, although there may not be a definite *optimum*, as with output

Fig. 1. Effect of circuit elements on impedance; in this case basically a resistance.



*From notes prepared by **Norman Crowhurst**, British audio consultant.*

Fig. 2. Basic circuits and patterns which illustrate what various loadings can do to the impedance of a crystal mike or pickup.



Tape Recorders . . . 3-Speed Changers . . . Amps . . . Tri-Speaker Phonos

Wireless microphone, which weighs less than four ounces and is actually a miniature FM transmitting unit; mike can broadcast to receiver and accompanying power supply containing speaker at distances up to 300'. (Stephens Manufacturing Corp., Culver City, California.)

Gyromatic swivel, which swivels through 360° and can be used on desk stand or floor stand. It locks safely in any position by a turn of the locking knob. Length is 4½". Male and female threads are 5/8"-27. (Model SW-1; Atlas Sound Corp.)

All-purpose high-impedance crystal microphone, which can be used on a desk stand; floor stand; desk or floor stand, mounted on a swivel adapter; in the hand; and around the neck, with a lavalier. (Slim-X models 777 and 777S; Shure Brothers, Inc.)

Tri-speaker phono equipped with three 5" Alnico-5 matched speakers. Has a four-tube plus rectifier amp with negative cathode feedback and push-pull output stage. Uses ceramic weather-proof cartridge, and aluminum die cast tone arm. Also said to feature jam-proof changer mechanism. Automatic tone-arm setdown for 7", 10" and 12" records; 10" and 12" records of the same speed may be intermixed. (Model 555; V-M Corp.)

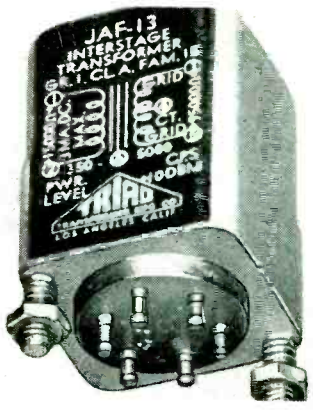
A single-speed tape recorder, designed for universal use, break-away electrical cord. Has automatic retractable rubber pressure roller, and plugin head. Permits playback through external amplifier. Frequency range said to be approximately 70-5000 cycles at 3¾"; rewind speed is 6 to 1 with 2 hour, 7" reel tape capacity. (Model 400; Tape Recorder Division, Eicor, Inc.)

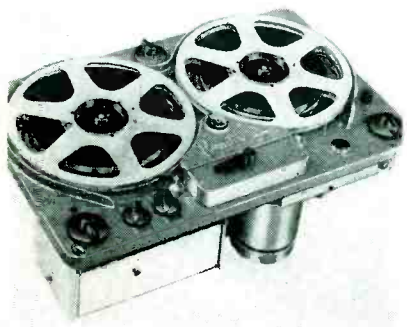
Automatic 3-speed record changer designed for 7, 10 and 12-inch records. No intermediary pulleys are used. Changers are provided with two plug-in cartridge shells. Unit is also said to feature a jam-proof mechanism; a muting switch and a four-pole motor with self-aligned oilite bearings. (Models 3/532-intermixes 10" and 12" records—and 3/531-non-intermix; Collaro Div., Rockbar Corp.)

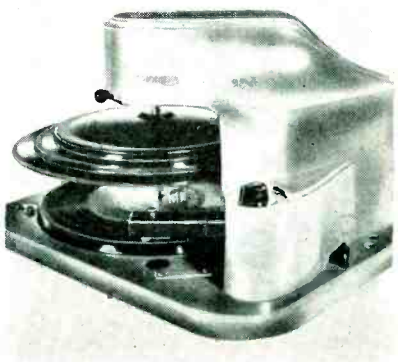
Magnetically shielded, hermetically sealed transformer, designed for use with transistor or tube amplifying equipment. Transformers are available in standard MIL cases with mounting studs so arranged that transformers may be mounted in closest possible proximity to each other. (JAF series; Triad Transformer Corp.)

Tape recorder driven by a two-speed hysteresis sync direct-drive motor (said to eliminate flat spots) at 7.5" and 15" per second. Entire drive assembly is interchangeable as an integral unit. Timing accuracy of ± 0.3% is claimed. (Model 1502; Berlant Associates.)

Double-sided record changer which permits playing both sides of 33 1/3, 45 and 78 recordings successively, or, if desired, only one side of each record; and playing of 10" and 12" records mixed in any order, or twelve 7" records at 33 1/3, 45 or 78. (Model CD-53; Thorens Co.)







Audio

(*Continued from page 75*)

matching, there are definite limits at the input end. Too little stepup results in loss of gain, which if rectified by increased amplification causes an unnecessarily high noise level and emphasizes hum problems. Too high a stepup restricts the frequency range, losing fidelity.

What then, will be a good impedance to use for matching to the grid circuit of an input tube? (Incidentally, there is another factor that limits us. This is the inductive component invariably possessed by dynamic units at the high-frequency end of their *impedance* characteristic, due to voice-coil inductance. If a stepup, even to 500,000 ohms, is used, this will either resonate with grid-input capacitance to produce an undesirable peak, or cause an earlier rolloff than that described.)

In practice, good fidelity requires the dynamic unit to be matched up to somewhere between 50,000 and 200,000 ohms. Therefore, the ratio for our assumed 50-ohm mike or pickup should be between 30:1 and 60:1.

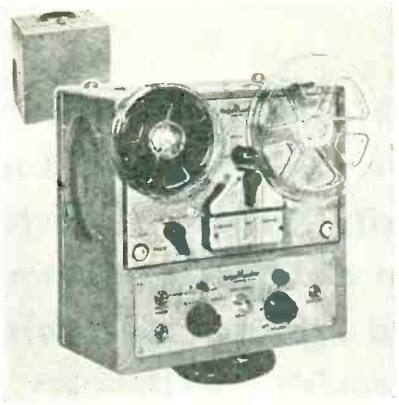
Crystal Mikes and Pickups

So much for dynamic units, but how about crystal or condenser types? These are often given an impedance rating in ohms, which can be misleading.

Circuit elements affect ordinary impedances, like that of a dynamic transducer: A low inductance causes low frequency loss, and capacitance causes high-frequency loss. Loading down with a resistance causes uniform loss at all frequencies, called insertion loss. This is illustrated in Fig. 1 (p. 74). The impedance in this case is basically a resistance. It is true, that any acoustic resonances and voice-coil inductance contribute a little too, but the basic value of impedance is the dynamic resistance; this is not much greater than the *dc* voice coil resistance, in most cases.

Now, the impedance of a crystal is basically a capacitance; the same as it is with a condenser microphone. Thus, all these devices fall in the same group. Fig. 2 (p. 74) shows what various loadings do to this kind of a transducer impedance. A capacitance alone acts as a potential divider, and thus causes uniform loss at all frequencies, or insertion loss. A resistance load causes the source reactance to cut off the lower frequencies, while an inductance load will resonate at some frequency. If a resistance is used to damp down this resonance, a doubly sharp rolloff at the low-frequency end remains, usually starting at rather a high frequency. This might be convenient for use with small horn-type loudspeakers intended for speech only,

Control unit and combined preamp which provides push-button switching for three separate inputs and up to eight pre-selected equalizing combinations for phono. Has independent linear treble and bass rise and fall controls, and audio harmonic filter. Amplifier incorporates balanced feedback utilizing a fourteen-section output transformer which is said to eliminate phaseshift and need for selected or matched tubes. Power output: 15 watts, 20 to 20,000 cps within .2 db and 10—50,000 cps within .5 db. (Acoustical Quad QC II control and 15-watt amp; Beam Instruments Corp.)



Dual speed, portable tape recorder, which includes a push-pull supersonic bias-erase oscillator, 3½-watt amplifier, 4x6 oval speaker and microphone. Dual track: ¼" width tape; manual reversal. Dual speed: 7.5 and 3.75 ips. Direct threading of tape; no loops said to be required. Frequency response: 50-8000 ± 3 db at 7.5 and 50-5000 at 3.75. Offers high frequency compensation in record and low-frequency compensation in playback. Input impedance is high; output impedance is 22,000 ohms. Can be operated vertically as well as horizontally. (Model PT-150; Tape Master, Inc.)

but otherwise results in extremely poor fidelity.

This means that for fidelity work, a crystal or condenser microphone can never be used with a transformer.

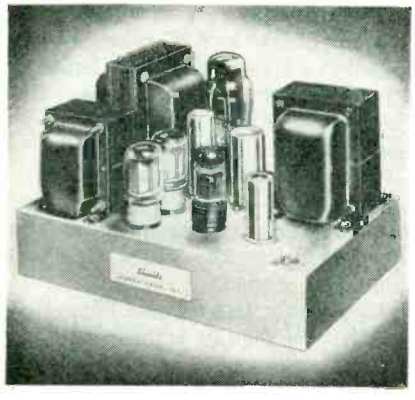
Use of an unduly long screened lead, instead of causing top loss, as it would with other high-impedance devices, produces a level insertion loss.

Use of too low a grid resistor results in excessive low-frequency loss. This would be convenient for use on speech only, but for quality reproduction of music, a high value grid resistor (at least a megohm) is needed.

The most useful rating for a crystal or condenser type transducer is obviously a statement of its capacitance,

(Continued on page 94)

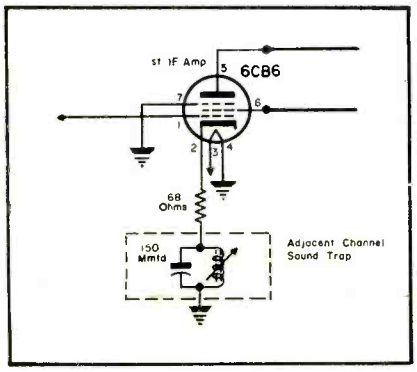
Power amplifier (25 watts) with a frequency response of from 7 cps to 100 kc ± 1 db. Power response of this amplifier is said to be 18 to 40 cps, ± 1 db. Has an internal output impedance of less than one ohm, allowing it to act as almost a complete short circuit to any transient distortion produced by the loudspeaker. This is said to provide for a reduction of "boomy bass" and "muddiness" in reproduced sound. (Model SPA-25; Shields Labs, Inc.)



Servicing Helps

Troubleshooting With Resistive Isolating and Low-Capacity Probes . . . Installation of Adjacent Channel Sound Traps . . . Aligning Syncroguide Transformers . . . Vertical Crosstalk Cures . . . Signal Generator Waveform Tests

by T. L. GILFORD

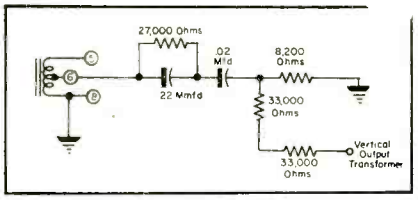


(*Above*)

Fig. 1. Circuit of if amp of Stewart-Warner 9300 model with adjacent-channel sound trap installed.

(*Below*)

Fig. 2. Changes incorporated in Columbia 800 chassis to eliminate vertical shading or cross-talk.



To MINIMIZE INTERFERENCE caused by the sound carrier of the lower frequency adjacent-channel, sound traps (slug tuned coil and fixed ceramic capacitor) have been introduced.

Installation: When required for *Stewart-Warner 9300* series chassis, the trap[1] is added to the cathode circuit of the 6CB6 first *if* amp.

In installing, the trap coil is mounted in the hole located adjacent and to the right of the 6CB6. The coil must be inserted from the under side of the chassis and pushed through the hole until the mounting clip snaps into position.

Then the 6800-ohm resistor (*16*) is disconnected from the chassis ground. The open end of this resistor is connected to one terminal of the trap coil. And the other terminal of the trap coil is connected to the chassis ground.

Diagram (Fig. 1) shows this sound trap wired into the receiver circuit.

Adjustments: After installing the adjacent-channel sound trap in the proper manner, it will be necessary to make several adjustments:

The slug should be rotated counter clockwise until stem of slug is out as far as possible.

Then the receiver should be tuned for a normal picture by using fine tuning control on front panel of receiver. This control must not be touched during the rest of the adjustment procedure.

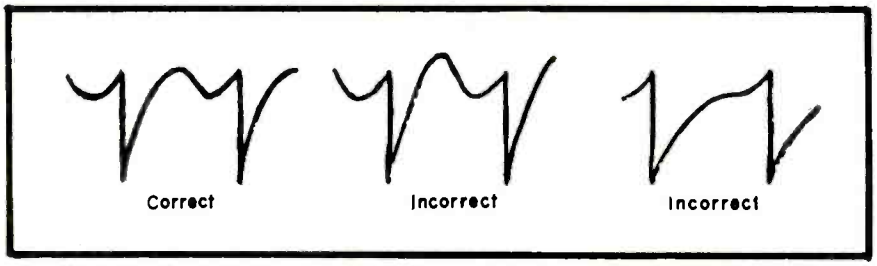
Now a pigtail should be soldered to the tube shield of the mixer-oscillator, and the shield lifted so that it is not grounded to chassis; do not remove shield from tube.

A standard signal generator should be connected to the pigtail and a *vtvm* to the green lead coming from the crystal detector shield can. The signal generator should then be set accurately to 27.3 mc, and adjacent-channel sound trap adjusted for minimum reading on the *vtvm*.

With a normal picture and a properly tuned receiver, a slight readjustment of the adjacent-channel sound trap coil slug may be necessary in weak signal areas to minimize further sound interference as viewed on the screen.

[1]Stewart-Warner part No. 522017.

Fig. 3. Correct and incorrect waveforms obtained when aligning syncroguide transformer in Stewart-Warner TV models.



Syncroguide Transformer Alignment

ALIGNMENT OF the syncroguide transformer used in the horizontal oscillator circuit of *Stewart-Warner 9300* chassis that *do not* include the letter *Q* in the series designation at the rear of the chassis, can be accomplished by utilizing the procedure outlined below. To perform this alignment, it will be necessary to use a 'scope; preferably one that has a 2-mc response and a low input capacity probe (under 100 mmfd to ground).

Alignment: The *top* and bottom slugs of the syncroguide transformer should

(*Continued on page* 80)

Servicing Helps

(*Continued from page 78*)

first be set to their maximum counter-clockwise positions. Then terminals *C* and *D* of the transformer should be shorted, and the *horizontal range* control, located on rear of chassis pan, set to its maximum clockwise position. The horizontal hold control, located at front of chassis, should be set to its maximum counter-clockwise position.

Receiver should now be turned on and any local TV channel tuned in.

Top slug should be adjusted clockwise until picture just locks in horizontally.

Short on terminals *C* and *D* should now be removed. If picture does not hold sync when short is removed, bottom slug should be adjusted clockwise until picture locks in. The 'scope should now be connected to terminal *C* of the syncroguide transformer and sweep rate of 'scope adjusted until two cycles of the waveform remain stationary. The *bottom slug* should be turned clockwise until waveform peaks are equal in height as shown in Fig. 3 (p. 78).

Warning: The first peak of the waveform should never be higher than the second peak, nor should the first peak be lower than the second peak by more than 3%. When adjusting the *bottom slug*, the picture must be in sync; therefore it may be necessary to turn the *horizontal hold* control clockwise when performing this step.

Vertical Crosstalk Cures

Under certain conditions, such as fringe area reception and transmitter variations, vertical shading or crosstalk and horizontal ringing, might be noticed on some *Columbia 800* chassis.

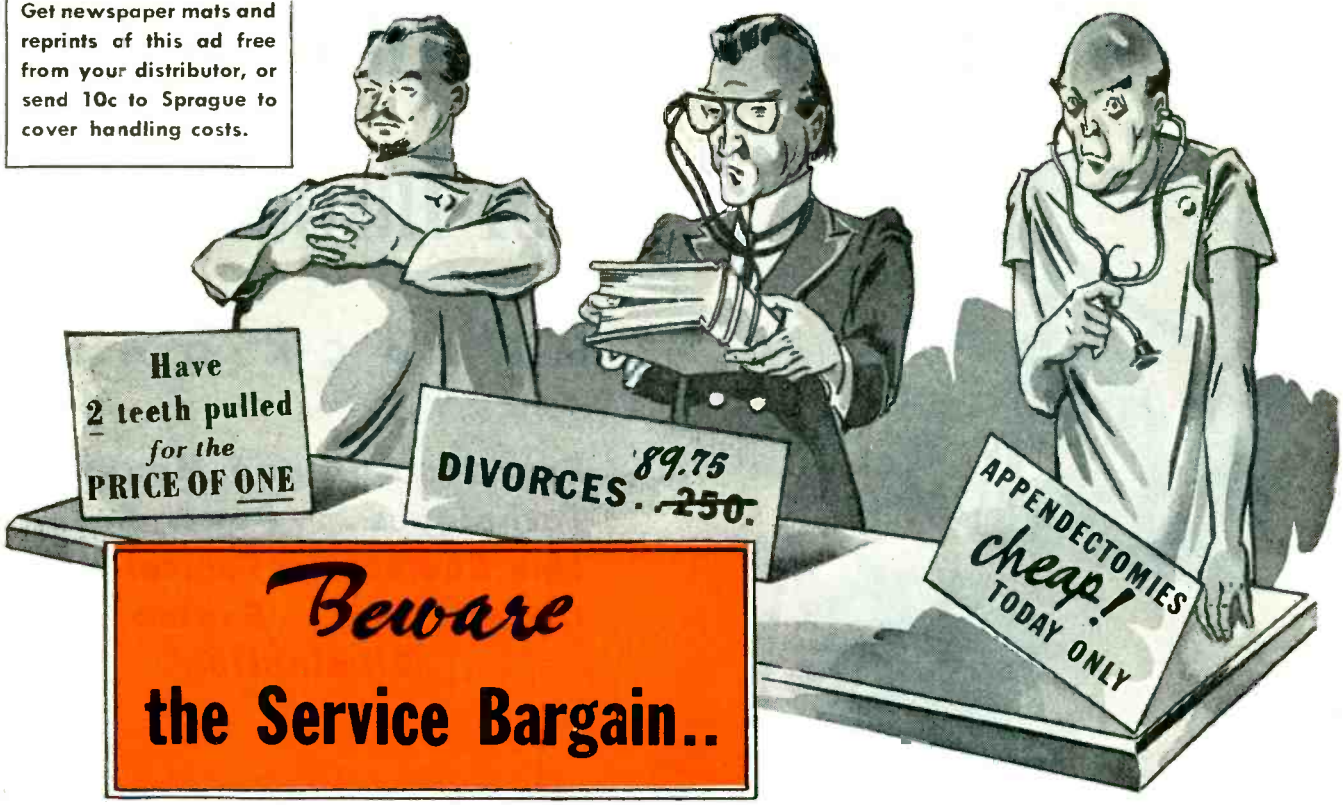
In most cases, the shading has been found to be due to crosstalk in the deflection yoke; this can be lessened by increasing the value of the .01 mfd/600 capacitor (C_{220}) to .1 mfd/600 *v*.

To compensate for excessive ringing in the flyback circuit which appears on the raster as alternate light and dark vertical bars, the following network should be added to the horizontal blanking circuit, Fig. 2; p. 78.

Modification changes: The 2.2-megohm resistor (R_{227}) should be changed to 330,000 ohms (1 watt). The 220-mfd (1000 *v*) capacitor (C_{318}) now becomes a 680,000-ohm (1 watt) resistor. And the 15,000-ohm (1 watt) resistor is also changed to a 680,000-ohm resistor (1 watt). Then two additions must be made: A 10-mmfd

(*Continued on page 100*)

Get newspaper mats and reprints of this ad free from your distributor, or send 10c to Sprague to cover handling costs.



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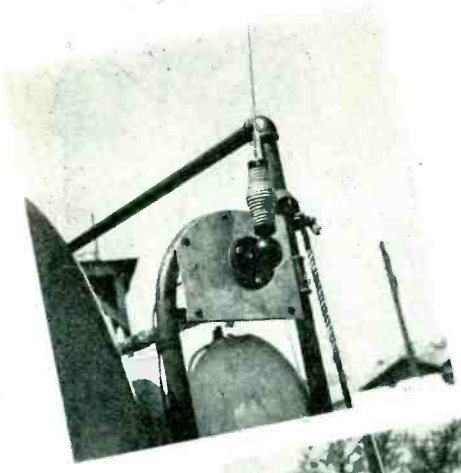
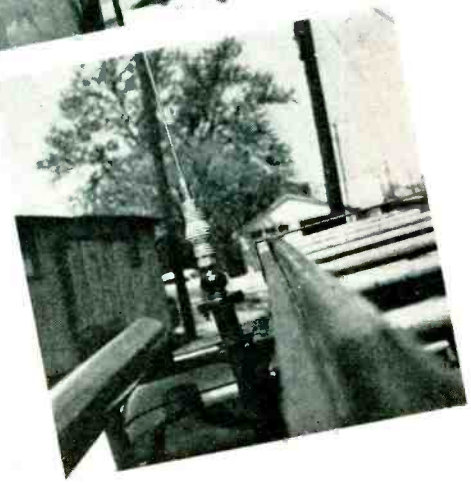


Above: Fig. 1. FM antenna mounted on frame of fuel-tank holder.



Left: Fig. 2. FM antenna mounting on pipe.

ANTENNA MOUNTING on pickup trucks requires careful planning. The 152 to 162-mc whips are generally mounted in the center of the cab-roof, and the leadin brought down inside the headlining. This is usually a heavy fiberboard, held in place by screws; the board can easily be removed or loosened enough to allow access to the cable and antenna mount. If the set is mounted above the floor of the truck-bed, a hole should be drilled through the back of the body, close to the set's cabinet, and the leadin brought through into the cabinet, a heavy rubber grommet being inserted in the hole to prevent cable chafing. One word of caution: If there are ladder or pipe racks or other gear mounted over or near the cab-roof, it is important to be sure that none of these items are within a ¼ wavelength of the antenna base, or about 20". Large metal objects which are closer than this can cause severe distortion of the antenna's radiation pattern.

The longer whips used in the 30 to 50-mc band present a different problem. They must be mounted on some part of the body which will afford sufficient clearance for the rod when the transmitter is in use, but still have a minimum of height above the body, for clearance.

Compromise Installation

A compromise is, of course, the only answer. Good results have been obtained with mounts on the upper back corner of the cab, and with mounts also on part of the truck's framework close to the sets, as shown in Fig. 1. In this instance, the plate was bolted to part of the pipe framework holding the fuel tank. Incidentally, for *vhf* work, this type of mount *must* be grounded to the body; preferably with a heavy braided strap. An excellent mounting is shown in Fig. 2.*

A standard mobile-base, bolted to the top of a length of heavy steel pipe, was strapped to the truck frame. A pipe-flange was welded to the top of each pipe and the antenna base bolted down to this. The leadin coax cable was run down inside the pipe, emerging into the cabinet holding the sets.

In some cases, by special permission, the sets can be mounted inside of the cab, on the floorboards. This can be done only in special cases, since such an installation kills passenger space inside the cab, although it does save quite a bit of time in cable-taping, routing, etc. This particular location is usually a messy one and sets must be protected against damage from tools or other equipment that might be dropped upon them. The cases should be provided with some sort of cover, to prevent entrance of floorboard dust and dirt; also moisture from inadvertently opened windows. A sheet-metal cover has been found to be the best for this purpose; as tape or other sealing materials will soon be kicked and scuffed off. Excess cables should be protected, too; they should be tucked up and behind the case, out of the way, and fastened securely in place.

Truck generators are somewhat heavier than the pleasure car types; thus no trouble is usually experienced in keeping the battery up. It is a good idea to connect the hot lead through the ignition switch, however, to prevent the radio equipment from being left on accidentally overnight. This is a comparatively simple connection to make on most sets. The RCA

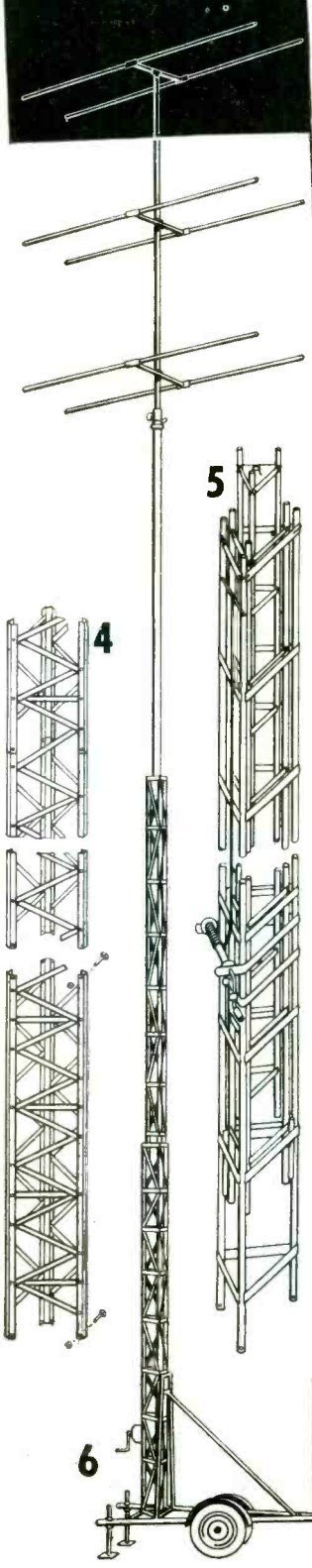
(*Continued on page* 89)

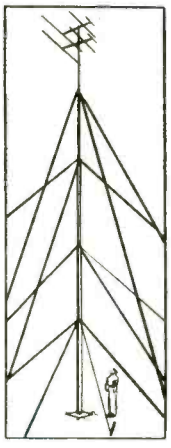
*These mounts were made by J. L. DeCamp, transportation superintendent of the Southwestern Gas & Electric Co. at Texarkana, Ark.-Texas. The sets were installed by Beall Radio Service of the same city.

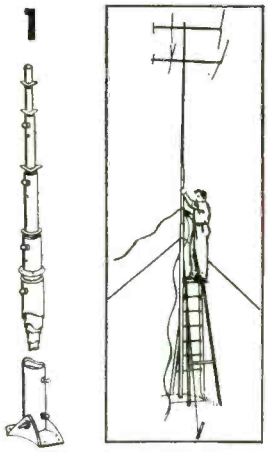
TV MASTS and TOWERS

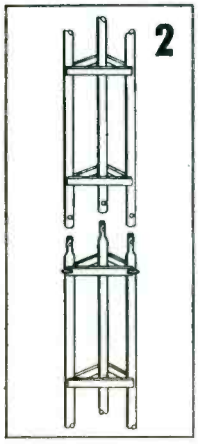
What do you want to buy? What do you want to pay?

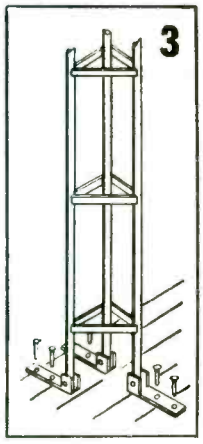
YOUR *Admiral* DISTRIBUTOR *has it!*











1. TELESCOPING MASTS *up to 50 ft. high*

These masts are available in 2, 3, 4 or 5 sections, each 10-foot section telescoped within the next section. Up to fifty feet in height just by extending sections and tightening bolts. Lowering mast one section at a time provides easy access to antenna or line for servicing. Mast may be completely rotated by hand from the base section. Finest quality throughout . . . cold rolled seamless steel tubing, bright zinc plated for weather resistance. Furnished complete with all necessary accessories.

Suggested retail price, 20 foot mast, No. M- 1 . . . . . $12.50
Suggested retail price, 30 foot mast, No. M- 4 . . . . . 22.10
Suggested retail price, 40 foot mast, No. M- 6 . . . . . 34.75
Suggested retail price, 50 foot mast, No. M-30 . . . . . 52.75

2. SECTIONAL STEEL TOWERS *up to 100 ft. high*

Furnished in 10-foot sections which are easily fastened together for any desired height up to 100 feet. Quality built of heavy duty tubular steel, electrically welded throughout. Can be mounted on any peaked, pitched or flat surface with accessory angle base plate.

Suggested retail price, standard 10 ft. section, No. M-13, $17.95

3. SINGLE SECTION STEEL TOWERS *10 ft. or 20 ft. high*

For low cost guyed or unguyed installations. Tubular steel, electrically welded throughout. Complete with self-aligning mounting brackets.

Suggested retail price, 10 ft. tower, No. M-15 . . . . . $21.95
Suggested retail price, 20 ft. tower, No. M-16 . . . . . 35.75

4. SECTIONAL ALUMINUM TOWERS *up to 120 ft. high*

Furnished in knocked down or preassembled 6-foot sections. This tower may be easily erected in one piece to 42 feet in height. Six-foot sections may be added to maximum height of 120 feet. Made of spring-tempered aircraft aluminum alloys. Combines highest strength with amazingly light weight of only one lb. per foot for safe, easy installation, low shipping cost. Unexcelled corrosion resistance. Available accessories include mast kit, rotator adaptor kit, hinged aluminum base plate and rotating universal base for manual rotation of tower.

Suggested retail price, 6 ft. section, No. M-21 . . . . . $16.50

5. CRANK-UP STEEL TOWERS *28-38-55 ft. lengths*

Made in two or three telescoping sections, raised and lowered with hand crank. Ideal for experimental work and deluxe installations, especially in hurricane areas. Also suitable for mounting on panel trucks. Heavy duty tubular steel, electrically welded throughout. Angle base plate included for mounting on any peaked, pitched or flat surface.

Suggested retail price, 28 ft. tower, No. M- 9 . . . . . $ 79.50
Suggested retail price, 38 ft. tower, No. M-10 . . . . . 99.50
Suggested retail price, 55 ft. tower, No. M-11 . . . . . 164.50

6. TRAILER-MOUNTED TOWER *for fringe area demonstration*

Designed for fast, easy, one-man operation. Maximum extended height 75½ ft. Minimum length 21 ft. Overall trailer length 16 ft. 6 in. Worm type winches for raising and extending mast provide important safety factor . . . prevent mast from collapsing if winch handle is accidentally released. Full 360 degree antenna rotation. Includes standard trailer coupler and ball. See your Admiral Distributor *now* about special offer for limited time only.

Call your ***Admiral*** *Distributor for*

ADMIRAL TV ANTENNAS • TUBULAR STEEL TV TABLES
MOUNTING HARDWARE and ACCESSORIES

Admiral Corporation, **Accessories and Equipment Division, Chicago 47, Ill.**

Ser-Cuits

(*Continued from page* 40)

stantially the same whether the sync pulses in the *agc* information were made into sawtooth signals or not. If the sync pulses were passed on to the grid of this tube as pulses and not in the form of a sawtooth, coincidence of the grid and plate pulses in the tube would be necessary to make the tube conduct. The sawtooth on the grid of the tube keeps the grid in conduction range, so that exact coincidence is not necessary to get the full benefit of the *agc* action.

If pulses were used on the grid of the pulsed *agc* tube, at the ends of the horizontal hold range or, if the receiver goes out of sync, the lack of complete coincidence would cause less than normal *agc* to be developed. This would result in contrast changes with the horizontal hold setting and reduce horizontal pull-in range. These undesirable effects are eliminated by use of the sawtooth.

If the same *agc* voltage could be used for *rf* as well as *if* bias, the filtering circuit shown in Fig. 1 (p. 40) would be sufficient. However, it is desirable to have the application of the *rf* bias delayed until several volts of *if* bias have been developed, and then have the *rf* bias rise as rapidly as possible after the delay has been overcome. This is because the *rf* bias must meet two requirements:

(*1*) It must not reduce the gain of the *rf* amplifier until the signal level has risen to such an extent, that the noise introduced by the converter need not be overridden by the *rf* amplifier gain.

Under normal design characteristics, it is possible to have the *rf* tube, the converter stage and, possibly, even the first *if* tube, introduce noise into the circuit. Generally, the design of the circuit around the *rf* tube calls for best possible noise factor with at least 5:1 gain. Such results will provide the converter stage with enough clean signal so that it can amplify cleanly. If the *rf* tube has very low gain, say about 1:1, then the converter stage could introduce some noise, especially since a pentode is used in this circuit. This would hold true even though the received signal at the antenna were fairly strong; say about 1,000 microvolts.

(2) It must reduce the gain of the *rf* amplifier sufficiently on strong signals so that the converter is not overdriven.

The circuit used in this chassis to obtain desired *rf* and *if* bias characteristics is shown in Fig. 3 (p. 41). The

47,000-ohm resistor (R_{86}) between the plate of the pulsed *agc* amplifier and the *agc* voltage divider network, is only a decoupling resistor for the *ac* pulse on the plate and is relatively unimportant for *dc* consideration. The other four resistors (R_{70}, R_{81}, R_{92} and R_{93}) are important and determine the value of the *rf* and *if* bias voltages.

Although the high side of R_{70} is tied to B++ (270 volts) for delay purposes, the low side of this resistor, at the junction of R_{81} and R_{79} cannot go positive to any extent on weak signals, because this point is tied to the plates of the twin diodes of the 6AV6 *rf agc* clamp and first audio amp (V_9). Since the cathode of this tube is tied to ground, any positive voltage appearing at point *B* would cause conduction and keep the potential at this point close to ground. Since this junction is the takeoff for the *rf* bias, it can be realized why it is undesirable to have a positive voltage there. However, this point can go in the negative direction from ground or zero potential, after a certain amount of negative *agc* voltage is developed at the 47,000-ohm (R_{86}) minus point.

Servicing Techniques for AGC System

Improper *agc* action will fall into one of three general categories: (1) Insufficient *agc;* (2) excess *agc;* and (3) improper division between *rf* and *if* bias.

The insufficient *agc* condition will be evidenced in the picture in various ways depending on the degree of insufficiency. If there is no *agc* developed, the contrast will increase rapidly as the signal increases from a low level. Synchronizing will be unstable on weak signals and very poor on slightly stronger ones. On strong signals, the picture may reverse and appear as a negative or go completely black. If some *agc* is developed, but not enough, the set may exhibit overload tendencies on strong signals and the effects will not be as severe as when no *agc* is being developed.

Too much *agc* is evidenced by a lack of available contrast, or, in extreme conditions, by a complete lack of picture at any signal level.

Checking for the development of proper *agc* voltage can best be done by measuring the voltage at the top of the *agc* dividing resistors (junction of R_{81}, 180,000 ohms) and R_{92} (330,000 ohms) with a *vtvm*. With a normally strong signal, the voltage at this point should read about —60. A voltage reading considerably higher than this would indicate a short or open on one of the *agc* buses, or a grid-cathode short in the *agc* amplifier tube. A voltage considerably lower than this could indicate a lack of second detector signal due to a failure of tuner or *if* amplifier. This can be checked by measuring *dc* at the second detector; it should exceed —2 volts. The condition can also be caused by a lack of *agc* referencing pulse. This problem can be checked with a 'scope on the plate of the *agc* amplifier; this point can be touched with an insulated handle screwdriver, watching for a small spark. A grid can also be shorted to cathode on *agc* amplifier with a screwdriver. Voltage at junction of the 330,000 and 180,000 ohm resistors or pin 6 of V_{11b} of the *agc* dividing resistors should rise to about –100. This indicates proper pulse voltage and a good *agc* amplifier tube.

If the second detector voltage is highly negative and the *agc* tube develops —100 volts or more when grid and cathode are shorted together, the trouble is in the sync amplifier and associated circuits, or in the cathode circuit of the *agc* amplifier. Cathode *v* should be about 150 + on strong signals.

Improver division between *rf* and *if agc* voltages will show up on strong signals. If the picture is snowy on

(*Continued on page* 88)

TV Station Listing: Part 2

City	Call Letters	Channel
ILLINOIS		
Belleville	WTVI	Signal Hill Telecastg Corp., 6900 W. Main St. 54
Bloomington	WBLN	Cecil W. Roberts, 909 Mich. Ave., Farmington, Mo. 15
Champaign	WCIA	Midwest Television, Inc., 2501 S. Neil St. 3
Chicago	WBBM-TV	Columbia Bcstg System, Inc., 485 Madison Ave., N.Y.C. 4 (2)‡[1]
	WBKB	American Bcstg-Paramount Theatres Inc., 7 W. 66th St., N.Y.C. 7‡
	WGN-TV	WGN, Inc., 441 N. Mich. Ave. 9‡
	WNBQ	Nat'l Bcstg Co., Inc., Merchandise Mart. 5‡
	WIND-TV	Johnson Kennedy Radio Corp., 400 N. Mich. Ave. 20
	WHFC-TV	WHFC, Inc., 3350 S. Kedzie Ave. 26
Danville	WDAN-TV	Northwestern Publ. Co., 17-19 W. North St. 24
Decatur	WTVP	Prairie Tele. Co., 250 N. Water St. 17
Harrisburg	WSIL-TV	Turner-Farrar, 21½ W. Poplar St. 22
Peoria	WEEK-TV	West Central Bcstg Co., 100 Commercial National Bank Bldg. 43*
	WTVH-TV	Hilltop Bcstg Co., 406 Fayette Bldg. 19
Quincy	WGEM-TV	Quincy Bcstg Co., Hotel Quincy 10
Rockford	WTVO	Winnebago Tele. Corp., 190 N. State St., Chicago 39*
	WREX-TV	Greater Rockford Tele., Inc., 815 Rockford Trust Bldg. 13
Rock Island	WHBF-TV	Rock Island Bcstg Co., Telco Bldg. 4‡
Springfield	WICS	Plains Tele. Corp., c/o U.S. Corp. of Ill., 33 N. La Salle St., Chicago 20
INDIANA		
Bloomington	WTTV	Sarkes Tarzian, Inc., 539 S. Walnut St. 10 (4)‡[1]
Elkhart	WTRC-TV	Truth Publ. Co., Inc. 416 S. 2nd St. 52
Evansville	WFIE	Premier Tele. Inc., 215 Sycamore St. 62
Ft. Wayne	WKJG-TV	Northeastern Ind. Bcstg Co., Inc., 20 E. Jefferson St. 33
Indianapolis	WFBM-TV	WFBM, Inc., 1330 N. Meridian St. 6‡
	WJRE	Marion Radio Corp., 303½ S. Adams St. 26
	WNES	Empire Coil Co., Inc., 85 Beechwood Ave., New Rochelle, N. Y. 67
Lafayette	WFAM-TV	WFAM, Inc., McCarty Lane 59*
Marion	WMRI-TV	Chronicle Publ. Co., Inc., 610 S. Adams St. 29
Muncie	WLBC-TV	Tri-City Radio Corp., 420 Alden Rd. 49*
Princeton	WRAY-TV	Princeton Bcstg Co., c/o M.R. Lankford, Box 28 52
South Bend	WSBT-TV	South Bend Tribune, 225 W. Colfax Ave. 34*
Waterloo	WINT	Tri-State Tele., Inc., 114 Engrs. Bldg., Cleveland, Ohio 15
IOWA		
Ames	WOI-TV	Iowa State College of Agr. & Mech. Arts 5 (6)‡[1]
Cedar Rapids	WMT-TV	American Bcstg Stations, Inc., Paramount Theatre Bldg. 2
Davenport	WOC-TV	Central Bcstg Co., 1002 Brady St. 6‡
	KDIO	Mel-Foster-Harold Hoersch, 316 Brady St. 36
Des Moines	KTLV	Rib Mountain Radio, Inc., 1225 Tower Ave., Superior, Wis. 17
IOWA		
Ft. Dodge	KQTV	Northwest Tele. Co., 912 First Ave 21
Sioux City	KCTV	Great Plains Tele. Properties of Ia. Inc., c/o U.S. Corp. of Ill., 33 N. LaSalle St., Chicago 36
	KVTV	Cowles Bcstg Co., Frances Bldg. 9*
KANSAS		
Hutchinson	KTVH	Hutchinson TV, Inc., 601 Wolcott Bldg. 12*
Pittsburgh	KOAM-TV	The Pittsburgh Bcstg Co., Inc., Professional Bldg. 7
Topeka	WIBW-TV	Topeka Bcstg Assn. Inc., 1035 Topeka Blvd. 13
Wichita	KEDD	The C.W.C. Co., Inc., 1806 Baltimore Ave., Kansas City, Mo. 16
KENTUCKY		
Ashland	WPTV	Polan Industries, 321—8th St., Huntington, W. Va. 59
Henderson	WEHT	Ohio Valley Tele. Co., RFD 3 50
Louisville	WAVE-TV	WAVE, Inc., 334 E. Broadway 3‡
	WKLO-TV	Mid-American Bcstg Corp., Henry Clay Hotel 21
	WHAS-TV	WHAS, Inc., 6th & Broadway 11‡
	WLOU-TV	Robert W. Rounsaville, 2549 S. 3rd St. 41
Richmond	.....	Blue Grass Tele. Co., c/o J. W. Betts, Tobacco Sq., Maysville, Ky. 60
LOUSIANA		
Alexandria	KSPJ	Barnet Brezner, 2833 Lee St. 62
Baton Rouge	WAFB-TV	Modern Bcstg Co., Box 1566 28*
	KHTV	Capital Tele. & Bcstg Co., 204 W. 6th St., Erie, Pa. 40
Lake Charles	KTAG-TV	KTAG, Inc., Box 30, Baton Rouge 25
Monroe	KNOE-TV	James A. Noe, Bernhardt Bldg. 8
	KFAZ	Delta Tele. Inc., 3708 DeSard St. 43
New Orleans	WDSU-TV	WDSU Bcstg Corp., 520 Royal St. 6‡
	WJMR-TV	Supreme Bcstg Co., Inc., 1500 Canal St. 61
	WTLO	New Orleans Tele. Co., Magnolia Bldg., Dallas, Tex. 20
	WCNO-TV	Community Tele. Corp., 505 Barrone St. 32
	.....	CKG Tele. Co., Melrose Bldg., Houston, Tex. 26
MAINE		
Bangor	WABI-TV	Community Telecstg. Service, 57 State St. 5*
Portland	WPMT	Portland Telecstg. Corp., Columbus Hotel 53
MARYLAND		
Baltimore	WMAR-TV	A. S. Abell Co., Sun Square 2‡
	WBAL-TV	The Hearst Corp., 2610 N. Charles St. 11‡
	WAAM	WAAM, Inc., 3725 Malden Ave. 13‡
	WITH-TV	WITH-TV, 7 E. Lexington St. 60
Frederick	WFMD-TV	The Monocacy Bcstg Co., E. Church St. 62
Salisbury	WBOC-TV	The Peninsula Bcstg Co., Radio Park 16
MASSACHUSETTS		
Boston	WBZ-TV	Westinghouse Radio Stations, Inc., 1170 Soldiers Field Rd. 4‡
	WNAC-TV	General Teleradio Inc., 21 Brookline Ave. 7‡
	WSTB-TV	E. Anthony & Sons, Inc., 555 Pleasant St., New Bedford, Mass. 50
Cambridge	WTAO-TV	Middlesex Bcstg Corp., 439 Concord Ave. 56
Lawrence	.....	General Bcstg Co., 11 Pemberton St., Boston 72
North Adams	WMGT	Greylock Bcstg Co., 8 Bank Row, Pittsfield 74
Northampton	WNOH	Regional Tele. Corp., Hotel Bridgway, Springfield, Mass. 36
New Bedford	WNBH-TV	E. Anthony & Sons, Inc., 555 Pleasant St. 28
Swansen	WSEE-TV	New England Tele. Co., Inc., 514 Industrial Trust Bldg., Providence, R. I. 46
Springfield	WHYN-TV	The Hampden-Hampshire Corp., 180 High St. 55*
	WWLP	Springfield Tele. Bcstg Corp., 1387 Main St. 61*
Worcester	.....	Salisbury Bcstg Corp., 6 Norwich St. 14
MICHIGAN		
Ann Arbor	WPAG-TV	Washtenaw Bcstg Co., Inc., Hutzel Bldg., Main & Liberty Sts. 20*
Battle Creek	WBCK-TV	Mich. Bcstg Co., Security Nat'l Bank Bldg. 58
	WBKZ-TV	Booth Radio & Tele. Stations Inc., 700 Buhl Bldg., Detroit 64*
Cadillac	WWTV	Sparton Bcstg Co., 2301 E. Mich. Ave. 13
Benton Harbor	WHFB-TV	Palladium Publ. Co., 59 Wall St. 42
Detroit	WWJ-TV	The Eve. News Assn., 615 W. Lafayette 4‡
	WJBK-TV	Storer Bcstg Co., 500 Temple Ave. 2‡
	WXYZ-TV	WXYZ, Inc. Mutual Bldg. 7‡
E. Lansing	WKAR-TV	Mich. State Board of Agr., State College 60
Flint	WIAC-TV	Trendle-Campbell Bcstg Corp., Mutual Bldg., Detroit 16
	WCTV	Trans-America Tele. Corp., 1420 Walnut St., Phila., Pa. 28
Grand Rapids	WOOD-TV	Granwood Bcstg Co., Grand Rapids Nat'l Bank Bldg. 7 (8)‡[1]
Jackson	WIBM-TV	WIBM, Inc., 2511 Kibby Rd. 48
Kalamazoo	WKZO-TV	Fetzer Bcstg Co., 124 W. Mich Ave. 3‡
	WKMI-TV	Howard D. Steere, State Theatre Bldg. 36

‡Licensed pre-freeze station.

*Operating under special authority since freeze lift.

st—Sharing time.

[1]Old and new channel assignment.

**Stations without superscripts have been authorized to operate, but have not begun to telecast.

Now on the Air and Authorized to Operate**

City	Call Letters		Channel
MICHIGAN			
Lansing	WJIM-TV	WJIM, Inc., Bank of Lansing Bldg.	6‡
	WILS-TV	Lansing Bcstg Co., 407 N. Wash. Ave.	54
Muskegon	WTVM	Versluis Radio & Tele. Inc., 6 Fountain St., N.E., Grand Rapids	35
Saginaw	WKNX	Lake Huron Bcstg Corp., c/o Station WKNX	57*
MINNESOTA			
Austin	KMMT	Minn.-Iowa Tele. Co., Austin	6
Duluth	WFTV	Great Plains Tele. Properties of Minn., Inc., c/o U. S. Corp., 33 N. LaSalle St., Chicago	38*
Minneapolis	WCCO-TV	Midwest Radio Tele. Inc., 50 S. 9th St.	4‡
	WTCN-TV	Minn. Tele. Public Service Corp., 1st Nat'l Bank Bldg., St. Paul	11st
Rochester	KROC-TV	Southern Minn. Bcstg Co., 100 1st Ave. Bldg.	10*
St. Cloud	WJON-TV	Granite City Bcstg Co., 522 Lincoln Ave., S. E.	7
St. Paul	KSTP-TV	KSTP, Inc., 3415 University Ave.	5‡
	WCOW-TV	WCOW Telecstg Co., 208 3rd Ave. N.	17
	WMIN-TV	WMIN Bcstg Co., 538 Hamm Bldg.	11st
MISSISSIPPI			
Columbus	WCBI-TV	Birney Imes, Jr., c/o St. WCBI, Columbus	28
Gulfport	WGCM-TV	WGCM Tele. Corp., Hewes-Martin Bldg.	56
Jackson	WJTV	Miss. Publishers Corp., Box 427	25*
Meridian	WCOC-TV	Miss. Bcstg Co., Box 591	30
	.....	Southern Tele. Corp., Box 1771	11
MISSOURI			
Cape Girardeau	KGMO-TV	KGMO Radio-Tele Inc., c/o KGMO	18
Clayton	KFUO-TV	The Lutheran Church, Mo. Synod, 210 Broadway, St. Louis	30
Columbia	KOMU-TV	The Curators of the U. of Mo.	8
Festus	KACY	Ozark Tele. Corp., Louderman Bldg., St. Louis	14
Hannibal	KHQA-TV	Courier Post Publ. Co., 102½ S. Main St.	7
Kansas City	WDAF-TV	Kansas City Star Co., 3030 Summit St.	4‡
	.....	Midland Bcstg Co., 222 W. 11th St.	9st
	KCTY	Empire Coil Co., Inc., 85 Beechwood Ave., New Rochelle, N. Y.	25*
	KCMO-TV	KCMO Bcstg Co., 125 E. 31st St.	5
	.....	WHB Bcstg Co., Searritt Bldg.	9st
St. Louis	KSD-TV	Pulitzer Publ. Co., 1111 Olive St.	5‡
	KSTM-TV	Broadcast House, Inc., Security Bldg.	36
	WIL-TV	Mo. Bcstg Corp., Chase Hotel	42
St. Joseph	KFEQ-TV	KFEQ, Inc., KFEQ Bldg.	2
Sedalia	KDRO-TV	Milton J. Hinlein, Terry Hotel	6
Springfield	KTTS-TV	Independent Bcstg Co., Chamber of Commerce Bldg.	10*
	KYTV	Springfield Tele. Inc., 605 Boonville Ave.	3
MONTANA			
Billings	KRHT	Rudman-Hayutin Tele. Co., c/o M. B. Rudman	8
	KOOK-TV	The Mont. Network, 7002 S. Billings Blvd.	2
Butte	KOPR-TV	Cooper Bcstg Co., Hotel Finlen	4
	KZLF-TV	Tele. Mont., 1306 11th Ave., Helena	6
Great Falls	KFBB-TV	Buttery Bcstg Inc., 1st Nat'l Bank Bldg.	5
	KMON-TV	The Mont. Farmer, Inc., 412 2nd Ave.	3
Missoula	KGVO-TV	Mosby's Inc., 127 E. Main St.	13
NEBRASKA			
Lincoln	KOLN-TV	Cornhusker Radio & Tele. Corp., Box 987	12*
	KFOR-TV	Cornbelt Bcstg Corp., Stuart Bldg.	10*
Omaha	KMTV	May Bcstg Co., 2615 Farnam St.	3‡
	WOW-TV	Meredith WOW Inc., Insurance Bldg.	6‡
NEVADA			
Las Vegas	KLAS-TV	Las Vegas Tele. Inc., Box 1510	8
Reno	KZTV	Nev. Radio-Tele. Inc., Riverside Hotel	8
NEW HAMPSHIRE			
Keene	WKNE-TV	WKNE Corp., 17 Dunbar St.	45
NEW JERSEY			
Asbury Park	WRTV	Atlantic Video Corp., c/o Walter Read, Jr., 710 Matheson Ave.	58
Atlantic City	WFPG-TV	Neptune Bcstg Corp., Steel Pier	46*
	WOCN	Matta Enterprises, 1233 Braddock Ave., Braddock, Pa.	52
New Brunswick	WDHN	Home News Publ. Co., 127 Church St.	47
Newark	WATV	Bremer Bcstg Corp., 1020 Broad St.	13‡
NEW MEXICO			
Albuquerque	KOB-TV	Albuquerque Bcstg Co., 234 S. 5th St.	4‡
	KGGM-TV	New Mexico Bcstg Co., Box 1294	13
	KOAT-TV	Alvarado Bcstg Co., Inc., 122 S. Tulane	7
Clovis	KNEH	Telepolitan Bcstg Co. Star Route	12
Roswell	KSWS-TV	John A. Barnett, Box 670	8*
Santa Fe	KTVK	Greer & Greer, Lansic Bldg.	2
NEW YORK			
Albany	WROW-TV	Hudson Valley Bcstg Co., Inc., 204 Wash. Ave.	41
	WPTR-TV	Patroon Bcstg Co., Inc., Hotel Ten Eyck	23
Binghamton	WNBF-TV	Clark Associates, Inc., Arlington Hotel	12‡
Buffalo	WBES-TV	Buffalo-Niagara Tele. Corp., Elicott Sq. Bldg.	59
	WBEN-TV	WBEN, Inc., Hotel Statler	4‡
	WBUF-TV	WBUF-TV, Inc., 797 Seneca St.	17
Elmira	WTVE	Elmira Television, c/o Sales & Evans, 415 E. Water St.	24*
	WECT	El-Cor Tele. Inc., c/o Walter Valerius, 222 E Market St.	18
NEW YORK			
Ithaca	WHCU-TV	Cornell University, Savings Bank Bldg.	20
Jamestown	WJTN-TV	James Bcstg Co., Inc., 110 W. 3rd St.	58
Kingston	WKNY-TV	Kingston Bcstg Corp., 17 Dunbar St., Keene, N. H.	66
New York	WABD	Allen B. DuMont Labs., Inc., 515 Madison Ave.	5‡
	WCBS-TV	Columbia Bcstg System, Inc., 485 Madison Ave.	2‡
	WJZ-TV	American Bcstg-Paramount Theatres, Inc., 7 W. 66th St.	7‡
	WNBT	Nat'l Bcstg Co., Inc., 30 Rockefeller Plaza	4‡
	WOR-TV	General Teleradio, Inc., 1440 Broadway	9‡
	WPIX	WPIX, Inc., 220 E. 42nd St.	11‡
Poughkeepsie	WEOK-TV	Mid-Hudson Bcstrs Inc., 385 Main St.	21
Rochester	WHAM-TV	Stromberg-Carlson Co., 100 Carlson Rd.	6 (5)*¹
	WVET-TV	Veterans Bcstg Co., Inc., 17 Clinton Ave.	10st
	WHEC-TV	WHEC, Inc., 40 Franklin St.	10st
	WRNY-TV	Genessee Valley Tele. Corp., 40 N. Main St., Gloversville, N. Y.	27
	.....	Star Bcstg Co., Inc., 87 Seneca St., Geneva, N. Y.	15
Schenectady	WRGB	General Electric Co., 1 River Rd.	4 (6)‡¹
	WTRI	Van Curler Bcstg Corp., Proctor's Theatre Bldg.	35
Syracuse	WHEN	Meredith Syracuse TV Corp., 101 Court St.	8‡
	WSYR-TV	Central N. Y. Bcstg Corp., 224 Harrison St.	5 (3)‡¹
Utica	WKTV	Cooper City Bcstg Corp., Smith Hill Rd.	13‡
Watertown	WWNY-TV	The Brockway Co., 120-132 Arcade St.	48
NORTH CAROLINA			
Asheville	WISE-TV	Radio Station WISE, Inc., 89 College St.	62*
Charlotte	WAYS-TV	Inter-City Adv. Co. of Charlotte, N. C., Inc., 102 E. 3rd St.	36
	WBTV	Jefferson Standard Bcstg Co., Wilder Bldg.	3‡
Durham	WCIG-TV	T. E. Allen & Sons, Inc., Fidelity Bldg.	46
Greensboro	WFMY-TV	Greensboro News Co., 212 N. Davis St.	2‡
	WCOG-TV	Inter-City Adv. Co. of Greensboro, N. C., Inc., 316 S. Greene St.	57
Greenville	WNCT	Carolina Bcstg System, Inc., Box 898	9
Hendersonville	WHKP-TV	Radio Hendersonville Inc.	
Mt. Airy	WPAQ-TV	Ralph D. Epperson	55
Raleigh	WNAO-TV	Sir Walter Tele. Co., 204 W. 6th St., Erie, Pa.	28
Winston-Salem	WTOB-TV	Winston-Salem Bcstg Co., Inc., 826½ W. 4th St.	26
NORTH DAKOTA			
Bismark	KFYR-TV	Meyer Bcstg Co., 200½ 4th St.	5
	KBSM	Rudman Tele. Co., 5507 Elden Dr., Dallas, Tex.	12
Fargo	WDAY-TV	WDAY, Inc., 118 Broadway	6*
Minot	KNDK	Rudman Tele. Co.	10
	KCBJ-TV	N. Dak. Bcstg Co., Inc., 15-A W. Central Ave.	13*

[To Be Continued]

Community TV

(*Continued from page* 39)

graph, and the final results of the tests were far from encouraging. The field strength readings from Schenectady were less than 40 microvolts well over 60 per cent of the time. Readings from Boston were much lower, but the Montreal signal was excellent. The problem now was how to improve these weak signals. In community TV work, the only way the signal-to-noise ratio, which is what determines the picture quality, can be improved is through the use of higher gain antennas. The problem was placed before a manufacturer of TV system equipment in Cambridge, and after careful consideration a newly developed type of antenna, now known as the Horn antenna, was suggested. This proposed antenna was described as having a calculated gain of 20 db over a dipole, the highest theoretical gain now possible to develop. However, the dimensions of the antenna were found to be so large and the construction so involved, that a trial run of the actual antenna would not be possible.

To test the proposed antenna a carefully constructed model was built and readings made to determine the experimental results. Fortunately, the results showed that the antenna would have sufficient gain over the previously used *yagis* to produce a picture of satisfactory quality. After reviewing a simulated reproduction of the signal that would be available from the new antenna, it was decided to go ahead with the community system.

The next step was a legal one: It was necessary to make arrangements to satisfy the many legal requirements for a TV distribution system. First, a franchise had to be obtained from the city council to permit the installatin of cables, electronic equipment, and additional poles where necessary, and obtain permission for right of ways to cross streets and buildings. The city council proved very receptive to the idea of a community system, and once they were assured they would have to bear no responsibility for the construction and maintenance of the system, their approval was wholeheartedly granted.

It was now possible to negotiate with the telephone and power companies for permission to mount the amplifiers, distribution equipment, and coax cable on their poles. The utility companies proved very cooperative in this venture. However, to insure proper practices by the TV operating company and to protect the telephone company from any claims for damage

it was necessary to post a performance bond. Once the extensive negotiations were completed, the telephone company gave permission to begin construction of the community system.

It was necessary to agree to adhere to many special rules and regulations during construction and operation. For instance, operators were told that TV cable must be located on the same side of pole, preferably above telephone cable. When telephone open wire only is present the TV cable may be either above or below the open wire. Vertical runs must be so placed as to provide a minimum separation of 2" from all telephone equipment and through bolts, and shall not interfere with the use of pole steps and telephone equipment.

TV cable, it was said, must be supported on a strand which is effectively grounded to multigrounded power neutral wires or underground water pipe systems. An effective ground should also be located as near as practicable to the master antenna. In the absence of a multigrounded power neutral or water pipe ground, a driven ground of 25 ohms, or less should be placed. Where a ground resistance of 25 ohms cannot be obtained with one electrode, multiple interconnected electrodes shall be provided. It was also noted that telephone and television strand must be bonded by No. 6 solid copper wire at the first and last pole, and at every tenth pole, until the remaining section is not more than 13 or less than 4 spans.

When the vertical power lead for the television equipment is a multiple conductor cable, it was noted, each conductor of such cable which is not effectively grounded shall be insulated for a potential of at least 600 volts.

In addition, the rules declared that the supporting strand for television service cable to customers' premises must be bonded to the television line-cable-supporting strand.

Then began the many and involved steps of construction. Not the least of these problems was the selection of the type of equipment to be used. After a careful study of the various factors involved, it was decided to use amplifiers of the chain type. Such amplifiers were chosen because they amplify the entire TV band, and they do not need to be tuned in the field, thus eliminating a major maintenance problem. In addition, since all the tubes are in parallel, a tube failure does not result in the loss of a picture.

While the antennas were designed to receive only three stations, it was decided to select equipment that would allow future channels to be added if

(*Continued on page* 108)

ASSOCIATIONS

At service meeting in San Francisco sponsored by G. M. Popkey (left), which featured a talk by John F. Rider (on stage). Over 1000 Service Men attended.

ONE OF THE MOST interesting gatherings of the year, the annual clambake-meeting of NETSDA and FRSAP, held a few weeks ago at Lily Lake, Pa., attracted over 100 delegates from the state and national groups. Cities represented included Harrisburg, Philadelphia, Reading, Altoona, Hollidaysburg, Wilkes-Barre, Scranton, Carbondale, Chambersburg, Williamsport, Pittsburgh, York, Steelton, Long Island, and New York.

Milan Krupa, FRSAP prexy, presided over the State meeting, which featured a roundup of association and industry problems, and discussions of proposed solutions. A highlight of the affair was a survey of licensing prospects for the state associations. It was pointed out by some representatives that although the measure introduced into the State legislature had been tabled, every effort should be exerted to have the bill resubmitted. And, it was stressed, the new proposal should be studied carefully to be sure that it will not be criticized for any weakness, insofar as control or acceptance inequities are concerned. The state measure was also described as superior to suggested municipal ordinances, at least for the state of Pennsylvania, because of the unique urban-suburban makeup of most communities. Large city measures, it was said, would be of little value, since the state is dotted with towns, villages and cities, and each could require some means of control. In addition, in most areas, there are actually more suburbanites than large-city dwellers. Thus, it would probably be more important to have legislation in the towns and villages, than in the city proper.

The extremely active educational work of TSDA was also reported on, one delegate stating that two TV stations were now carrying special programs sponsored by the group; WHUM-TV and WFIL. In the latter case, a half hour is currently devoted to problems of the day. Described are typical difficulties that may

(*Continued on page* 102)

At the annual FRSAP-NETSDA conclave at Lily Lake: Charles Scheffs, Joseph Montel, Maurice Rader, Roy Strob, George W. Frisbie, Dan Evans, Frank Chebalo, John Beeunas, Phil Jones, Al Williams, Jr., Frank Kreipar, Jack Polunes, Ed Martin, W. L. Mosteller, James Stratton, Tony Shelcoski, Bud Shelcoski, Daniel F. Grant, Charles Romane, Steve Martin, Ray Straub, Joe Naranci, Ed Kuzma, Ed Buckman, J. A. Renville, J. Hannabal, Carl Sipler, Alex Chippel, Frank Drako, Wilks Swartwood, J. Walsh, Joseph Zamgulis, Frank Komsisky, Joseph Sincavage, W. J. Morgan, Jr., Ed Lukas, Joseph Czapracki **and** E. H. Nowicki **(all of the Radio Servicemens Association of Luzerne County);** Frederick Schmidt **and** Mark Houtz **(Mid-State RSM);** Charles Krajewski **and** Roy Rogers **(Lackawana RTA);** Leon Helk **and** Milan Krupa **(FRSAP);** A. R. Guild, Chuck West, W. Guild **and** Frederick Delgert **(ARSM of Central Pa.);** Hugh E. Shaw, Jr., Bill Lenker, Bob Griffith, Jack Smith, Robert Whalen; Louis G. Smith, Richard S. Smith **and** Dave Krantz **(TSDA);** Sam Brenner **(PRSMA);** B. A. Bregenzer **and** Francis P. Skolnick **(RTSA, Pittsburgh);** W. Deardoff **and** G. W. Ebock **(Harrisburg RSM);** W. J. Lansberry **(Altoona);** Max Liebowitz **and** Art Rhine **(ARTSNY);** O. Capitelli **(ESFETA);** Henry Wawryck **and** J. Wheaton **(LIETA);** John Rader, **and ye editor.**

Electrolytic Capacitor Re-former

by JAMES S. KENDALL

Simple Device Can be Used to Revive Temporarily Electrolytics That Have Aged While in Set or on Shelf

IT IS WELL KNOWN that electrolytics can deteriorate if stored for long periods. And if then used, breakdown can occur within a few weeks. The difficulty can be temporarily overcome with a re-forming unit, which features a parallel-stabilized circuit employing a large beam tetrode, but connected as a triode; almost any type can be used, such as the 807 or 6L6G. The stabilization impedance of the unit depends on the slope of the tube used and the maximum current on plate dissipation. Voltage is controlled by the use of a variable resistor of the volume control type connected between the *hv* line and the chassis. A suitable value for this would be ½ megohm; the power dissipated would only be one watt, since no grid current is taken by the tube. The resistor in the cathode circuit must be of a rather high rating, 30 watts being recommended at a resistance of 20,000 ohms; the full rating is only approached when the output is short-circuited. Smoothing capacitors should be of the paper type and withstand about 1,000-volt test.

Operation of Unit

In operation, as the grid voltage is raised, current through the tube causes a voltage drop to develop along the 20,000-ohm resistor. Thus the cathode is kept positive to the grid, as a load current is applied. The extra voltage so developed, diverts the current from the tube to the load by increasing the negative bias on the tube. After the bias on the tube has reached cutoff (when the output is overloaded the supply impedance rises from between 80 and 200 ohms, depending on the type of tube used, to 20,000 ohms) voltage will fall very rapidly past a certain point.

Judging Capacitor Age Quality

When a new rectifier tube is inserted, it is advisable either to re-form the existing electrolytic or install a new one. If a new one is used, how can one tell if it has aged on the shelf? An answer can be found through the following test: A voltage equal to that just below the working voltage of the electrolytic should be applied, and leakage current noted. For example, if the leakage current were 5 ma, voltage would not rise more than one volt, at point of re-forming. If the leakage current was high, the output could be set at 5 ma and the voltage raised; the leakage current would fall until the electrolytic was completely re-formed.

Patience . . . Key to Effective Re-forming

One of the most important requisites in re-forming work is patience. If, for instance, the current through the capacitor is too great, the unit can be very quickly ruined. Re-forming current should not be in excess of 500 microamperes for each mfd. It is customary to raise the voltage with the instrument to 50 volts above the normal working voltage; then at the correct working voltage there will be very little leakage. If the charging or forming current is too high, current through capacitor will rise very slowly, then suddenly a short will appear. This is what often occurs when a new rectifier is installed; the breakdown might happen after two or three weeks, with intermittent usage.

The instrument can also be used to recondition old stock capacitors, which might be used in the shop only for design or lab work, but *not replacement*.

In some models built, one end of the *hv* winding had been grounded. It has now been found that it is better to join the cathode of the tube to the chassis; this provides only one point above chassis. In the earlier method, the *hv* negative terminal was from a few volts up to 600 positive to case.

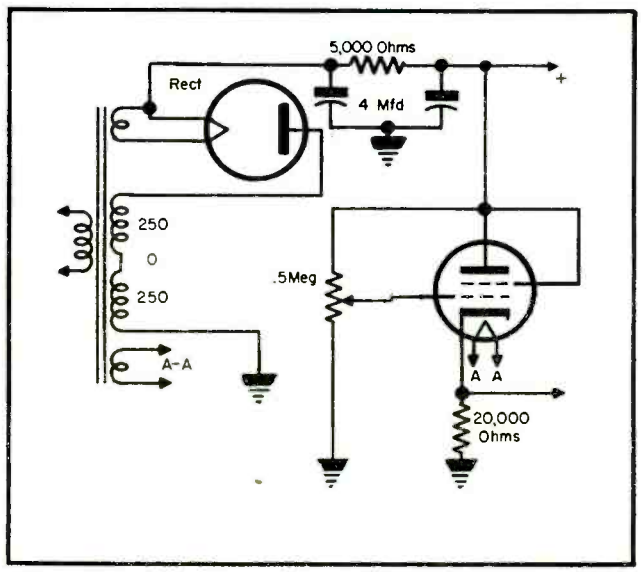


Fig. 1. Circuit of electrolytic re-former.

Audio

(*Continued from page 77*)

which some makers do specify, rather than impedance in ohms.

Relative Levels

It's easy, with the aid of *vu*s, to work out relative levels these days, at least while we are concerned with electrical circuits. But, when sound levels are involved, 10 phons[1] usually affords little response affect; thus, the specification of levels is apt to become a bit vague. It might even be found that even after securing the correct matching, a microphone or pickup intended for high quality purposes, will be rather insensitive, and so more gain is required. A preamp, in front, is the obvious answer.

But this is where matters can get somewhat tantalizing. The preamp boosts the gain nicely, and now it is only necessary to move the gain control up a little. Such an increase results in distortion of louder passages. And turning the gain down further, still causes distortion on louder passages, although the output is much lower. This occurs because distortion is produced before the signal reaches the gain control. Although the gain was insufficient without the preamp, not very much more was wanted, and the preamp has considerably too much extra gain available. In other words, one of the stages before the gain control, overloads, before it can limit the level.

A preamp with a gain control must be used. This means that the system will have two gain controls, and operation of either will adjust the volume level at the output. When operating this way, the gain control settings must be adjusted carefully, in the right proportions. Having done so, to avoid drifting away from the best combination of settings, it is best to regard one as preset, not to be touched once correctly set, and the other for controlling volume.

Working with the preamp control too high and the main contol too low will result in distortion of louder passages, as already noted. On the other hand, working with the preamp control too low, and the main control nearly flat out, can result in a noise level higher than necessary, and possibly in increased hum level, if any.

For best performance, one should evaluate the best combination of set-

[1]Unit of loudness which is based on average human ear sensitivity.

tings as cited, and then mark the pre-amp control for its present position.

Pitch in Audio Design‡

SYSTEM DESIGN, which has become a basic consideration in the development of audio components and accessories, has focused attention on the related properties of acoustics, music and electronics. To illustrate, *pitch*, once purely a musical problem, has now become a factor in the development of enclosures and speakers, as well as amplifiers. Many have set up tone bases to evaluate assorted response factors, with 440 cps, long a standard for the permanently-tuned type of instrument, such as the piano and organ, as the key tone.

In some labs, based on numerous studies, other tones, varying from 440 to 446, have been employed with equally satisfactory results.

Some observations have disclosed that a considerable *variation* of the tuning note must be reckoned with, but that this does not necessarily conflict with any major musical laws. On the contrary, it appears as if the *pitch* of the tuning note must be regarded as a means of expression in the same way as *tempo* or *dynamic* range. Any considerable increase in *volume* and also in tempo apparently leads to a raising of the pitch of the tuning note.

Key Frequency Variations

At one concert, the key frequency measured during the tuning of the instruments was about 446 cps, which later dropped to 445 cps, and rose to 449 cps during the final passage. During a piano recital, with full orchestra, an orchestra was tuned to between 439 and 440, the violins were tuned to 444 cps, and the orchestral prelude was also tuned to 444 cps. During the piano cadenza, the orchestra adapted itself to the piano, only to rise again in the finale.

If, as was evidently the case in the second example, no difficulties arise in the harmonics between differently tuned instruments, this may be due to the fact that there exist between pitch, as it is subjectively felt and the number of harmonics, rather complicated relationships which are dependent also on volume.[1]

In view of the foregoing, some have decided that electrical tuning-note sources should be able to produce three frequencies: 440, 443 and 446 cps, and

‡Based on a report in *EBU* by Dr. Heinrich Kosters.

[1]Fletcher, Harvey, *The Pitch, Loudness and Quality of Musical Tones*; 1946.

(*Continued on page* 100)

Tools . . . Instruments Parts . . .

C-D MOLDED AND MINIATURE TUBULARS

A tubular capacitor *Cub* molded in mica-base bakelite, has been announced by the *Cornell-Dubilier Electric Corp., South Plainfield, N. J.*

Unit is processed by special vacuum temperature pressure cycling impregnation; 200 and 400 volt series is impregnated with *HT* compound and the 600 volt and up series with Dykanol *C* oil. Capacitor is dry assembly processed and sealed immediately after impregnation. Copper-weld leads are permanently crimp-sealed to the capacitor section.

C-D has also developed a series of high-temperature, metal-cased miniaturized tubulars; *Demicon, TWM,* featuring extended foil construction using duPont Mylar polyester film dielectric.

Capacitors are said to maintain insulation characteristics at temperatures to +160° *C,* through the temperature range of —55° to +130° *C,* no voltage derating being required; to +160° *C* derating only to 75%. Hermetic sealing of the capacitor within the metal housing is accomplished with glass-to-metal sealed terminals. Available in six variations of the basic style, with a selection of mounting brackets and threaded studs in 100, 400 and 600 *v dc* ratings.

* * *

PECO METER REVERSING POLARITY SWITCH

A meter reversing polarity switch, *MS-1,* designed to reverse polarity when making circuit tests, without removing test lead to meter, has been announced by *Pomona Electronics Co., 524 W. 5th Ave., Pomona, Calif.*

Designed for use with the Simpson model 260 tester, switch is inserted into the unit on the left side of the meter in the corresponding tip jacks. Toggle switch position will indicate polarity of the circuit being tested.

Peco MS-1 Reversing Switch

HICKOK UV SIGNAL GENERATOR

A microvolt signal generator. *Airline 292 XAL,* providing continuous coverage from 125 kc to 165 mc on fundamentals, has been introduced by the *Hickok Electrical Instrument Co., 10514 Dupont Ave., Cleveland 8, Ohio.*

Generator provides coverage of the aircraft band including all the necessary *if* frequencies and covers all *rf* frequencies with calibrated output. Can be externally modulated from 15 to 10,000 cps; measures both input and output of units under test. Features temperature compensation, self contained crystal oscillator reference level, and is crystal controlled. Doubly shielded for minimum signal leakage.

Hickok Microvolt Signal Generator

* * *

GOODMARK ADAPTER AND CHUCK

A ½" *chuck* with a ¼" *adapter,* which is said to convert a ¼" drill into a ½" capacity drill, has been introduced by Goodmark, Inc., 21 East 2nd St., Dayton 1, Ohio. Can be used on either hand or electric drills: ¼", 5/16" or ⅜" and on flexible shafts.

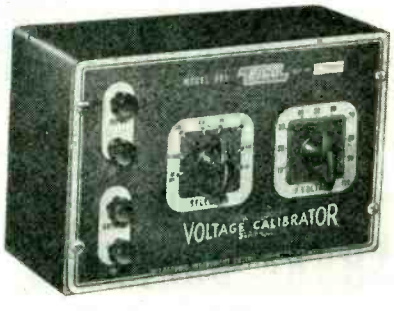
* * *

EICO 'SCOPE VOLTAGE CALIBRATOR AND BATTERY ELIM-CHARGER KITS

A 'scope voltage calibrator, *495,* and a 6-volt and 12-volt battery eliminator and charger, *1050,* in kit and wired form, are now available from *Electronic Instrument Co., Inc., 84 Withers St., Brooklyn 11, N. Y.*

'Scope voltage calibrator features a square-wave output at power-line frequency with readings of .1, 1, 10, or 100 volts peak-to-peak; amplitude is variable from zero on each range. Instrument uses OC3, 6AL5 and selenium rectifier.

Battery eliminator and charger features continuously variable output voltage, separate voltmeter and ammeter; *dc* output is 0-8 *v* or 0-16 *v*; current rating is 10 *a* at 6 *v* and 6 *a* at 12 *v.*



Eico Voltage Calibrator

SCHAUER BATTERY ELIMINATORS

Two battery eliminator models, *Electrox AR 5612* and *AR 4612,* are now available from the *Schauer Manufacturing Corp., 4500 Alpine Ave., Cincinnati 36, Ohio.*

Model *AR 5612* is an adjustable *dc* power supply, variable between 4.5 and 9 volts, and 11 and 17 volts. Supplied with 0-20 *v* and 0-20 *a* meters. Model *AR 4612* is a non-adjustable model, without meters. On 6-volt setting, unit delivers 7.5 *v* at 7.5 *a,* continuous; 25 *a,* intermittent. On the 12-volt setting, output is 15 volts at 4 *a*; 12 *a* intermittent. Both units are equipped with bridge-type, full-wave selenium rectifiers and transformers of the two-winding type.

Schauer Battery Eliminator

* * *

RADIO RECEPTOR GERMANIUM DIODE

Another germanium diode, *1N34A,* has been introduced by the *Seletron and Germanium Division Radio Receptor Co., Inc., 251 West 19th St., New York 11, N. Y.*

Built to *JAN* designation, diode has a tapered case which gives polarity identification; case is marked with an arrow following the direction of the taper.

* * *

ERIE DEPOSITED-CARBON RESISTORS

One-half watt deposited-carbon precision resistors, *Hi-Stab 155,* in values from 100 ohms to ½ megohm, have been announced by the *Erie Resistor Corp., Erie, Pa.*

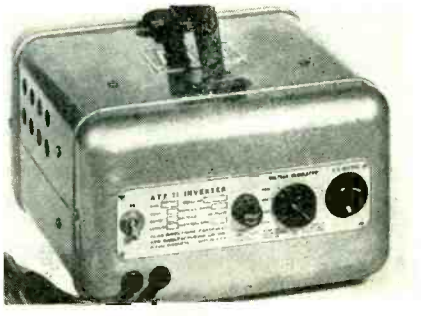
Resistors feature a one-piece molded case. Size is 19/32" long by 3/16" diameter, and leads are axial 20 tinned copper wire.

* * *

ATR INVERTERS

Inverters, for operation from 6-volt or 12-volt storage batteries, providing 110-volt *ac* 60-cycle output in various wattage capacities, have been introduced by the *American Television and Radio Co., 300 E. Fourth St., St. Paul, Minn.*

Other models are also available for operation from other *dc* input voltages ranging from 6-220 *vdc.*

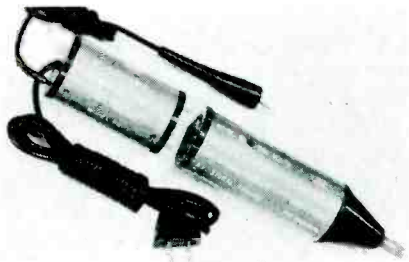


ATR Inverter

LEE MINIATURE POWER SUPPLY

A miniature electronic power supply, *PS-1*, for use with *E-C* or *E-A* circuit analyzers, is now available from *Lee Electronic Labs., Inc., 233 Dudley St., Boston 19, Mass.*

Unit provides both *ac* and *dc* test voltages, permitting range of resistance and continuity tests; increases the sensitivity of circuit analyzer models to over 200 megohms. Model features a miniature selenium rectifier and dual-capacitor *rc* filter network, which permits testing of capacitors for leakage with actual *dc* voltages applied and indication of intermittent open capacitors with *ac* applied.



Lee PS-1

RCA MIDGET B BATTERY

A midget alkaline-type 45-volt *B* battery, *VS086*, designed for use in personal portable radios, has been announced by the *tube department* of *RCA, Harrison, N. J.*

Battery weighs approximately three ounces and is 3 9/16" long, 1 1/16" wide, and 11/16" deep. Alkaline cells are small, self-contained units.

* * *

STACKPOLE RESISTORS FOR PRINTED WIRING

Standard ½-watt fixed composition resistors, now available with specially formed and trimmed leads for assembly on standard 0.062" printed wiring base, have been announced by the *Electronic Components Division, Stackpole Carbon Company, St. Marys, Pa.* Hot tin-dipped leads are cut and formed for a tight fit and extend through the printed circuit base just far enough for soldering. Resistors snap into place.

* * *

CTC COLOR-TV MINIATURE DELAY CABLE

A delay cable or high-impedance circuit element, *HH-2500*, designed to meet the delay requirements in color TV receivers and transmitters, has been introduced by the Columbia Technical Corp., 5 East 57th St., New York 5, N. Y.

Flexible cable is built around a low-loss magnetic core which carries a closely-wound inner conductor of 38 AWG wire. A heat-resisting tape is wrapped around the inner conductor helix. The spiral-wound outer conductors consist of individually insulated wires of 32 AWG and are held in place by an overlapping tape. A polyvinyl jacket protects the cable against moisture and abrasion.

* * *

BURGESS 75-VOLT B BATTERY

A 75-volt *B* battery, *XX50*, for '53 model portable radios, has been introduced by the *Burgess Battery Co., Freeport, Ill.*

Unit is recommended for replacement in all sets using a 75-volt *B* battery.

Picture-Tube Fundamentals

(*Continued from page 49*)

the triode above and permits the focus anode current to be practically zero.

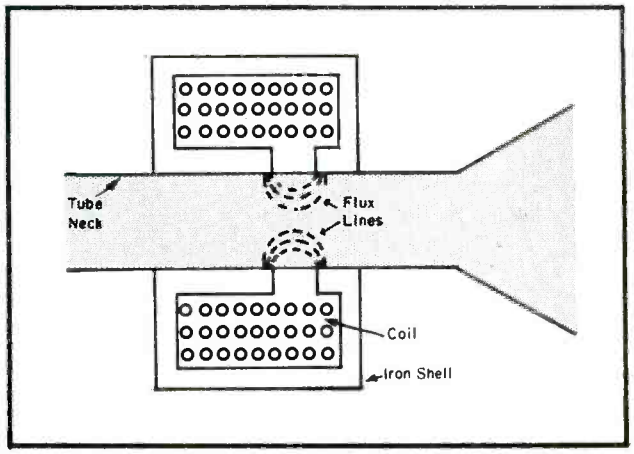
Practically all electrostatic focusing systems are subject to *modulation defocusing*. This means that as the grid voltage is changed to vary the beam current, the focus voltage must be adjusted to keep the spot in proper focus. Particularly important is the fact that changes in the line voltage will require adjustment of the focus voltage. A variation in the tube construction, known as *self focus or automatic focus* returns the focusing anode through a resistor to the cathode inside the tube. This enables the focusing anode to remain at the cathode potential and the beam stays in focus over a larger range of voltages, even if the line voltage does vary. Electrostatic focus tubes may be either *high* or *low* electrostatic focus, or *automatic*-focus types.

Focusing can also be done electromagnetically by placing a current-carrying coil about the neck of the tube. The coil is shaped as shown in Fig. 3, so as to produce a very concentrated magnetic field which does not extend beyond the section of the tube neck in which the focusing is to be accomplished.

Now that we have a beam of electrons, capable of being varied in intensity, it becomes necessary to devise a means of deflecting this beam so as to be able to scan all portions of the screen. This may be done either by means of electrostatic fields from pairs of deflecting plates, or by electromagnetic fields from deflecting coils. The electrostatic method is commonly used for smaller tubes, and usually has a better high-frequency response and requires less deflecting power, since the current to the deflecting plates is extremely low. The main disadvantage is that as the size of the tube is increased, the deflecting voltages required become prohibitively high, and the tube becomes excessively long. This method finds wide application in 'scopes and in small (e.g., 7") TV receivers. The electron beam is passed between pairs of electrodes called deflecting plates. When a voltage difference is applied between the plates, the electron beam is deflected toward the more positive plate. One pair of plates can deflect the beam, and thus move the spot, along only one axis. Hence, in a tube two pairs of plates are mounted between the focusing unit and the screen, with the beam passing first between one pair, then between the second pair which are mounted at right angles to the first. Acting together, they can move the spot to any point on the screen.

The deflection sensitivity of electrostatically-deflected tubes may be increased by two methods. The simpler of the two consists of shaping the plates so as to have a small effective plate spacing. With plates formed to fit the shape

Fig. 3. How electromagnetic focusing is accomplished, through current carrying coil around neck of tube.



of the electron beam at its maximum required deflection, sensitivity may sometimes be almost doubled over that obtained with ordinary parallel plates. Another method consists of adding an intensifier electrode, or third anode in the form of a separate conducting ring on the inner surface of the bulb. This anode often operates at a voltage about twice that of the second anode, and is sometimes also termed a *post deflection* accelerator anode. Either or both systems can be used to give a greater deflection for a given voltage available.

Deflection can also be accomplished by using coils to produce magnetic fields for deflecting the electron beam. Since the electron beam is really an electric current flowing in a vacuum, the magnetic forces acting on the beam are of the same type as the force which moves the coil in an ordinary meter. Thus, as the beam enters the magnetic field it will be bent or deflected at right angles to the field producing the force and also at right angles to its own motion toward the screen. Accordingly, by passing current through pairs of coils, as indicated in Fig. 4, at the proper voltage and frequency, the beam may be directed toward any point in the screen. It will be noticed that the coils above and below the neck control the horizontal motion of the spot, while the other pair control the vertical motion. This is due to the right-angle effect mentioned earlier. These two pairs of coils must be exactly at right angles to each other and to the axis of the tube to produce a rectangular pattern centered on the screen.

Electromagnetic deflection may suffer from lowered high-frequency response as compared with electrostatic deflection, and considerably more power may be required from the amplifiers. Electromagnetic deflection types have a great advantage in that they are much less subject to deflection defocusing, an effect which results in a perfectly shaped spot at the center of the screen becoming oval shaped when it is deflected to the edge of the screen. This results from the electrons on one side of the beam being deflected through a slightly different angle from those on the opposite side, thus distorting the spot in the direction of its deflection. Since electromagnetically-deflected tubes are less susceptible to this, it is possible to make such tubes with wider deflecting angles than could be used in electrostatically-deflected types. This results in a shorter tube for the same screen size, which is advantageous in designing reasonably-sized television receivers.

Originally, electromagnetic deflection tubes did present problems, with respect to ion burns on the screen: Ions are either gas molecules or molecules of the cathode-coating material; they are much more massive and heavier than electrons, and if negatively charged (as are electrons) they

(*Continued on page* 116)

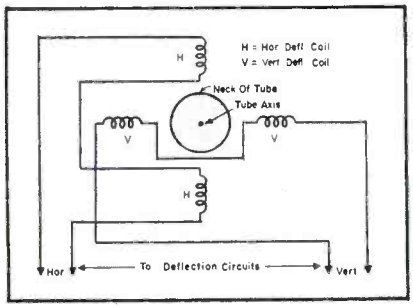


Fig. 4. Electromagnetic-deflection design. Here current, passed through pairs of coils at proper voltage and frequency, permits direction of beam toward any point on the screen.

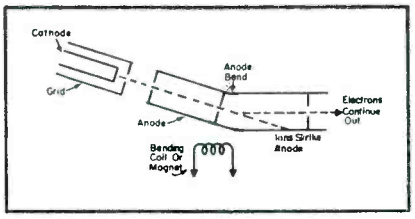


Fig. 5. Bent-anode construction evolved to prevent iron burns.

Audio

(*Continued from page* 95)

either one or all three considered during listening and measuring tests.

Capacitive Pickup Design

A novel hi-fi system, featuring use of a capacitive type of pickup that employs the entire radio instead of only the audio portion, has been developed.[2] When the phono switch is on, an oscillator is tuned to 455 kc. The phono needle and a set-screw in the cartridge form a capacitor which, electrically, is across the *if* input transformer. The capacitor varies with the needle fluctuations and modulates the 455-kc carrier. The modulated signal then goes through the *if*, detector, and audio in the usual manner.

Where a crystal pickup must generate a voltage, the capacitive type merely controls a voltage.

[2]Motorola; used in model 53 F2, a table-model radio-phono, and model 21F5, a 21-inch TV combination.

Service Helps

(*Continued from page* 80)

capacitor (1500 *v*) should parallel the 680,000-ohm resistors, and a 22-mmfd capacitor (1000 *v*) connected to the junction of the 330,000 and 680,000-ohm resistors.

Signal Generator Waveform Tests

The waveform from the output of a signal generator can be checked with a half-wave crystal probe to determine whether the positive-peak voltage is equal to the negative-peak voltage. To make the test, the voltage from the generator is read on a *vtvm* with the crystal in the probe polarized in one direction. The crystal is then turned over, so that it is polarized in the opposite direction, and the voltage from the generator read again. Unless the two readings are equal, there is even-harmonic distortion present. The test does not disclose the presence of odd-harmonic distortion, which must be checked with a frequency meter or similar device.

TPTG Oscillation Checks

Tuned circuits are inductive at frequencies above resonance, and capacitive at frequencies below resonance. The plate circuit of an amplifier must be inductive for tuned-plate tuned-grid regeneration or oscillation to take place. If the plate-load impedance is capacitive, degenerative feedback takes place; this reduces the gain of the am-

plifier. Since the plate-to-grid feedback becomes greater at higher frequencies, such feedback impairs the high-frequency response of the stage. However, it may be noted that neutralization of the plate-to-grid capacitance serves to eliminate the feedback and to hold up the high-frequency response.

'Scope Probes*

SINCE TV STATIONS transmit a composite TV video signal, which consists of an *rf* carrier modulated by picture information plus blanking and associated sync pulses, the modulated *rf* must be rectified (demodulated), before application to a 'scope, so that the relatively low-frequency modulated pattern itself (picture information, pulses, etc.) may be portrayed on the 'scope screen. Crystal probes[1] provide this demodulation facility, and can be generally employed to trace modulated carriers on most AM communication circuits and systems.

Resistive Isolating Probes: In visual-alignment work, it is necessary to isolate the circuit under test from the 'scope cable and input circuit. For this purpose, resistive isolating probes[2] are available. In addition, this unit also serves as a low-pass filter probe, sharpening broad marker pips which would otherwise mask important portions of response traces. Its installation is illustrated in Fig. 4.

Low Capacity Probes: TV sync signal tracing represents another use of a probe, which in this instance must be a low-capacity type.[3] Progress of the horizontal and vertical sync pulses can be followed from the video second detector on through the *dc* restorer, sync separator and integrating network. The vertical pulse can then be checked on through to the vertical oscillator, graphically revealing the operation of the pulse in triggering the vertical oscillator.

The effectiveness of the reactance-tube circuit in controlling the operation of the horizontal sync discriminator is another useful application of the low-capacity probe and 'scope. The important function of the low-capacity probe in tests of this type is the effective reproduction of pulse shapes as they actually appear in each circuit.

The grid of the vertical-blocking oscillator is frequently a difficult test point, and is a good example of the application of the low-capacity probe. The grid-leak in this circuit may have a value as high as 10 megohms. Furthermore, the waveform is sharply spiked, and the *hf* content of the waveform is easily lost if a direct connection (or a direct probe) were to be used. However, the low-capacity probe is said to reduce the test capacitance across the circuit to 1/10 of the value imposed by a direct probe. As a result, the waveform displayed on the 'scope screen is essentially the true waveform, since the operation of the circuit is virtually undisturbed.

It should be noted that the high resistance of such circuits usually develops another source of difficulty, due to the fact that the input resistance of some low-capacitance probes causes excessive *dc* drain-off. The low-capac-

(*Continued on page* 102)

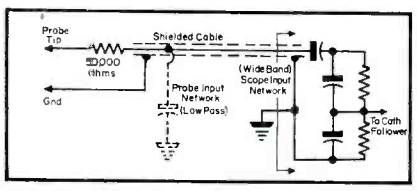


Fig. 4. Resistive isolating probes[2] hookup to 'scope.

*From notes prepared by the engineering department of Precision Apparatus Co., Inc.

[1]Such as Precision Apparatus SP-5B.

[2]Precision Apparatus SP-5C.

[3]SP-5A.

Servicing Helps

(*Continued from page* 101)

ity probe in this series, however, includes a built-in blocking capacitor which, it is said, avoids circuit disturbance by preventing drain-off of *dc* bias voltage.

Hor.-Deflection Coil Tests: The horizontal-deflection coils present a testing problem as a result of the relatively high peak-to-peak voltage which is present. Typical TV receivers develop approximately 1,500 peak-to-peak volts across these deflection coils. Although such voltages exceed the input voltage rating of the 'scope, and will produce severe waveform distortion due to overload of the vertical amplifier if applied directly, such difficulty, it is claimed, can be avoided by use of the low-capacity probe.

General tests in video, sync, and sweep circuits, should usually be made with the low-capacity probe, since the Service Man then need not be concerned whether the input capacitance of the 'scope might be overloading the circuit under test, and distorting the waveforms.

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Associations

(*Continued from page* 92)

be encountered on the ultrahighs as well as on the standard TV bands, and how the Service Man can provide a solution.

A series of 18 newspaper advertisements, promoting TSDA members was also described. The campaign, which will appear in the *Evening Bulletin*, will use a $1,200 appropriation from the association's advertising fund.

Copy for this series will follow an institutional-type format, promoting TSDA services and explaining to the reader the advantages of using qualified radio and TV service dealers. It was also noted that a grievance committee has been appointed to investigate any consumer complaints that might arise concerning members' service work.

Offices have been established at 6021 Ogontz Ave., with a central telephone system, to channel all requests for service to the nearest member. A standard rate charge, for all calls cleared through this office, has been set up.

Dave Krantz has been named chairman of a new industrial relations committee, and Edward Strychowski will head the public relations committee.

Plans for an Eastern conference to be held in early January, 1954, and

TEN YEARS AGO

ELECTRONIC TIMER TROUBLE SHOOTING was discussed by *S. J. Murcek*. . . . The repair of test instruments was analyzed by *Alfred A. Ghirardi*. The article featured an instrument check chart. . . . A wireless record player using a single tube (6L7G) oscillator-modulator in a Hartley circuit, was front-covered. . . . *R. C. Cosgrove*, vice president and general manager, manufacturing division, The Crosley Corp., was named chairman of a special RMA committee on postwar planning. . . . *W. L. Fattig* was appointed acting supervisor of the technical service section of the G.E. receiver division, replacing *P. R. Butler*, former manager, who became a lieutenant in the U. S. Navy. . . . *R. M. Karet* was appointed sales manager of the wholesale sound division of Utah Radio Products Co. . . . *James Quam*, president and general manager of Quam-Nichols Co., was elected a director of the Nichols Steel and Wire Co. . . . *Arthur A. Brandt, George W. Henyan* and *V. M. Lucas* became general sales manager, assistant to the vice president, and manager of government divisions, respectively, of G.E. . . . *Dave Grimes*, vice president in charge of engineering for Philco, was reported killed when the war-mission transport plane in which he was travelling crashed in northern Ireland. . . . *E. G. Brown* was appointed advertising manager of Hallicrafters. . . . *J. J. Nance*, Zenith vice-president, was named to postwar planning committee of RMA. . . . *A. C. Sanger* was named sales manager for appliance divisions of G.E. . . . *Richard Earnest* was named supervisor of the cost accounting department of Universal Microphone Co. *G. Schmidt* was named director of plant protection for the company. . . . *E. C. Crowther* of Philadelphia was accepted for membership by Mid-Atlantic chapter of The Reps.

covering states from Maine to Florida, were also discussed by FRSAP.

William Morgan of Wilkes-Barre was announced as the editor of the FRSAP news letter.

Increased activity of associations in the new *uhf* zones was also described at the conclave. Thus far, the boys reported, new groups have been formed in Lewisburg and Middletown, and many more on the way.

Ye editor also appeared on the program and discussed a lecture program now being prepared under his direction for associations in New York City, Long Island, New York State and several in New Jersey. The talks, which are scheduled for early fall presentation will cover black and white, and color TV; instruments; auto radio; portables; audio; tubes, and service engineering. A novel three-screen rear and front projection technique will be employed during the lectures. And, actual equipment under discussion will also be on stage.

An announcement detailing the program will be in the mails soon.

At a subsequent meeting of FRSAP, it was noted that the Buffalo Valley Radio-TV Association, headed by prexy *Frank B. Lauver*, 1620 Washington Ave., Lewisburg, Pa., was now in operation.

The Altoona group reported that they plan to start a school to aid members in TV servicing, and will utilize film in many of the discussions. It was also revealed that Elmer W. Metz, Jr., has been elected president of RTSA of Pittsburgh. And the Luzerne group, who completed a successful sponsorship of a Broadway show at Nuangola Summer Theater, reported that the affair was a grand success.

NATESA

PLANS FOR the fourth annual convention of the National Alliance of Television and Electronic Service Associations, to be held at the Morrison Hotel in Chicago October 9, 10 and 11, are nearing completion, according to Frank J. Moch, national president.

More than one thousand members of the thirty-five affiliated state groups are expected to accompany the seventy delegates, with an additional five hundred persons representing Chicago area companies, John Cecich, convention chairman estimated.

This year's plans call for both an industry convention and product display and an open forum, to which the public is invited.

The convention's entertainment program is under the direction of Phil Levant; an industry banquet is scheduled for Saturday night, Oct. 10.

National officers of NATESA include: J. B. McDowell, Kansas City, Kansas, secretary general, and John Hemak, Minneapolis, treasurer.

TV Parts... Accessories

NEW LONDON UHF SWEEP GENERATOR

A *uhf* sweep generator, *130*, which features single range tuning and a 0 to 30-mc sweep width, has been announced by the *New London Instrument Co., P. O. Box 189, New London, Conn.*

Other features include at least one volt output into 75 ohms; continuously variable attenuator; a blanked signal on the return sweep, thus providing a reference base line.

No beating or multiplication are said to obtain. Balun is available for conversion to a 300-ohm line.

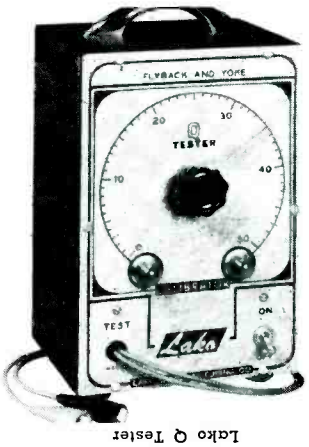
New London UHF Sweep Generator

* * *

LAKO FLYBACK AND YOKE Q TESTER

A *Q* tester, model *400-A*, designed to check deflection yokes, width coils, and horizontal transformers, without removing them from the set, has been developed by the *Lako Manufacturing Co., 510 East Townsend St., Milwaukee, Wis.*

Instrument is said to drive the test part at proper waveform and frequency, and measure the output voltage. Since it is noted, the output is a function of *Q*, a single shorted turn will result in almost negligible output compared to that obtained from a good part.



Lako Q Tester

PHILCO SERVICE LAB TEST EQUIPMENT

Completely redesigned versions of standard Philco test units, featuring entirely new models, among them the model *G-8000 vhf* to *uhf* signal generator adapter and model *G-8002* auto-level sweep generator, are now available from the *Philco Accessory Division*.

The test instruments, previewed in the editorial and advertising columns of SERVICE, and released during the past six months are said to compose a line that can serve as a complete service lab for *uhf* and *vhf* field and shop requirements. As the future brings greater electronic advancements and more demanding needs of servicing personnel, Philco reports that test equipment will be available to meet such needs.

Availability of such new model test equipments will be announced by Philco through the medium of advertising in this publication.

* * *

SUPEREX PIX-TUBE ADAPTER FOR TUBE TESTERS

A picture-tube adapter, that can be used with tube testers and picture tubes has been announced by *Superex Electronics Corp., 23 Atherton St., Yonkers, N. Y.*

One end of unit plugs into tube tester and the other end plugs onto picture tube, which does not have to be removed from TV cabinet. Any tube, it is said, electrostatic or magnetic, 10" to 30", can be checked for cathode emission, shorts, etc. Overall length, 49½".

Superex Adapter

* * *

JFD MINIATURE UHF PISTON-TYPE TRIMMER

A miniature piston-type variable trimmer capacitor, *VC3-G*, for *uhf* TV chassis, has been introduced by *JFD Manufacturing Co., Inc., 6101 Sixteenth Ave., Brooklyn 4, N. Y.*

Capacitance range is from 1 to 8 mmfd; overall length is 1" at maximum capacitance; temperature coefficient is 2×10^{-3} mmfd at 0° *C*; *Q* rating is said to be over 1,000 at 1 mc; dielectric strength is 1,000 *vdc* at sea level and 500 *v* at 3.4" mercury.

JFD Piston Trimmer

PERMA-POWER TUBE BRIGHTENER AND VOLTAGE REGULATOR

A TV tube brightener, *C-301*, for use with sets with parallel-wired or series-wired filaments has been developed by *Perma-Power Co., 4727 North Damen Ave., Chicago 25, Ill.*

Unit is claimed to relieve cathode filament short problems; its isolation type transformer gives normal 6.3 *v* to filament to relieve cathode short, or 7.8 *v* to increase cathode emission and restore lost brightness. Design allows operation as constant voltage (parallel-wired sets) or constant current (series-wired sets) transformer.

A TV voltage regulator, that is said to return full heights and width of picture when low-line voltage distorts picture, has also been announced.

Color TV

(*Continued from page* 51)

predominantly *red* signal, when attenuated in the color mixer, reversed in polarity by the *G-Y* video amplifier and combined with the *Y* signal in the picture tube, will result in a signal which consists largely of a *green* component but with a trace of *blue* signal distortion. There will be no output from the *B-Y* video amplifier and no signal applied to the *blue* cathode. The blue-producing phosphor in the picture tube will therefore respond to the *Y* signal on the picture-tube grid.

The overall result is that for signals up to 500-kc color components will be faithfully reproduced. Hence, objects larger than about 1/60 of the horizontal picture width; about ¼" on a 17" tube, will be faithfully reproduced in color. From 500-kc to 1.5 mc, red and green components will be reproduced with somewhat less color faithfulness and blue components will not be reproduced. This distortion will not be objectionable since at these higher frequencies the eye begins to lose its sensitivity to blue color. Refined circuitry may be developed to provide somewhat better small-object color reproduction than indicated; however, it will probably be of the same general form as described in *Part I* of this discussion.

Above 1.5-mc, no color components will be reproduced and the *Y* signal will provide the fine picture detail in monochrome. This arrangement of shifting from full color reproduction at low frequencies, at which the eye is color sensitive, to monochrome reproduction at the higher frequencies where the eye is color blind is known as the technique of *mixed highs*.

Troubleshooting

Many of the troubleshooting techniques developed for monochrome receivers will, of course, be applicable to the NTSC color receiver. Although the circuits used to provide the color information may be new to the TV Service Man, they are combinations of oscillators, amplifiers, detectors, filters and networks, each in itself similar to corresponding devices used in monochrome receivers. Hence, it can be expected that extensions of such existing techniques as signal tracing and wave-shape observation will have application to these color circuits. As in the servicing of any other electronic equipment it will, of course, be necessary to have a good understanding of the functioning of the various elements of the circuits. An interesting con-

jecture is, that in color television, the viewer may demand a higher standard of performance. It is well known that many TV set owners tolerate fuzzy, blurred pictures far below the performance capabilities of a properly operating receiver. It is quite possible that a poorly-reproduced color picture will be considerably less tolerable than a poor black-and-white picture, thereby requiring color receivers to be kept operating nearer to peak performance.

For those receivers which are designed to allow it, one of the most useful troubleshooting methods will probably be to disable first the color circuits and service the monochrome portion of the receiver. After a satisfactory black-and-white picture is obtained the color circuits can be tackled with less chance of confusion. It may be necessary to have somewhat higher-performance test equipment than has been required for monochrome receivers. For instance, in order to use 'scope signal-tracing in the subcarrier circuits it will be necessary to have a 'scope with a response of about 3.5 mc; considerably higher than that provided by many 'scopes used in TV service work. It may also prove necessary to have a means of measuring the output frequency of the subcarrier oscillator. The grid-dip meter, which is becoming more generally available, will probably prove satisfactory for this use. It will not be necessary to have high accuracy, but only to be able to determine that the oscillator frequency is within the operating range of the *afc*. Service techniques will have to be developed to provide an indication of proper phase relationship of the subcarrier reference signal.

Since the relative gain of the three color-video amplifiers must be maintained at specific values to provide the proper relative level of the three primary colors, it may be necessary to accomplish accurate gain measurements during receiver servicing. Since the circuits involved must pass a wide band of frequencies, square-wave testing may find application for this purpose. While square-wave testing has not come into common use in service shops, it is a well established lab technique which could be readily adopted to service work. Experience may show that even simpler techniques involving gain settings with standard color patterns will prove adequate for video circuit servicing. However, it would be well for Service Men to become familiar with square-wave testing since it has proved such a potent tool for similar applications, and since it may be the only tool available for the start of color TV servicing.

The *if* response represents another area which will require more careful treatment than in monochrome receivers. In the present receivers the picture carrier must be placed at about the 50% response point because of the vestigial sideband (partial single sideband) transmission. In the NTSC color system the color subcarrier is also placed so that for the *R-Y* signal, vestigial subcarrier sideband transmission results, thereby requiring the color subcarrier to fall at the 50% response point on the high side of the receiver *if* response curve. Obviously aligning a receiver to this characteristic will require somewhat more care than has been found necessary in the alignment of monochrome receiver *if*s.

A signal generator modulated with a fixed color pattern will probably be found quite useful for signal tracing. However, it will be well to develop effective troubleshooting techniques, without the use of such a device, because normally specialized test equip-

(*Continued on page* 108)

(*Continued from page* 107)

ment usually lags the introduction of new devices. It is interesting to note that a signal generator with modulation, which could be switched to red, green, or blue, would not be too useful in isolating trouble since all three transmission channels (*Y*, *R-Y*, *B-Y*) transmit different percentages of all three colors. It is well to remember that the picture tube itself is a very useful *'scope* for troubleshooting. Service Men will have to become completely familiar with the visual results on color pictures as faults are introduced in various circuits in the receiver. Skillful use of this technique will serve to speed the localizing of faults after which conventional troubleshooting can determine the exact cause of the trouble.

The NTSC color TV receiver is by far the most complicated and highly technical device yet proposed for consumer use. When color sets become available, there will be tremendous opportunity for Service Men who promptly acquire proficiency in this field.

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Community TV

(*Continued from page* 91)

they became available at the antenna site. For this reason broad-band amplifiers were used throughout the system. To reduce the initial investment the broad-band amplifiers were used to handle only three channels in the main run from the antenna site to town, but provisions were made for the additional amplifiers in the future, so that the system will be able to handle up to seven channels when they become available. With the granting of construction permits for TV stations on Mount Washington and in Vermont this has proved to be a sound decision.

Today, after a year's operation the system has 450 customers, with plans to have a thousand within another year. The total goal for the system is 2,000 customers.

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Service Engineering

(*Continued from page* 68)

by replacing the .0027-mfd interstage audio coupling capacitor, C_{640}, with a .01-mfd capacitor.

To prevent the *if* and other trimmers, particularly the *rf* and mixer trimmer capacitors in the receiver, from being shaken out of alignment, a dab of radio cement may be used for locking the adjustments in place. In addition to using a good tube checker, the substitution method of weeding out weak tubes will be found most effective.

Rep Talk

J. T. HILL Sales Co., Los Angeles, Calif., has been appointed rep for Wall Manufacturing Co., in Arizona and southern California. . . . *Clark R. Gibb,* 1409 Hennepin Ave., Minneapolis 3, Minn., has been named rep for Utah Radio Products Co., in North and South Dakota, Minnesota and western Wisconsin. . . . *Jim Kay, Kay Sales Co.,* 3760 Broadway, Kansas City, Mo., will represent Halldorson in Iowa, Kansas, Missouri and Nebraska. . . . *William Engelbretson Co.,* 906 Ottawa Ave., St. Paul, Minn., will cover North and South Dakota, Minnesota and northern Wisconsin for the company. . . . *Adolph L. Gross Associates, Inc.,* 45 W. 45th St., New York 36, will act as rep for the Wilcox-Gay Corp., in the Metropolitan New York area. . . . *Ben Joseph,* 509 Fifth Ave., New York 17, has been named rep for La Cesa Engineering Corp., in New York, New Jersey, Pennsylvania, Delaware and Maryland. . . . *Russell Ragon,* 1406 W. Idaho Ave., St. Paul, Minn., has been appointed rep for the United Transformer Corp., in Wisconsin and Minnesota. . . . *Bob Smith* has been added to the city sales staff of Kenneth E. Hughes Co., New York City. Smith was formerly with Sun Radio and Electronics. . . . *Ed Wineblatt,* formerly with the Art Cerf organization, has established his own rep firm, *Edward Wineblatt Sales Co.,* with headquarters at 10 Fiske Place, Mt. Vernon, N. Y. . . . *James J. Bacher,* 2321 Second Ave., Seattle 1, Wash. (Washington, Oregon, western Idaho, western Montana and British Columbia); *Eugene Loeb,* 5052 N. Shoreland Ave., Milwaukee, Wis., *William Linz,* 7115 N. Mobile Ave., Chicago 30, Ill. (northern Illinois); and *L. F. Waelterman,* 3938 Lindell Blvd., St. Louis, Mo., and *A. S. Engelman,* 2718 Linwood Ave., Kansas City, Mo. (southern Illinois, Missouri, Iowa, Kansas and Nebraska); *Milton R. Benjamin,* 1746 E. 47th St., Brooklyn, N. Y. (New England, New York state); *Albert D. Leban* and *Wilfrid Graham,* Leband and Graham, 218 Lloyd Lane, Philadelphia, Pa. (southern New Jersey, eastern Pennsylvania, Maryland, and Washington, D. C.); *James Podolny,* 4716 Coleridge St., Pittsburgh, Pa. (western Pennsylvania, Ohio and West Virginia); *R. C. Nordstrom,* Davis Bldg., Birmingham, Mich. (Michigan); and *Robert C. Whitesell and Associates,* 2208 E. Washington St., Indianapolis 1, Ind. (Indiana and Kentucky), have been appointed reps for the General Instrument and Appliance Corp., subsidiary of General Instrument Corp. . . . *R. W. Farris Co.,* Kansas City, Mo., has been named rep for Permo, Inc., in Missouri, Kansas, Iowa and Nebraska. . . . *Cartwright and Bean,* Memphis, Tenn., have been appointed reps for The Radell Corp., in the southeastern part of the country. . . . *J. R. Benge* of *Technical Representation,* Glenside, Pa., will handle the Merit Coil and Transformer line in eastern Pennsylvania. . . . *Frank J. Perna* (Mid-Atlantic states) and Samuel Hooker Co. (New England), have been named reps for the Brach Manufacturing Co. . . . *James Millar Organization,* 1036 Peachtree St., N.E., Atlanta, Ga. (Memphis, Tenn., and Mississippi), and *J. Y. Schoonmaker,* 2011 Cedar Springs, Dallas, Texas (Louisiana and Arkansas), have added the new territories indicated as reps for Clarostat. . . . *J. K. Rose and Co.,* 2323 W. Devon Ave., Chicago, Ill., will replace *W. Hemminger,* Victoria Sales Co., in covering Eastern Iowa, Wisconsin, Illinois and Indiana, for Jersey Specialty Co. . . . *The Lowry Dietrich Co.* have been appointed reps for the Rectifier Division of the Schauer Manufacturing Corp., in western Pennsylvania and West Virginia. . . . *W. T. Brase,* 5604 Kentucky Ave., Fort Wayne, Ind., has been appointed Indiana rep by Astron Sales Corp.

R. C. Nordstrom

Ed. Wineblatt

L. F. Waelterman

James Podolny

Audio Conversions

(*Continued from page 71*)

sistance and the grid resistor. Since the grid resistor is quite high in value, a seemingly unimportant leakage resistance of several megohms will allow a significant amount of plate voltage to appear at the grid of the following stage, upsetting the correct bias conditions, and introducing distortion. The coupling capacitors to the output tubes especially must be of very high grade.

The bypass capacitors of cathode resistors can also upset proper bias conditions when they become leaky, and will introduce bass losses if they lose a large part of their rated capacitance.

Components Added to the System: FM Tuner

Older radio-phonos can be modernized by the addition of an FM tuner and of a 3-speed record player. The input jacks for these new components are inserted at the volume control, as illustrated in Fig. 5 (p. 71). In *a* the selector circuit is as simple as possible; in *b*, while more complex, it grounds out the unused signal channels so that there can be no signal leakage from one circuit to the other.

When there is room, the FM tuner can be mounted physically in the original cabinet. It may even be possible to gang the FM tuning mechanism to the AM drum with an additional piece of dial cord. If this is done it is also necessary to replace the AM dial face with an AM-FM scale. One method of dial coupling that has been used is illustrated in Fig. 6 (p. 71). Mechanical coupling between the AM and FM tuning section has the advantage of operating simplicity, but usually involves considerable effort, a sacrifice of accurate calibration for either AM, FM or both, and a maintenance headache when the chassis must be removed for repair.

In metropolitan areas the majority of stations broadcast on both AM and FM simultaneously, so that the complete elimination of AM from the system may not be considered a large sacrifice.

Three-Speed Record Player

A modern record player can usually be installed in place of an old changer with no cabinet modifications except for the substitution of a new motor board, since the newer changers in general require less mounting space, both vertically and horizontally, than older models. A high-quality crystal pickup, and preferably a magnetic pickup and associated preamp. should be used. A preamp, with adjustable

compensation or a separate record compensator, to provide variable adjustment for the bass and treble recording characteristics of different recording companies, is especially useful here, as the amplifier's tone control facilities are likely to be limited.

When the initial budget permits, diamond needles are favored as providing both superior and less expensive performance in the long run. A new sapphire needle will not be inferior in actual performance quality to a diamond, but it wears down much more quickly and must be replaced. A compromise that is often made is to provide a diamond stylus for the *lp* cartridge, and a sapphire for the standard pickup, since the latter will in most cases be used much less frequently.

The Final System: Cost and Performance

The conversion of a given radiophono to high-quality audio may involve all or only a few of the procedures outlined. It is possible to produce a final system with performance characteristics that will be comparable to that of a good custom assembly. How much of a saving there will be depends upon the features of the original set. For example, if the Service Man starts out with an AM-FM console (one-speed phono) housed in a large and sturdy cabinet, a speaker that reproduces clean, full bass, and a push-pull amplifier with gain to spare, he can create a high-quality radiophono which includes a two-way speaker system correctly mounted acoustically, a feedback amplifier, and a three-speed record player with magnetic pickups, for a parts cost of less than one-hundred dollars. Without the player the parts cost becomes less than fifty dollars. The latter figure includes a new output transformer, new capacitors for the amplifier, a tweeter, dividing network and tweeter level control, and lumber and acoustical lining for the speaker enclosure.

The saving in cost is partly offset by the increase in labor. Consideration must also be given to the fact that special problems may arise during the conversion, and that some of the equipment being used is old and more susceptible to breakdown.

* * *

WINCHARGER TO MOVE

Plans for the construction of a new manufacturing plant have been announced by the *Wincharger Corp., Sioux City, Iowa,* wholly owned subsidiary of *Zenith Radio.*

Factory, which will be located on high ground, will have floor space of 300,000 square feet, with increased facilities for production of motors, and capacity for one million radio and upwards of 100,000 TV sets per year.

RETMA TRAINING PROGRAM GEAR

Top: View of instrument tables that will be used during pilot training course for TV Service Men at the New York Trade School under the auspices of the RETMA service committee. Right: Stock room at school which houses components, accessories and test gear that will be used during trade school program.‡

‡National Scene, SERVICE; August, 1953.

On Book Row

How To Use Signal Generators; How To Use Meters; Obtaining and Interpreting Test 'Scope Traces: Series of *How To Use* books highlighting test equipment. . . . *How To Use Signal Generators,* written by *J. R. Johnson,* is a 120-page text that describes various uses for AM and FM signal sweep and marker generators, and test oscillators and calibrators. Typical test setups are included. . . . *How To Use Meters,* a 140-page book by *John F. Rider,* discusses all types of meters and how to use them for servicing. The panel-type meter, volt-ohm-milliammeter, *vtvm,* etc., are described. . . . *Obtaining and Interpreting Test 'Scope Traces,* 140-pages, also written by *John F. Rider,* provides more than 500 actual test 'scope patterns and explains what they mean. Also describes how to obtain maximum value from the 'scope when servicing.—*All 5½" x 8½", paper bound; priced at* $2.10, $2.40 *and* $2.40, *respectively; John F. Rider, Publisher, Inc., 480 Canal St., New York 13, N. Y.*

* * *

Television Broadcasting . . . By Howard A. Chinn: Designed to meet the needs of radio engineering and operating personnel interested in the technical aspects of TV broadcasting, this book surveys the equipment, systems and facilities of the broadcasting station, both in the studio and in the field, stressing up-to-date engineering practices and techniques of operation. Broadcasting fundamentals are supplemented with information on cameras, lighting, projectors, picture and sound recording, transmitters and antennas, etc.—*Priced at* $10.00; *McGraw-Hill Book Co., 327 W. 41st St., New York 36, N. Y.*

* * *

Audio Amplifier Data Manual . . . Volume 4: This is a continuation of audio amplifier manuals, with detailed servicing data, parts lists, and specific information on 60 chassis (75 models) of equipment produced during '51 and '52-*352 pages, 8½" x 11", paper bound, priced at* $3.95; *Howard W. Sams and Co., Inc., 2201 E. 46th St., Indianapolis 5, Ind.*

* * *

UHF Television Notebook . . . By Edward M. Noll: A 72-page book covering *vhf-uhf* tuners, *uhf* antenna performance, *uhf* propagation characteristics and *uhf* converters. Featured is a discussion of basic *uhf* considerations and useful *uhf service information.*—*8½" x 11", paper bound, priced at* $1.00; *The Paul H. Wendel Publishing Co., Inc., P. O. Box 1321, Indianapolis 6, Ind.*

* * *

Fields and Waves in Modern Radio. . . . By Simon Ramo and John R. Whinnery: In this, the second edition of this book, the authors include new material on horns, slot antennas, paraboloids and receiving antennas; slow-wave guiding structures; microwave networks; and *mks* units. Also featured in the book (with twelve chapters) are solutions to static field problems; circuit concepts and their derivation from field equations; skin effect and circuit impedance elements; characteristics of common wave guides and transmission lines; resonant cavities, and radiation.—*576 pages, priced at* $8.75; *John Wiley and Sons, Inc., 440 Fourth Ave., N. Y. 16.*

CATALOGS, BULLETINS ETC.

CHICAGO STANDARD TRANSFORMER CORP., Standard Division, Addison and Elston, Chicago 18, Ill., has published a 24-page catalog featuring electrical and physical specifications of almost 500 transformers. Twenty-five new units are listed, including thirteen TV components and five transistor transformers. A cross index chart between obsolete power transformers and the current 8400 series power types is also included.

* * *

WALDOM ELECTRONICS, INC., 911 N. Larrabee St., Chicago, Ill., has prepared a catalog, *5C3*, listing more than 2,000 items in stock. Included are tuner assemblies; mask, glass and escutcheon kits; knobs; instrument drives and dials; TV replacement items and accessories, and other components.

* * *

ASTRON CORP., 255 Grant Ave., East Newark, N. J., has released a catalog supplement, *AC-3A*, for its expanded line of twist-prong electrolytics. Supplement provides catalog numbers, capacitance and voltage ratings, and case sizes of new capacitors.

* * *

TELEVISION HARDWARE MANUFACTURING CO. (Division of General Cement Manufacturing Co.), 919 Taylor Ave., Rockford, Ill., has prepared a 32-page catalog on TV hardware.

* * *

FEDERAL TELEPHONE AND RADIO CORP., Selenium-Intelin Dept., 100 Kingsland Rd., Clifton, N. J., has issued a 24-page catalog, *Federal Quality Controlled Cables*, which describes coax cables and TV leadins. Booklet details cable production techniques, cable characteristics and applications, and includes coax cable impedance nomographs.

* * *

ALLEN B. DUMONT LABORATORIES, INC., Technical Sales Dept., 760 Bloomfield Ave., Clifton, N. J., has released the third edition of *Techniques of Photo-Recording from Cathode-ray Tubes*, a 36-page manual which presents a review of the problems and associated solutions encountered in photographing picture-tube patterns. Manual contains photo-recordings, scales, graphs and diagrammatic sketches.

* * *

SPRAGUE PRODUCTS CO., 61 Marshall St., North Adams, Mass., has prepared a condensed price list chart, *P-143*, on all *bread and butter* service capacitors and resistors. Catalog numbers are followed by both net and list prices.

* * *

NEWCOMB AUDIO PRODUCTS CO., 6824 Lexington Ave., Hollywood, Calif., has issued a 20-page catalog of public address equipment. Catalog contains information on amplifiers, portable systems and accessories, as well as rack and panel assemblies.

* * *

GEE-LAR MANUFACTURING CO., 1330-10th Ave., Rockford, Ill., has released a 16-page catalog, *55*, showing the hundreds of molded knobs carried in stock for immediate delivery.

TURNER CO., 930 17th St., N.E., Cedar Rapids, Iowa, has announced a technical bulletin on the new Turner *uhf* converter, model TV-3.

Also available is a bulletin on the Turner *ADA 95D* dynamic microphone; a general purpose unit, featuring Alnico V magnets and moving coils.

* * *

I. E. MANUFACTURING CO., 325 N. Hoyne St., Chicago 12, Ill., has released a catalog, *16*, describing a line of TV mounts, hardware and accessories.

* * *

CORNELL-DUBILIER CORP., South Plainfield, N. J., has issued a 4-page engineering bulletin, *NB-151*, featuring characteristics, test data, performance charts and diagrams of their *Demicon* line of high-temperature, metal-cased miniaturized tubular capacitors.

PERMA-POWER COMPANY, 4727 North Damen Avenue, Chicago 25, Ill., have released a 4-page catalog listing a new TV voltage regulator; deluxe model TV tube britener; C-Brite tube britener; universal TV tube britener; TV insulated high-voltage grid cap assembly; a TV high-voltage spring clip assembly; TV replacement socket; TV tube extensions, and three battery eliminators.

* * *

RADIO CITY PRODUCTS COMPANY, INC., 152 West 25th Street, New York 1, has issued a four-page catalog featuring complete specifications and data on the entire RCP test line, with particular emphasis on the model 750 *do-all* pattern, marker and signal generator for *uhf* and *vhf*, and the model 324 *do-all* tube and battery tester.

RAYTHEON TUBE PROMOTION

A tube-promotion item, *Tele-Jar Rotor*, specially designed for Service Men, has been announced by the *Raytheon Manufacturing Co., Newton, Mass.*

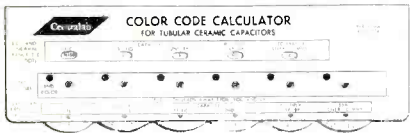
Approximately 17" high x 15" wide x 13" deep, rotor has 48 transparent plastic, unbreakable jars for storing transistors, crystal diodes, subminiature and miniature tubes, panel lamps, resistors, small capacitors, insulators and hardware. Featuring a ferris-wheel motion, unit can be used on the bench or on the wall.

* * *

CENTRALAB COLOR-CODE CALCULATOR

A color-code calculator, covering both capacitors and resistors, is now available from *Centralab, Dept. G-17, 900 East Keefe Ave., Milwaukee 1, Wis.*

By setting seven rotating wheels, capacitance or resistance, tolerance, and temperature coefficient can be read directly. Calculator covers RETMA color code specifications on normal and extended range tubular ceramic capacitors and radial or axial lead resistors.



CRL Color-Code Calculator

* * *

SERVICE MEN PRAISED IN NATIONAL MAG ADS

In a recent issue of *Life*, Raytheon paid handsome tribute to Service Men in a full-page ad. Titled *Nice Guy with An Undeserved Black Eye,* the ad noted that . . . "the vast majority of radio and TV Service Men are capable, efficient, thoroughly trustworthy, businessmen doing a magnificent job of keeping pace with a rapidly expanding new industry."

* * *

SIMPSON ELECTRIC PRODUCTION FACILITIES DOUBLED

Within the past year, facilities for the production of test equipment of *Simpson Electric* have doubled, according to Robert Brand, factory manager of the Chicago plant of the manufacturer, at 5200 West Kinzie St.

The announcement followed extension of the Lac du Flambeau plant in Wis. The third Simpson plant is located in Aurora, Ill., and a fourth plant, located adjacent to Simpson's Chicago home office, is scheduled for early occupancy.

* * *

25th ANNIVERSARY MODELS

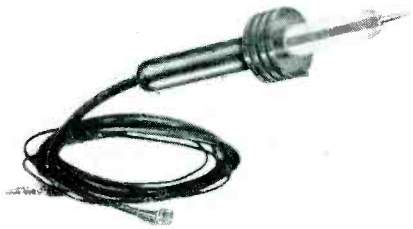
Nathan Pinsley, president of Espey Manufacturing Co., Inc., receiving first production model of Espey 25th year Trophy line of AM-FM receivers, tuners and amplifiers from Edward Robinson, director of Espey's high-fidelity engineering department, as Sol Pinsley, executive vice-president, looks on.

NEWS

PRECISION WINS TV PROBE PATENT

Patent 2,641,630 has been issued to *Precision Apparatus Co, Inc., 92-27 Horace Harding Blvd., Elmhurst, Long Island, N. Y.*, on the *Precision* series TV high-voltage safety test probe.

Probes were developed to afford direct measurement facilities up to 60,000 *v dc*. They provide direct kilovoltmeter facilities for most high sensitivity test sets and *vtvm* due to the availability of stock value and special value multiplier cartridges.



Precision Apparatus Probe

* * *

LEADER ELECTRONICS MAKING TV EQUIPMENT

Leader Electronics, Inc., Cleveland, Ohio, has begun the manufacture and sale of TV equipment. The firm now produces special industrial switches.

Full details as to the nature of the items being produced appear in the general announcements now being released. The items are primarily for consumer use, and extensive national sales are planned.

Les Wildberg

Prexy of Leader is Les Wildberg, who was founder and former president of Radiart Corp.

Other executives of the Leader organization include: *George J. Feiss, Jr.*, serving as vice president in charge of sales, and *Ralph Blauvelt*, who is chief engineer.

* * *

MUSIC MERCHANT SHOW EXHIBIT

Stephen Nester, president of Duotone Company, Inc., against backdrop of company display at recent Music Merchant's show in Chicago.

SIMPSON DOODLE PADS

A handy king-size desk pad, form *A-1 SPC*, with plenty of room for *doodling*, and a generous supply of pages for day-to-day use, has been prepared by the *Simpson Electric Company, 5200 W. Kinzie St., Chicago, Ill.*

Pads, printed in two colors, measure 17" x 22" and are padded 50 sheets each with non-slip chip board backing.

* * *

ALLIED RADIO OPENS NEW BUILDING

A $2,000,000 2-story plant has been placed in operation by *Allied Radio Corp., 100 N. Western Ave., Chicago, Ill.*

Building, with a total area of 147,000 square feet, covers a square block in the geographic center of the city. Air-conditioned salesrooms and the warehousing, shipping and receiving sections occupy the first floor area. Offices, reception rooms and a cafeteria are located on the second floor.

A system of pneumatic tubes and conveyor belts is used to speed order handling and movement of merchandise.

New Home of Allied Radio

* * *

RCP DISTRIBUTOR SPECIAL PURCHASE PLAN

A plan, for distributors, that it is said makes it easier to finance carrying an adequate stock of their products, has been introduced by Radio City Products Co., Inc., 152 W. 25th St., New York 1, N. Y.

Plan will permit a distributor to pay for stock carried over a period of 90 to 150 days without any interest. Trade acceptances will be the medium to cover such purchases. Distributors will receive a guarantee of liberal obsolescence protection.

* * *

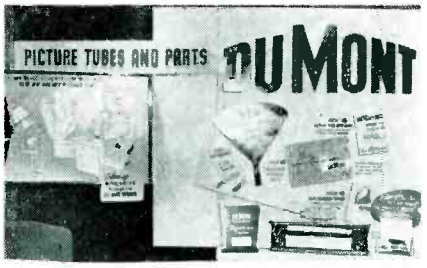
TUNG-SOL OPENS COLUMBUS, O. OFFICE

Tung-Sol Sales Corp., has opened a new office and warehouse at 755 W. Goodale Blvd., Columbus 8, *O. J. N. Hoover*, Detroit sales manager, will transfer the major portion of his sales activities to the new address. Telephone number is Fletcher 5494.

The new facility will provide 26,000 square feet of office and storage space.

* * *

REPLACEMENT TUBE-PART DISPLAY



Display prepared by replacement sales department of Du Mont. At right: 56-page TV service data containing schematics; cross-reference replacement parts guide; Du Mont picture tube data chart; Service News; and window and wall posters. At left, humorous ad-mat, one of a series, for Du Mont picture tubes.

AT LAST!

THE CD-53 "SYMPHONY"

Highest Quality and Performance Yet Achieved in a Record Changer

- **PLAYS BOTH SIDES** of all micro-groove and standard records at 33⅓, 45 and 78 rpm.
- Plays nine 10" and 12" records mixed in any order, or twelve 7" records at 33⅓, 45 or 78 rpm.
- Two motors E 53 with precision governor.

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Engineered for the Purpose . .

Copperweld GUY STRAND
TRADE MARK

provides REAL GUYING CONFIDENCE

Copperweld DOESN'T STRETCH

Soft wire guys frequently stretch badly in service and go slack. This means a wobbly antenna and poor reception. Copperweld Guy Strand is hard drawn—has the strength to stay taut—holds the antenna firmly in place—improves reception.

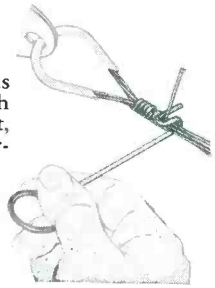
Copperweld COMBATS RUST

A guy weakened by rust may go unnoticed until a storm brings down the antenna, causing damage many times the cost of the guy. Copperweld Guy Strand is protected against rust by a molten-welded layer of pure copper on each wire. Its strength is lasting.

SOLD BY RECOGNIZED PARTS DISTRIBUTORS

Copperweld is EASY TO INSTALL

No clamps or clips are needed. An ingenious serving tool—one furnished free with each standard length of strand—turns out neat, tightly wrapped dead-ends as strong and permanent as the strand itself.



Write today for further details.

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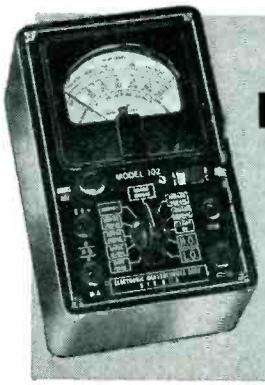
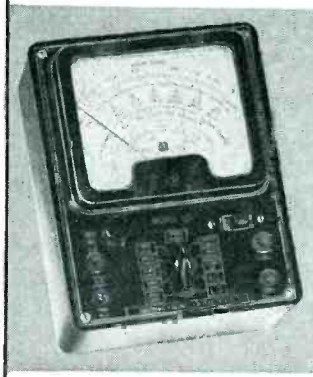
Glassport, Pa.

Compare... prove EMC superiority



model 102

(1000 ohms per volt meter) • 3" SQUARE METER • 3 AC CURRENT RANGES (0-30/150/600 ma.) • Same zero adjustment for both resistance ranges 0-1000 ohms 0-1 meghoms) • 5 DC & 5 AC Voltage Ranges to 3,000 volts • Also 4 DC Current Ranges **$14.90**



model 103

(1000 ohms per volt meter) 4½" SQUARE METER • 3 AC CURRENT RANGES (0-30/150/600 ma.) • Same zero adjustment for both resistance ranges (0-1000 ohms, 0-1 meghoms) • Some Ranges as Model 102 • Also 5 DB Ranges **$18.75**

Model 103-S with plastic carrying strap..... **$19.25**

model 104

(20,000 ohms per volt meter) • 4½" SQUARE METER 50 microamperes-Alnico magnet • Includes carrying strap • 5 DC Voltage Ranges at 20,000 ohms volt to 3,000 V.: 5 AC Voltage Ranges to 3,000 V. • 3 Resistance Ranges to 20 megs • Also 3 AC & DC Current Ranges • 5 DB Ranges **$26.95**

HVT 30,000 Volt Probe for Model 104 ..... **$7.95**

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Picture-Tube Fundamentals

(*Continued from page 99*)

are also subject to the action of accelerating voltages of the anodes.

In electrostatic deflection tubes the ions and electrons are similarly deflected due to the electrostatic field used. However, if electromagnetic deflection is used, the heavier ions are hardly deflected and will result in a dark ion burn at the center of the screen unless means are taken to prevent them from reaching the screen.

This problem can be solved by directing the mixed stream of electrons and ions away from the screen and then magnetically bending the electron stream only back where it can be scanned over the screen. The ions, being substantially unaffected by the magnetic field which returns the electron stream, strike the gun structure and are dissipated.

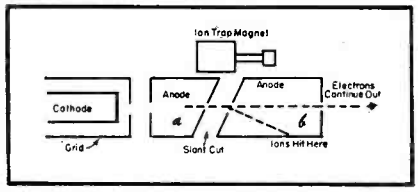

Fig. 6. Another method devised to prevent ion burns, featuring diagonal or slant-cut construction.

Several different structures for attaining this result have been devised. The gun structure may be built with a *bend* which directs the ions away from the screen, while the lighter electrons are bent by a magnetic field to permit them to pass through the rest of the gun and thence to the screen. Fig. 5 (p. 99) illustrates this action; the bend has been somewhat exaggerated. Another

(*Continued on page 118*)

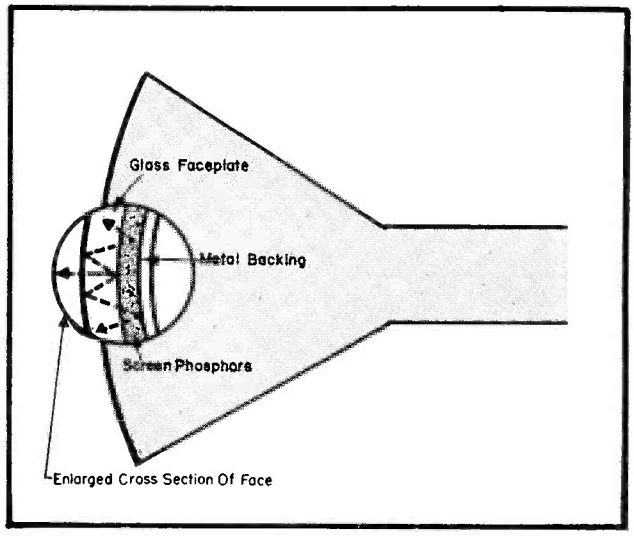

Fig. 7. Picture tube with an aluminized or metal-backed screen.

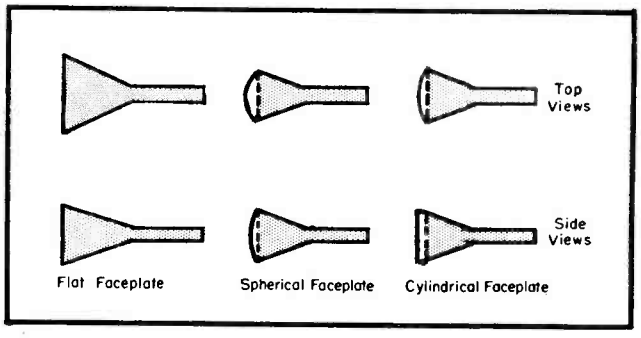

Fig. 8. Three types of faceplates used on 'scopes and picture tubes.

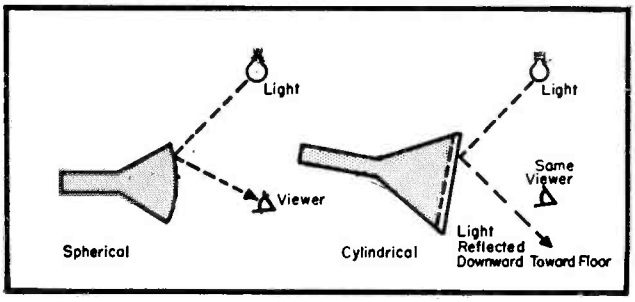

Fig. 9. Reflections that obtain with spherical and cylindrical-type faceplates.

(*Continued from page* 116)

method features the use of an electrostatic field transverse to the axis of the tube which causes the ions and electrons to bend and strike the anode *b*, as shown in Fig. 6 (p. 116). As indicated in this drawing, a slant or diagonal cut between the two accelerating anodes can be provided to furnish such action. A transverse magnetic field is applied to deflect the electrons sufficiently to continue on through to the screen. The heavier ions are not deflected sufficiently and strike anode *B*, and are thus prevented from reaching the screen. Fixed magnets are most commonly used, but some older sets were produced with magnets consisting of current-carrying coils. To adjust a permanent-magnet type ion trap, one should first locate the magnet approximately at the slant cut or anode bend which is visible through the neck. In the case of double-magnet ion traps, the smaller magnet should be toward the tube face. With the brightness and contrast controls turned to minimum, the set should be turned on and allowed to warm up for about a minute or two. Then the contrast and brightness controls should be turned up, about half way. The ion trap magnet should now be moved back and forth along the neck and around it until the picture is brightest. The contrast and brightness controls should then be readjusted for the desired picture. Then the ion trap position should be adjusted for maximum brightness. The ion trap must never be used to center the picture on the screen.

The screen brilliance of picture tubes can be increased by applying a thin coating of aluminum as a backing to the screen. The light output is thus increased since the metal acts as a mirror, reflecting forward the light which should otherwise be lost to the rear of the screen, as shown in Fig. 7 (p. 116). The metal backing has also been used to aid in reducing the ion burn, since the heavier ions will not penetrate metal as far as the lighter electrons. Thus, if the metal is sufficiently thin the electrons will be able to penetrate it and excite the screen in the usual manner while at the same time, if the screen is thick enough and has no holes or breaks in it, the ions will not reach the screen itself.

The action by which certain materials convert the energy of an electron beam into visible light is called *luminescence*. *Fluorescence* is luminescence, produced only when the substance is being excited by the electrons, while *phosphorescence* is luminescence which exists after the excitation is removed. Hence, the crystalline materials in pic-

ture tube screens are called phosphors. The color of the emitted light depends to a large extent upon the chemicals used in the phosphors. Green is relatively easy to produce, and is the one commonly used for 'scope tubes. For TV picture tubes a combination of zinc sulphide and zinc silicate is used, since it gives a very high conversion of beam energy to useful white light. While the electron beam hits a given spot for only a fraction of a microsecond, the light emission continues for several hundredths of a second. This factor of persistence is also important since it determines how long the image will remain upon the screen. A medium persistence is used for picture tubes, while a longer persistence is employed in some radar indicators. Extremely short persistences are also used in some special applications.

The *P4* part of a tube type designation denotes that it is a phosphor of medium persistence and white color; while *P7* indicates a cascade screen having a short blue-white and a longer persistence yellow trace. 'Scopes commonly use a *P1* medium persistence, green color trace.

The color of a white screen (*P4*) is dependent upon the absence of impurities in the phosphor. If the most extreme precautions are not taken by the manufacturer, small changes in the voltages applied to the tube will cause the screen color to depart from a pure white to greenish or some other color, depending upon the type of impurity present.

Faceplates

There are three basic types of faceplates used. A flat type is used on some special types of 'scope and measurement devices, and is not often seen by the average Service Man.

The spherical type was among the first to be used, mainly for mechanical reasons. The face of a tube must be able to withstand a tremendous force. The spherical type, therefore, is still in wide use because of its mechanical advantages, but does possess a disadvantage in that reflections from windows or room lights may disturb the viewer.

A cylindrical faceplate greatly minimizes such reflections, especially if the tube is tilted about 7½°. This tilt permits placing of room lights at many points in the room, where reflections would normally occur if a spherical faceplate tube were to be used instead, since the reflected light is directed downward and away from the viewer's line of vision. A disadvantage of a cylindrical faceplate is that since it has curvature in only one direction, a certain amount of distortion results. This may require a slight modification in the design of the deflection yoke to be used.

The faceplates were originally made of clear optical glass, but most faceplates are now made of gray, or tinted optical glass. Some tubes are produced with *frosted* or finely etched faceplates in an attempt to aid in reducing the reflections from the face of the tube.

The external conductive coating is also an important picture-tube factor. Since the inner coating of the bulb is

(*Continued on page* 120)

Picture-Tube Fundamentals

(*Continued from page* 119)

at a high potential above ground, another similar conductive coating on the outside would form an excellent high-voltage capacitor. This outer conductive coating is grounded, and thus the combination is used as a filter capacitance for the high-voltage anode power supply, thereby eliminating a capacitor in that supply. The capacitance thus provided is always given in the tube data for the particular tube type.

Picture Tube Service Notes

Since the tube itself is held in a sort of *cradle* in a fixed position in practically all applications, the tube socket should not be rigidly mounted.

It must be remembered, also, that even though the high-voltage supply is designed to supply only a very low current, it is still extremely dangerous and every precaution should be taken. Care should also be exercised in handling picture tubes, such as never grasping a tube by the neck to carry it, scratching or bumping the tube. Considerable injury may result if a tube is accidentally broken while being handled, since because of the high vacuum, it will blow inward or implode with considerable force.

•

U/V Field Strength Meter

(*Continued from page* 43)

but to make possible the display of the entire range of receivable signals in each band on two meter scales. An approximately logarithmic characteristic of the input-output response is therefore obtained.

For the taking of relative measurements, such as in optimizing the orientation of an antenna, a logarithmic response has been found to be undesirable. It is desirable for only a small change in antenna output to cause a large change in meter deflection, in order that the antenna can be oriented quite accurately. For this reason a variable sensitivity position is provided, in which no *agc* is used. The meter characteristic instead of being compressed, as with *agc*, is actually expanded more than even a linear scale; due to the detector characteristics. A sensitivity control is used to bring the meter on scale for any signal being received. It is then possible to see on the meter the effect of very small percentage changes in the received signal, taking much human error out of the antenna positioning and orientation.

PERSONNEL

EDWARD P. ATCHERLEY has been named merchandising manager for renewal tube sales of Sylvania Electric Products, Inc., headquartering at 1740 Broadway, New York City.

E. P. Atcherley

John Schweighauser

JOHN SCHWEIGHAUSER is now *antennigineer* for the Snyder Manufacturing Co., Philadelphia. Schweighauser will call upon Snyder distributors and service dealers in the capacity of a sales engineer.

* * *

CLARENCE M. CLARK has been appointed manager of the Westinghouse Bath plant.

* * *

JACOB H. RUITER, JR., has been named manager of public relations for Allen B. Du Mont Laboratories, Inc., and will report to Keeton Arnett, general assistant to the president. Public relations, institutional advertising and the coordination of technical advertising of several divisions of the company, previously handled by the advertising division, will now be the responsibility of the public relations department.

VINTON K. ULRICH, formerly renewal sales manager of National Union Radio Corp., has joined the David Bogen Co., 29 Ninth Ave., New York 14, N. Y., as general sales manager. Ulrich replaces W. Walter Jablon who has resigned as vice president in charge of sales. . . . MORTIMER SUMBERG has been named distributor sales manager.

V. K. Ulrich

M. Sumberg

* * *

G. F. BENKELMAN has been elected chairman of the board of Continental Carbon, Inc., Cleveland, Ohio. Others elected include: J. W. JIRA, president and chief engineer; W. M. WOOD, vice president in charge of sales.

* * *

HUGH J. DALY has returned to Eicor, Inc., 1501 W. Congress St., Chicago, Ill., as sales manager of the tape recorder division. Daly formerly was with Eicor from '46-'48 as mid-western and Canadian sales rep.

H. J. Daly

I. M. J. Kaplan

I. M. J. KAPLAN has been named vice president of Copperweld Steel Co., Frick Building, Pittsburgh, Pa. Kaplan was formerly manager of sales, special products, of the wire and cable division.

* * *

DOUGLAS CARPENTER, formerly chief engineer of the Vee-D-X division of LaPointe Electronics Corp., the Summit Engineering Co. and McMurdo-Silver, has been appointed chief antenna development engineer of the JFD Manufacturing Co., Brooklyn, N. Y. . . . JIM HALL has been appointed associate antenna test engineer.

Doug Carpenter

Jim Hall

* * *

JOHN A. RANKIN and JOHN S. STURGEON have been elected vice presidents of The Magnavox Company; Sturgeon is treasurer, while Rankin serves as director of engineering.

A Complete *Audio Fair*

Report on the Pacific Coast, Chicago, Philadelphia and New York shows . . . will appear next month in SERVICE. Don't miss this up-to-the-minute nation-wide survey of the latest in audio gear!

MAX FINK has resigned from the Hi-Lo TV Antenna Corp., 3540 N. Ravenswood Ave., Chicago 13, Ill. . . . FRANK J. KLANCNIK, president, will act as general sales manager.

* * *

F. W. BELL, president of Bell Sound Systems, Inc., 555 Marion Rd., Columbus, Ohio, has been elected to the board of directors of RETMA.

* * *

FREDERICK G. SUFFIELD, formerly manager of engineering for Transco Products, has been appointed assistant to the president of Triad Transformer Corp., Venice, Calif.

* * *

W. WARD WILLETT has been appointed advertising manager of LaPointe Electronics, Inc., Rockville, Conn. . . . LINC KINNICUTT has been named assistant to the general sales manager.

* * *

MALCOLM C. HUTCHINSON, former vice president of the Irving Trust Co., has been elected a director of the General Instrument Corp.

M. C. Hutchinson

* * *

ALLEN K. SHENK and JEROME D. HEIBEL have been named vice presidents in charge of sales, and in charge of research and engineering, respectively, of the Erie Resistor Corp., Erie, Pa.

* * *

THOMAS M. FITZGERALD, JR., has been named sales manager of the capacitor division of the P. R. Mallory and Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.

* * *

HARRY GRANAT has been appointed manager of the Chicago offices and warehouses of Allied Electric Products, Inc.

* * *

BRUCE R. CARLSON has been named statistical assistant to the president of the Sprague Electric Co., North Adams, Mass.

* * *

JACK GRAND was reelected chairman of the board of Granco Products, Inc., Long Island City, New York, at its annual stockholders' meeting. Others named included: HENRY FOGEL, president; ALLAN EASTON, vice president and general manager; SEYMOUR NAPOLIN, vice president and chief engineer; ALEXANDER THEEMAN, treasurer; and IRWIN GREEN, secretary.

* * *

WESTINGHOUSE LAUNCHES PREMIUM PROMOTION

An extensive promotion campaign has been launched by the electronic tube division of the *Westinghouse Electric Corporation, Elmira, N. Y.*

Overall theme of the campaign to Service Men cites that these sales-incentive items should be used *as a confidence builder . . . in your workmanship . . . in your shop . . . and in your pricing.*

Picture-Tube Checks

(*Continued from page 52*)

Verification and Correction

(*E*) Disconnect sync input from vertical oscillator and see if bending disappears. If so, trouble is due to coupling from vertical oscillator. Additional isolation in the vertical oscillator input circuit may decrease bending. . . . Connect *'scope-ext* sync to appropriate point in receiver under test to sync on horizontal pulses. Observe waveshape around *afc* and horizontal deflection circuits. Top-of-picture bending due to phase shift will show up as a following haze on the 'scope pattern, caused by the first few horizontal scanning lines of each frame falling at a slightly different place on the face of the 'scope. Disable vertical amplifier tube; if phase shift is eliminated, trouble is due to coupling in the yoke or through the power supply. Check power supply filter capacitors, and check performance with new yoke. . . . If phase shift is not due to vertical oscillator, check for presence of vertical sync pulse in the horizontal sync circuit caused by a faulty resistor or capacitor.

Possible Fault

6—*Horizontal wiggle with picture motion:*

(*A*) Peak of video signal getting through to horizontal *afc* circuits and causing false synchronization. (If only present on fast motion, trouble may be related to the response time of the sync separator and may be an inherent design fault of the receiver.)

Verification and Correction

(*A*) Replace tubes involved in sync separation and amplification. . . . Check wave shapes in sync circuits with 'scope. Sync pulses should be considerably greater in amplitude than highest peak of picture signal. Input to horizontal *afc* circuits should be completely free of picture signal.

Possible Fault

7—*Black horizontal bar:*

(*A*) Heater cathode leakage.

(*B*) Power frequency ripple on voltage buses.

Verification and Correction

(*A*) Determine whether bar is present with no signal being received. If so, leakage is in video amplifier; if not, defective tube is in tuner or *if* stages. . . . Replace tubes in appropriate portion of receiver.

(*B*) Replace bypass capacitors in power supply and on appropriate buses.

Possible Fault

8—*Vertical foldover:*

(*A*) Improper waveshape of sawtooth deflection signal.

Verification and Correction

(*A*) Replace vertical oscillator and output tube. . . . Check voltages and parts values in vertical deflection circuits. . . . Check values of resistors and capacitors in vertical deflection circuits.

Tube News

(*Continued from page 72*)

current flow is strong in one direction and weak in the other. If a second wire is placed in contact with the germanium, small signals on this wire greatly affect the current flow between the first wire and the germanium. This is how a *transistor* amplifies; it controls current flow in a solid material, the solid material being the *semiconductor*.

There are two prominent types of transistors. One is the *point* contact which involves two catwhiskers, making needle point contact with a tiny wafer of germanium.

The other type uses a thin wafer of germanium with two tiny pieces of some rare metal (each about the size of a pinhead) bonded to opposite sides of the germanium crystal. The joining of dissimilar metals in this fashion makes a *barrier* junction; hence these units are known as *junction* transistors.

*Transistor Operation**

The principle of operation of the junction transistor is somewhat different from that of the point-contact transistor. In the *n-p-n* junction transistor, electrons from the *n*-layer diffuse through the *p*-layer and are attracted to the collector. The *p*-layer has a surplus of holes. Because the *p*-layer is very thin, most of the electrons entering the base region from the emitter will reach the collector region without recombining (neutralizing) the holes. Practically all of the electrons leaving the emitter reach the collector, thus resulting in a current and amplification factor approaching unity.

The action of the *p-n-p* type of junction transistor is similar to that of the *n-p-n* type, except that the polarities of the battery voltages are reversed and conduction is caused by holes instead of electrons.

Fig. 1 (p. 72) shows some typical amplifier circuits. Circuit *a* is recommended for point-contact transistors; and circuits *b* and *c* for junction transistors of the *p-n-p* type. These circuits may also be used for junction transistors of the *n-p-n* type, provided the polarities are reversed.

Recently, two new types of transistors were developed: the tetrode and pentode.

The tetrode, a point-contact transistor, can be used, it is said, for switching or small signal applications. In the former case, it might serve as a two-input diode or in a gating circuit. In the latter instance (small-signal work) it might be applied for modulation or as an audio or low *rf* mixer.

As a modulator or mixer, the collector voltage (*dc*; with respect to base) has been experimentally set as –25. Emitter current (*dc*; either emitter) should be .5 ma.

Uses for Tetrode-Pentode Transistors

Because the tetrode and pentode transistors have more elements than the triode transistors and can serve as replacements for triodes on a one-for-two or one-for-three basis in some applications, they will result in more greatly simplified circuitry and will permit the building of even more compact electronic equipment than the triode will permit.

However, as far as application is concerned, transistors still are in the development stage. Application engineering shows, it has been noted, that triode, tetrode and pentode transistors all will have specific functions in electronic equipment, and that as transistors are developed with additional elements, there will be important uses for the less complex transistors.

Some technical problems which have been slowing the practical application of transistors in commercial electronic equipment are being solved.

Some Practical Circuits Developed

Engineers have developed some practical circuits for audio amplifiers, *rf* amplifiers and oscillators, multivibrators, and *flip flops* using point-contact and junction-type transistors. Performance variations which can develop from deviations in transistor characteristics, together with lab-

(*Continued on page 126*)

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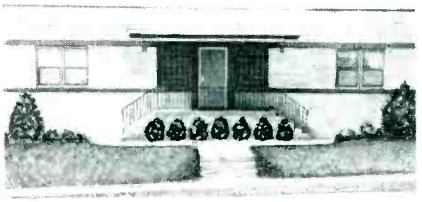
NEW MOSLEY BUILDING



New brick office building of Mosley Electronics, Inc., 8622 St. Charles Rock Road, St. Louis 14. Mo. Building adjoins the building formerly housing offices and now devoted entirely to packing and shipping operations. In addition, building contains a development and testing lab.

*From RCA notes on transistors.

²Sylvania.

(*Continued from page* 124)

tested methods for stabilizing transistor operating conditions, are now being blueprinted.

Transistors, whose operating characteristics will not deteriorate with age, as a result of contamination either sealed into or allowed to enter the case, have also been produced. One manufacturer[3] has noted that its transistors feature an all-welded metal construction, and are also evacuated and hermetically-sealed. The welded construction, it is said, eliminates the aging effects of moisture and trapped solder flux fumes.

[3]G.E.

* * *

ANTENNA MAKER PLANT ADDITION

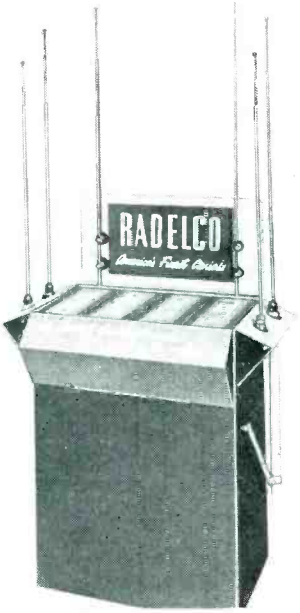
New addition to the Trio Manufacturing Co. plant at Griggsville, Illinois. Facilities add 24,000 square feet of manufacturing space. Also added was a new lab.

PC CO. MANAGEMENT CHANGE

Stellan C. Wollmar, vice president of LaPointe Electronics Inc., discussing recent purchase of a 95 per cent interest in Circuitron, Inc., a New Jersey corporation engaged in the manufacture of printed circuits, with Jerome E. Respess, LaPointe president. "By acquiring and managing Circuitron," Respess stated, "LaPointe is assured of a continuing supply of the printed circuits used in the Vee-D-X Mighty Match and other TV accessory equipment." In addition, he said, "LaPointe will manufacture printed circuits for a variety of fields withhin the electronic industry." Circuitron is being moved to Rockville, Conn.

* * *

AUTO ANTENNA FLOOR DISPLAYER



Auto antenna floor displayer developed by Radelco. Displayer is printed in three colors: body of the carton is dark blue; lettering is yellow against a background of red. Has mounting space for six different model antennas. Mounting shelves have open ends so that prospects can see how antennas are installed. Display available to those who order Radelco DB-40 assortment.

* * *

C-D ROTOR PROMOTION CAMPAIGN

Plans for accelerated promotion of *CDR rotors, including models TR-2, TR-11* and *TR-12*, at the consumer level beginning early this fall, have been announced by *Cornell-Dubilier Electric Corporation, South Plainfield, N. J.*, and their subsidiary, *The Radiart Corp., Cleveland, Ohio.*

Promotion will feature spot campaigns on TV stations in more than twenty-five cities representing the major rotor markets. Campaign will be paralleled with a program in newspapers in these same cities, as well as adjacent cities, with dealer listings showing the readers where they can buy the *CDR* rotors.

JOTS AND FLASHES

Tv, and radio chassis production, too, continues to zoom, according to RETMA. For the first 26 weeks of this year, nearly 4-million TV receivers and over 7-million radios came off the line; an increase of over a million and a half for TV, and nearly a 2-million rise for radios over the same period in '52. Included in the record production of AM sets were over 2-million home models, more than a million portables, over 3 million auto radios, and more than a million clock sets. . . . *Hal Schulman,* service manager of the receiver division of Allen B. DuMont Labs., is now chairman of the RETMA service committee, and *John F. Rider* has been named vice chairman. . . . *Harry A. Ehle,* of IRC, has been named president of the Radio Parts and Electronic Equipment Shows, Inc. *H. M. Carpenter,* of Thorow Distributors, Inc., Tampa, Fla., was chosen vice president; *Francis F. Florsheim,* Columbia Wire and Supply Co., Chicago, secretary, and *Bernard L. Cahn,* Insuline Corp. of America, Inc., Long Island City, N. Y., treasurer. . . . The Audio Fair and 5th Annual Convention, scheduled for October 14-17 at the Hotel New Yorker, New York City, will feature the presentation of 28 papers on audio. . . . G. E. has announced that it will increase production of its *aluminized* TV picture tubes by 50% when a multi-million-dollar retooling project, now under way at its Buffalo and Syracuse plants, is completed. . . . A half-hour telecast of a section of a Service Men's forum was conducted by *Marty Bettan,* RMS engineering head, recently at the studios of WHIZ-TV, channel 50, Zanesville, O. . . . According to *Emil G. Nichols,* sales manager of the Instrument division of DuMont, sales for the 26-week period were 23% above the same period last year.

ADVERTISERS IN SERVICE, SEPTEMBER, 1953

Industrial Television Inc.

TECHNI-TOPICS

By WALTER V. TYMINSKI

AN EVALUATION OF PASSIVE TELEVISION RECEIVER COUPLERS

Part One discussed the use of the IT-117A *Auto*Couplers and resistive couplers for two set operation.

PART TWO

Recently a modified resistive coupler was introduced by a major television receiver manufacturer. Instead of using a resistive terminated transmission line with resistive tap-offs for both receivers, the coupler instructions show the use of one receiver to terminate the transmission line. The operating characteristics for this modified resistive coupler are:

Loss Ant.-to-Set #1 = 1.3 db (P/114)
Loss Ant.-to-Set #2 = 11 db (P/13)
Loss Set-to-Set = 11 db (13)
Min. Directivity = 0 db
Freq. Range — VHF

It is interesting to note that the manufacturer recommends the use of separate couplers for each receiver when oscillator radiation is a problem. This latter connection is similar to the original I.T.I. Multivision* Antenna couplers and has similar characteristics.

I.T.I. has recently introduced the IT-131A Two Set *Auto*Coupler which not only provides improved performances, but also is directly usable with 75 and/or 000 ohm sets and antennas. The IT-131A uses a newly developed transformer in a unique arrangement incorporating directional coupler action. Typical operating characteristics for the IT-131A are:

Loss Ant.-to-Set = 3.5 db (P/2.2)
Loss Set-to-Set = 15.5 db (P/36)
Directivity = 12.0 db (16)
Freq. Range — VHF

Another arrangement which lends itself to two set operation is the so-called Wide Band Hybrid Ring†, a modification of the IT-117A which minimizes the effect of receiver mis-match.

While the Hybrid Ring can be used at VHF it is especially useful at UHF and such a unit is being marketed as the IT-135A UHF *Auto*Coupler. The operating characteristics for the IT-135A are:

Loss Ant.-to-Set = 3.5 db (P/2.2)
Loss Set-to-Set = 10 to 40 db (P/10 to P/10,000)
Directivity = 6.5 to 36.5 db
Freq. Range — UHF

For combined VHF-UHF installations the IT-131A, or IT-117A, and IT-135A Couplers can be used in conjunction with the IT-126A to provide a low cost, highly efficient, all-band two set television distribution system.

(to be continued)

† W. V. Tyminski & A. E. Hylas—A Wide Band Hybrid Ring for UHF—Proc. of I.R.E., Jan. 1953.

* Trade Mark

What does this symbol mean . . .

TO THE JOBBER-SERVICEMAN-DEALER-INSTALLER?

It is the symbol of responsibility and reliability which marks the business conduct and product standards of each member company.

It represents unity of action in planning a vigorous approach to the antenna replacement market . . . with aggressive promotion campaigns to assist your own selling effort.

It is your assurance of progress in technical standards and service to help you meet the changing conditions of the industry.

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RADIO MERCHANDISE SALES, INC.
New York, N. Y

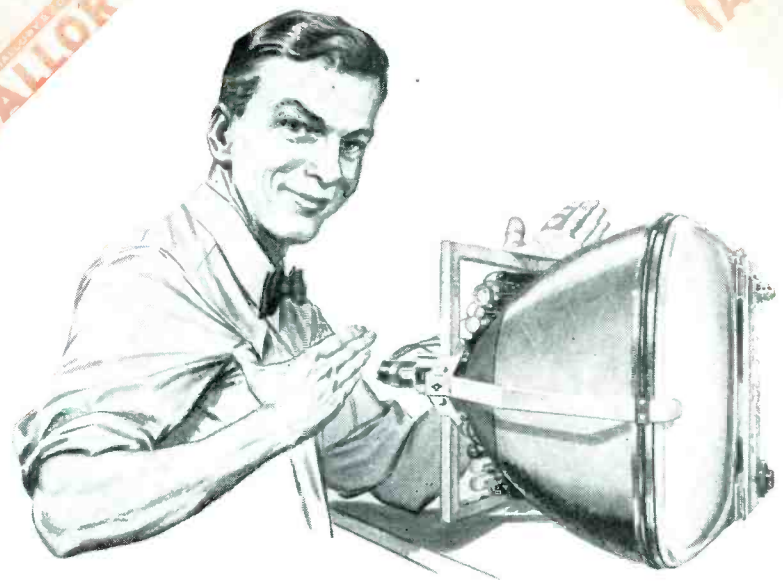
WALTER L. SCHOTT CO.
Los Angeles, California

SNYDER MANUFACTURING COMPANY
Philadelphia, Pa.

T-V PRODUCTS CO.
Springfield Gardens, L. I., N. Y.

WARD PRODUCTS CORP.
Cleveland, Ohio

ANTENNA MANUFACTURERS ASSOCIATION



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Can't Remember a MALLORY Capacitor <u>Ever</u> Letting Me Down . . ."

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Mallory FP Capacitors are the only fabricated plate capacitors available to the replacement market. They will give long lasting performance at higher temperatures and greater ripple currents . . . even at 185° F. (85° C.).

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For your plastic tubular requirements, be sure and specify Mallory Plascaps®. You can depend on them to end troubles with premature shorts . . . leakage . . . off center cartridges . . . and unsoldered leads.

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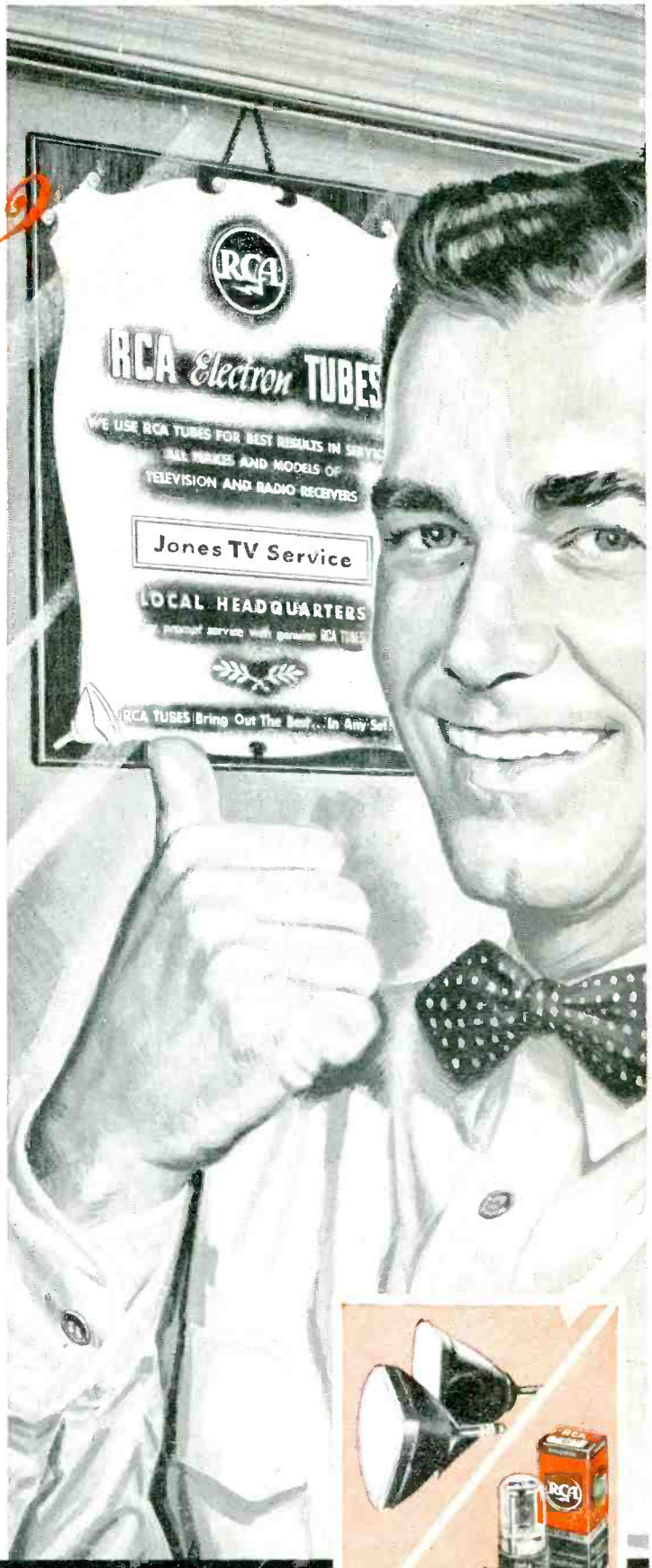

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Here's *your* key to better business . . . RCA's dynamic Dealer Identification Program. Ask your *RCA Tube Distributor* for your copy of the colorful, 16-page booklet "A Magic Pass-Key to Customer Confidence." It tells you how — for the first time — you can become a Registered Dealer . . . and get *extra* sales benefits.

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ELECTRON TUBES HARRISON, N.J.