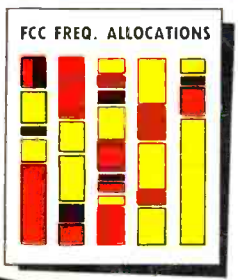
Formerly TELEVISION RETAILING

TECHNICIAN

TELEVISION • ELECTRONIC • RADIO • AUDIO • SERVICE

In 2 Sections • Section 1



In this issue

Full-Color Chart Showing the

1953 FCC FREQUENCY ALLOCATIONS

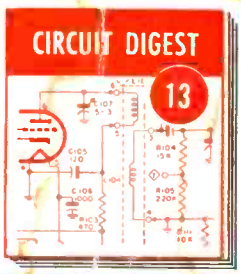
prepared by Caldwell-Clements • See Section 2

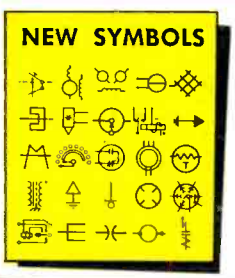
Also: "Theory and Servicing of Interlace Problems"
"Eliminating Vertical Retrace Lines in TV Sets"

In this issue

"CIRCUIT DIGEST" 24 pages of Service Notes and Schematics for the latest sets

Also: "Service Data on UHF Converters"
"Servicemen's Gripes About TV-Set Design"





In this issue

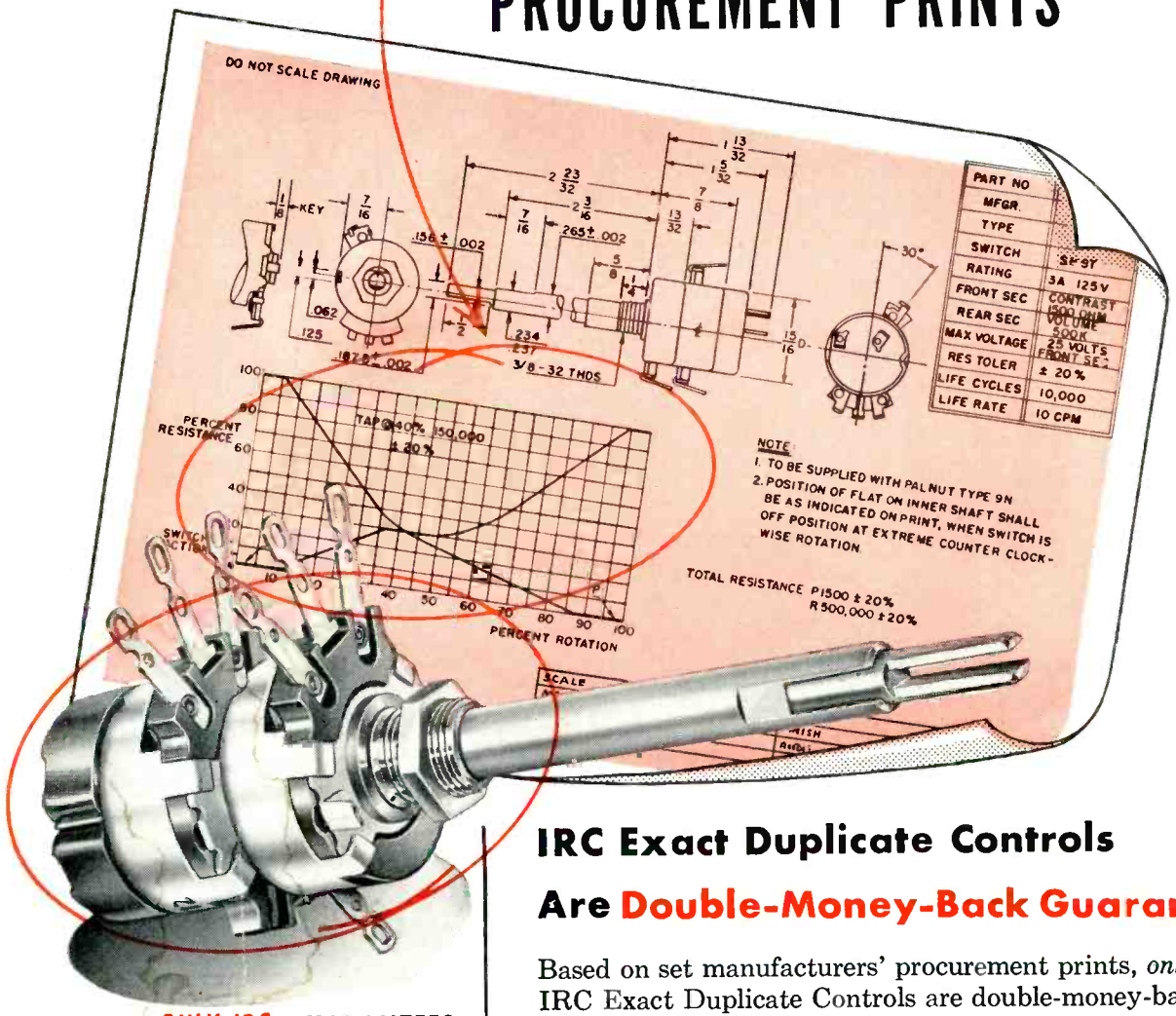
New Graphical Symbols for TV-Radio-Electronic Diagrams, the First Major Changes in Many Years; an IRE Standard

Also:
"Servicing FM Sets," "Sweep Circuit Troubles"
News of the Service Associations, Latest New Products and Many Other Up-to-the Minute Features

September • 1953

A Caldwell-Clements Publication

ASSURED ELECTRICAL ACCURACY BASED ON MANUFACTURERS' PROCUREMENT PRINTS



ONLY IRC GUARANTEES ACCURATE ELECTRICAL OPERATION AND SATISFACTORY MECHANICAL FIT OR DOUBLE-YOUR-MONEY-BACK

Electrical specifications of this typical manufacturer's procurement print are exactly duplicated by IRC's QJ-412 control (shown). CONCENTRIKIT assembly includes P1-206 and R1-223 shafts with B17-109 and B13-133X Base Elements and 76-1 Switch.

IRC

Wherever the Circuit Says ~W~

IRC Exact Duplicate Controls Are Double-Money-Back Guaranteed

Based on set manufacturers' procurement prints, *only* IRC Exact Duplicate Controls are double-money-back guaranteed for accurate electrical operation. This firm guarantee applies to both IRC factory-assembled Exact Duplicates *and* universal CONCENTRIKIT equivalents.

Set manufacturers' electrical specifications are closely followed.

Resistance values are carefully selected to match.

Tapers are watched careful'y; IRC doesn't arbitrarily substitute tapers to obtain wide coverage.

For exact duplicate controls of guaranteed accuracy, specify IRC. Most Service Technicians do.

INTERNATIONAL RESISTANCE CO.

425 N. Broad Street, Philadelphia 8, Pa.

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TECHNICIAN*

(Formerly the TECHNICIAN SECTION of "TELEVISION RETAILING")

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This issue: 44,000. Guaranteed circulation by January 1954:

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TECHNICIAN, September 1953, Vol. 58, No. 3. 50 cents a copy. Published by Caldwell-Clements, Inc., Publication Office, Emmett St., Bristol, Conn. Editorial, Advertising and Executive Offices, 480 Lexington Ave., New York 17, N. Y. Entered as second class matter at the post office at Bristol, Conn., July 17, 1952, under the act of March 3, 1879. Application for re-entry pending at Bristol, Conn. due to change in title. M. Clements, President; Orestes H. Caldwell, Treasurer. Subscription rates: United States and Canada, $4.00 for one year; $6.00 for two years; $8.00 for three years. Pan-American and Foreign countries: $7.00 for one year; $10.00 for two years; $14.00 for three years. Printed in U.S.A.

SEPTEMBER, 1953

TECHNICIAN'S CHART OF ALL RADIO AND TELEVISION CHANNELS, showing Complete 1953 FCC Frequency Spectrum—A valuable and appropriate reference for your place of business or over your service bench. Useful to show customers the relations of all radio, AM and FM channels, as well as VHF and UHF television, with intervening commercial marine, aviation and government assignments. All channels designated in both frequencies (megacycles) and wave lengths (meters). Handsome chart in six colors. **Section 2 of this Issue**

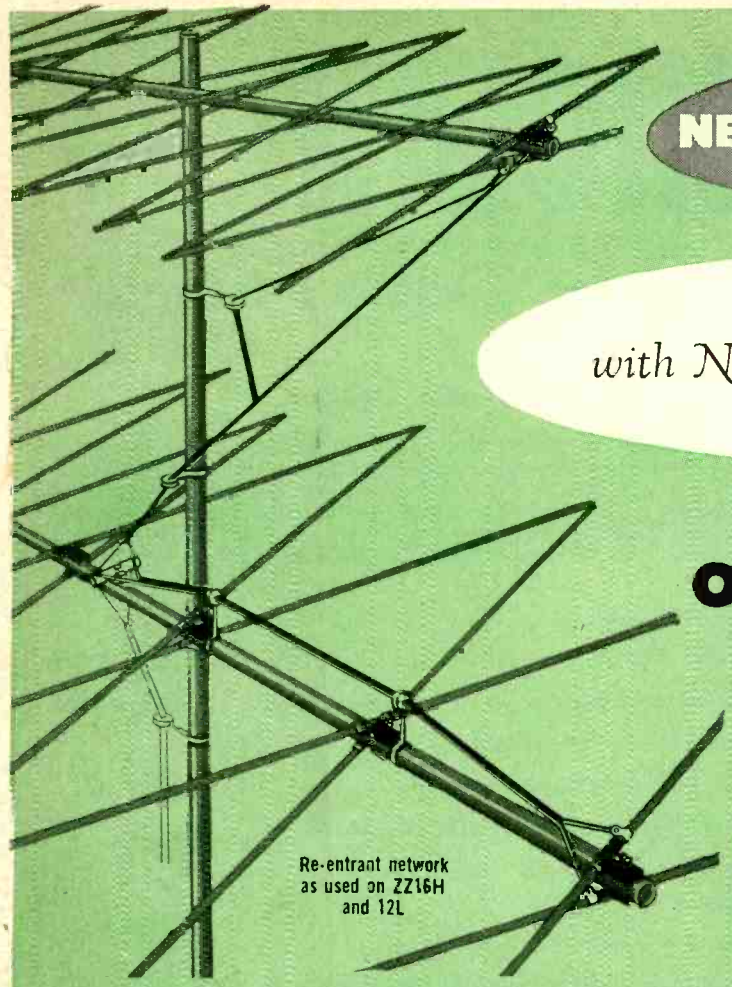
CIRCUIT DIGESTS (See page 99 and following sheets)

CROSLEY: Chassis 402, 403, 404, 402-1, 403-1, 404-1
FADA: Models U2100C, U2150C, U2100T, UDL2100T, UH21T
GENERAL ELECTRIC: "F" Chassis
SENTINEL: Models 1U-532, 1U-552, 1U-554
STANDARD COIL Tuner: Models TV-1532, TV-2232
SYLVANIA: UHF Converter Models C31M, C32M, C33M
ZENITH: Chassis 22L20

DEPARTMENTS

CALDWELL-CLEMENTS, Inc.
Publication Office, Bristol, Conn.
Editorial/Business Offices 480 Lexington Ave., New York 17, N. Y., Tel. Plaza 9-7880
Publishers also of MART and TELE-TECH & ELECTRONIC INDUSTRIES

*Reg. U. S. Patent Office



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!

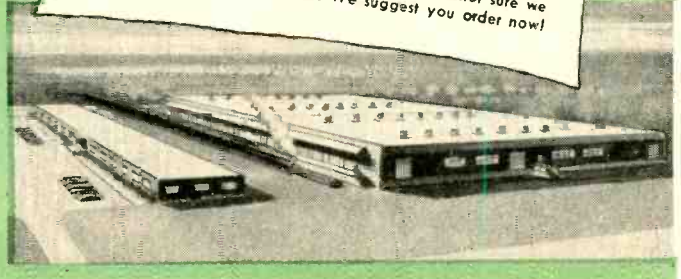
New descriptive literature available direct or from your supplier.

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!

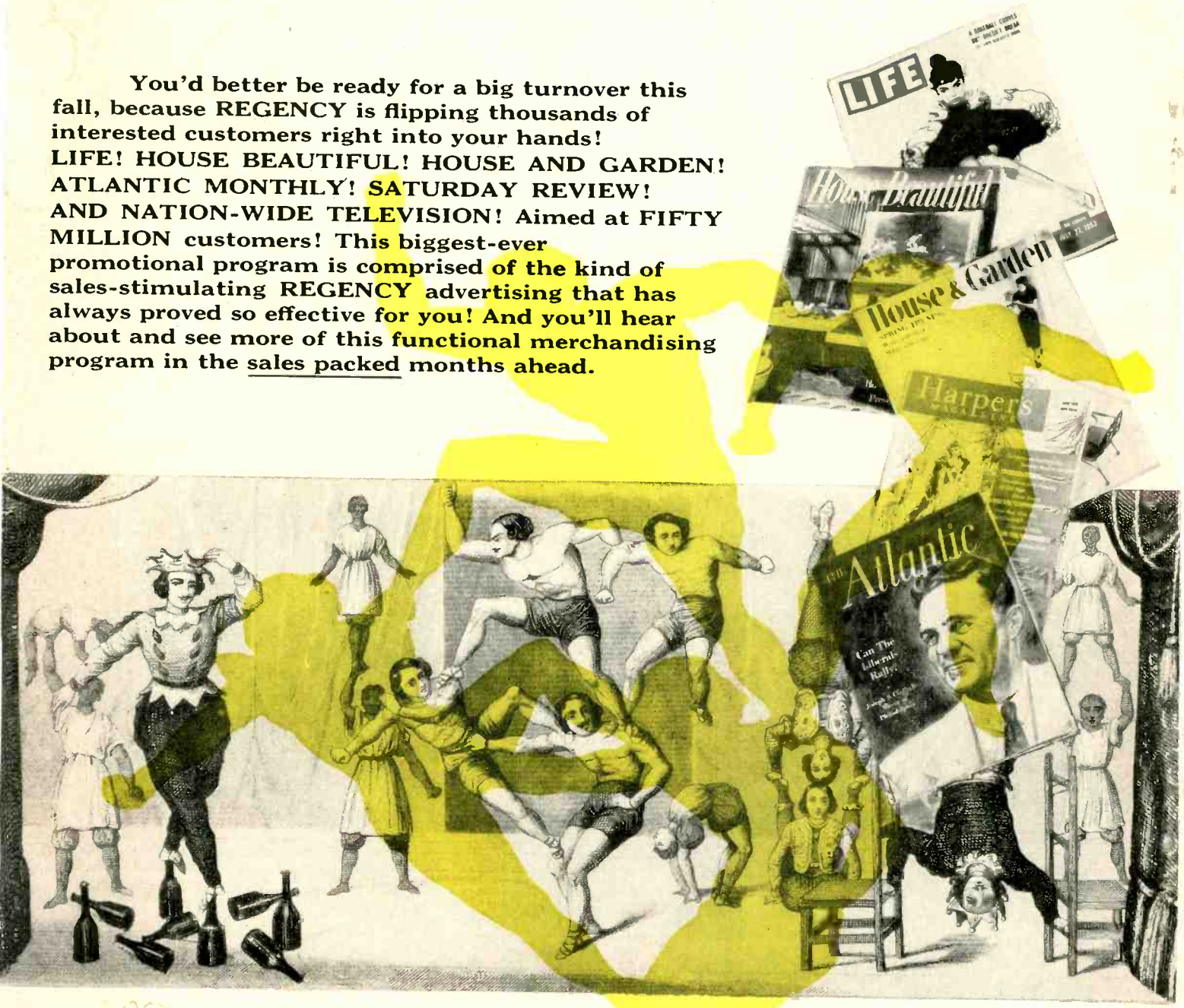


TRIO *Manufacturing Co.*

GRIGGSVILLE, ILLINOIS

are you ready... **ALLEZ OOPS!**

You'd better be ready for a big turnover this fall, because REGENCY is flipping thousands of interested customers right into your hands! LIFE! HOUSE BEAUTIFUL! HOUSE AND GARDEN! ATLANTIC MONTHLY! SATURDAY REVIEW! AND NATION-WIDE TELEVISION! Aimed at FIFTY MILLION customers! This biggest-ever promotional program is comprised of the kind of sales-stimulating REGENCY advertising that has always proved so effective for you! And you'll hear about and see more of this functional merchandising program in the sales packed months ahead.



Regency

DIVISION OF I.D.E.A., INC.

Makers of VHF Boosters, FM Boosters, UHF Converters, Professional High Fidelity Equipment and Remote Control for Television

Burton browne advertising

choose

K R Y L O N

Standard of Professionals

LEADING AEROSOL PROTECTIVE COATING

Use Crystal Clear for **High Voltage Coil and Rectifier Socket of High Voltage Rectifier • Transformer • Component Parts of High Voltage Rectifier Circuit. *Prevents Corona and Arcing.* Spray it on Antenna • Lead in Terminals. *Almost Indispensable for U.H.F. Installations!***

Use Aluminum for **Antenna Installations—Prevents Rusting and Pitting.**

Use Black for **Touching up Picture Tubes and Cabinets**

KRYLON has a dielectric constant of 3.2 to 3.7 (1000 cycles). Dielectric strength of 400 to 800 (number of volts necessary to cause an electric arc through a Krylon coat one mil thick.)

Easy to Apply! *Uniform Coverage!*

KRYLON

First to market an acrylic aerosol protective coating.

First national advertiser of an aerosol protective coating.

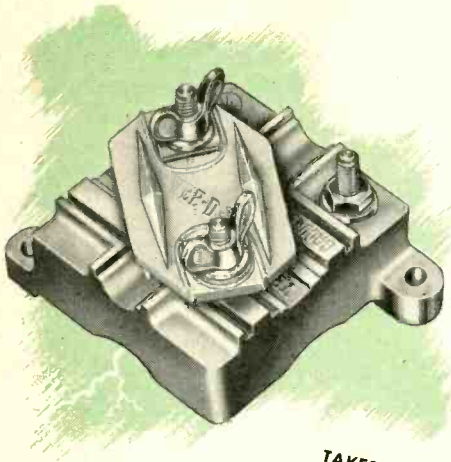
First choice of professionals.

KRYLON INC.

2038 Washington Avenue, Phila. 46, Pa.

no better choice...

VEE-D-X



THE SENSATIONALLY NEW VEE-D-X UNIVERSAL LIGHTNING ARRESTER FOR UHF - VHF - AM - FM

With revolutionary new design, Model ULA takes all popular transmission lines — flat, tubular, oval, round, open wire. No need for separate lightning arresters for each type of transmission line. This single hermetically-sealed Lightning Arrester takes 'em all. Compact, simple, inexpensive. The first and only Lightning Arrester with printed circuit.

TAKES ALL POPULAR TRANSMISSION LINES

VEE-D-X ANTENNA ROTATOR

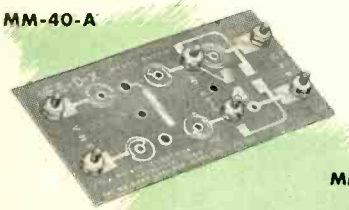
the finest in design, construction and performance.

Precision-built to the highest quality standards in both material and craftsmanship. Modern streamlined case design. Unique, compact gearing assures dependable performance. Fast and easy-to-install.

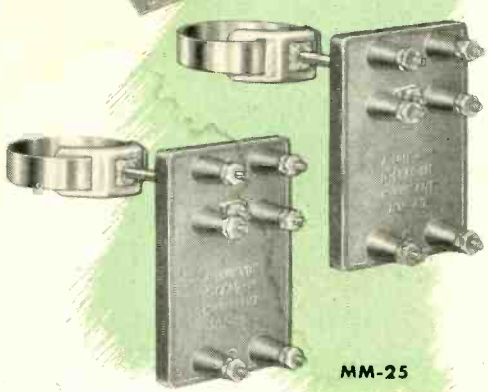
MAGNIFICENT DECORATOR STYLED CONTROL CONSOLE

Beautiful, efficient Control Console operates easily, positively with convenient downward pressure. Instantaneous clockwise and counter-clockwise action. Compact and streamlined. Beautifully styled. Available in two eye-appealing colors: Heather Green and Cordovan Mahogany.

MM-40-A



MM-40



MM-25

THE FAMOUS VEE-D-X MIGHTY MATCH

now 3 new improved models with the finest most efficient cross-over network filters ever perfected.

NEW MM-40 (yellow case) For combining UHF and VHF antennas to a single transmission line. New patented* printed circuit. Amazingly low insertion loss. New type terminals. Moisture-resistant case.
NEW MM-40-A Single line termination filter for use at set or converter. Separate terminals for UHF and VHF. Patented* printed circuit.
NEW MM-25 (green case) Permits use of single transmission line between separate high and low channel VHF antennas. New patented* printed circuit. Low insertion loss. New type terminals and moisture-resistant case.

*Lic. A.A.K. Pats. 2,422,458; 2,282,292; 2,611,086; others pending.

world's most powerful antenna systems

VHF ANTENNAS

MODEL DC Famous VEE-D-X low cost 5-element yagi with original VEE-D-X Delta Match construction.

MODEL DX The famous economy super power yagi. Has 30% higher gain on high channels than any other 10-element yagi. Delta Match and boom braced.

"V" SERIES BROAD BAND YAGIS Finest of all. 5-6 element "V" series in 2 cuttings. Cover entire VHF channel range.

"X" SERIES BROAD BAND YAGIS More popular than ever. Low cost 10-element "X" series in 3 cuttings. Cover entire VHF channel range.

MODEL JC For the most powerful single channel performance. A popular 5-element yagi. Easy-to-install.

MODEL QT The brilliant Q-Tee all-channel VHF antenna with patented* printed circuit channel separators. New improved construction and performance. Can be stacked for additional gain.

UHF ANTENNAS

MODEL BT-U The aristocrat of Bow-Tie antennas. Superior construction and performance. Can be stacked for extra gain.

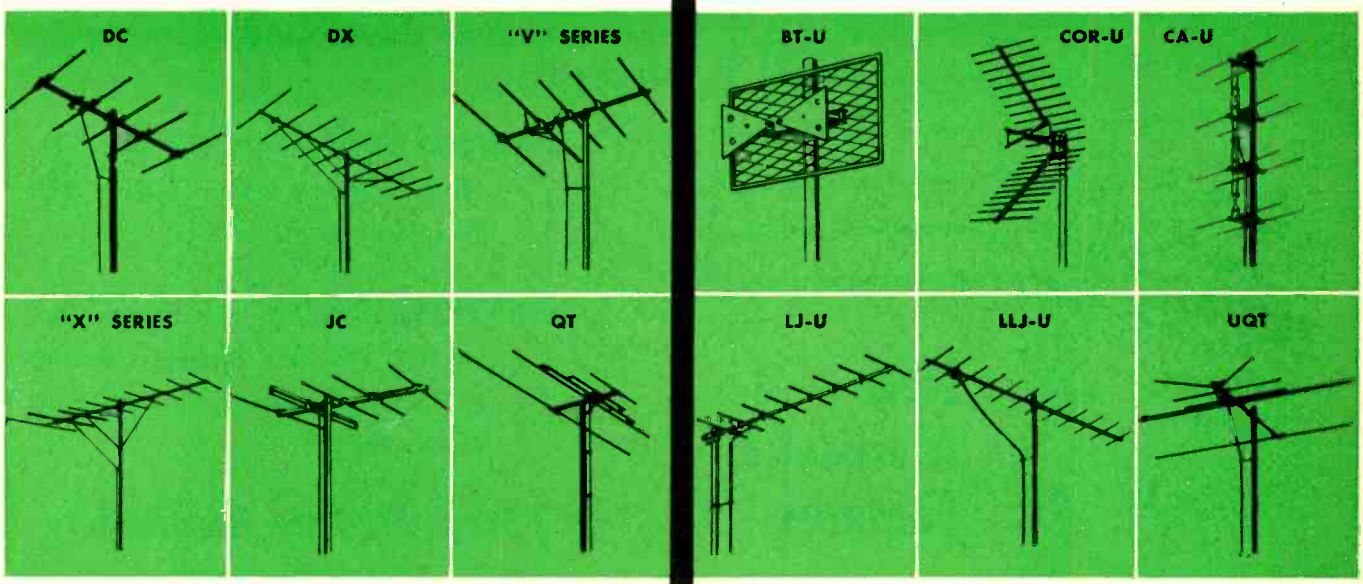
MODEL COR-U Corner Reflector has 40% higher gain than a single Bow-Tie. Finest construction, rugged Fiberglas boom. Solid aluminum elements. Minimizes probing.

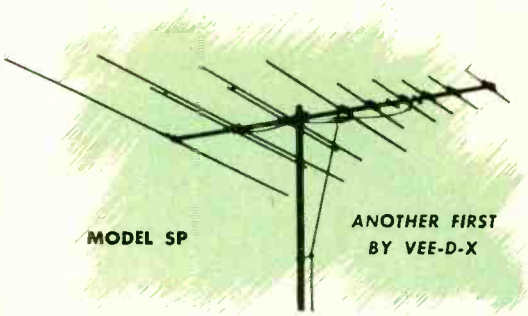
MODEL CA-U Famous Colinear with the highest gain of all broad band, fringe area UHF antennas. Available in Dual, Jr. models for specific area requirements.

MODEL LJ-U The UHF Long John. Single channel, 8-element yagi for primary and fringe areas. Compact. Efficient. Pre-assembled. Easy-to-install.

MODEL LLJ-U The most powerful of all single channel UHF antennas. Rugged Fiberglas boom and solid aluminum elements.

MODEL UQT Famous Ultra Q-Tee all-channel (2-83) UHF-VHF antenna. Has printed circuit filters. Ideal for primary area.





THE ONE AND ONLY ALL-CHANNEL YAGI

VEE-D-X tra Special

Higher gain than a double-stacked conical. Yagi power and directivity plus all-channel performance — all in one exceptional antenna — Model SP. Nine-element hi-low yagi (5-element on high channel—4 on low) "T" matched. Hi-Low sections phased together with new isolation filter (MM-25).

FREE LITERATURE

Write for your copies of the complete VEE-D-X Specification Sheets and the new 36-page pocket guide to the world's finest antenna systems.

T 9

La Pointe ELECTRONICS INC.
Rockville, Connecticut

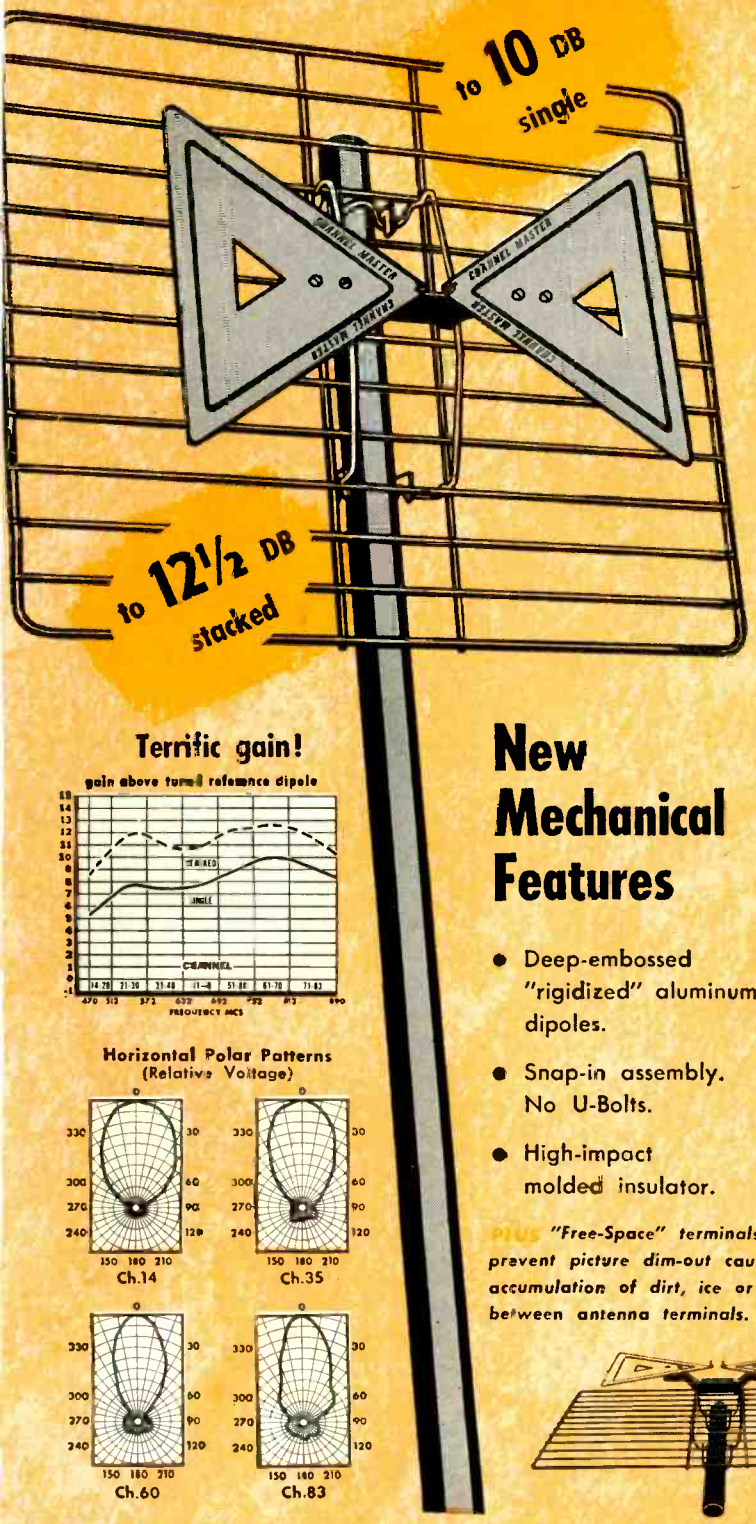
Send ..... copies of the new complete antenna booklet and specification sheets for .....
(Indicate by model number)

Name .....

Street .....

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

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!

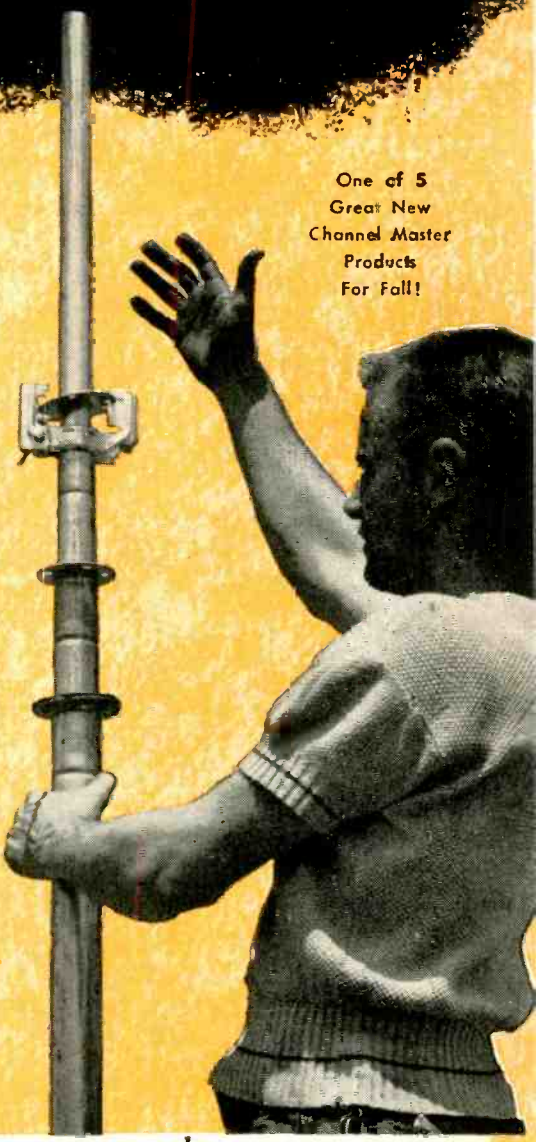
CHANNEL MASTER CORP.
ELLENVILLE, N. Y.

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!

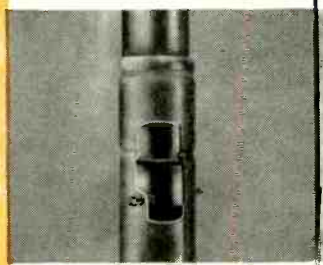
ZINC IS SELF-HEALING!

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.

18-Gauge Masting HEAVY ZINC ELECTRO-PLATING

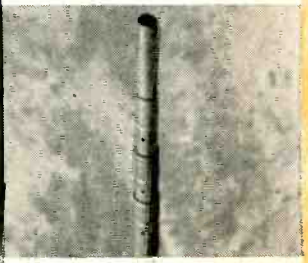
Heavy layer of bright zinc, exceeding Army-Navy specifications, provides effective long-lasting protection against elements. A chromate dip adds brightness; increases corrosion resistance. The strongest, most durable protection jacket of its type.

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.		Sections	Lengths	Weights	
16-Gauge	18-Gauge			16-Gauge	18-Gauge
1620	1820	A, B	20′	16 lb.	13 lb.
1630	1830	A, B, C	30′	26 lb.	22 lb.
1640	1840	A, B, C, D	40′	38 lb.	33 lb.
1650	1850	A, B, C, D, E	50′	52 lb.	48 lb.

USED IN PREASSEMBLED ANTENNAS

CHANNEL MASTER CORP. ELLENVILLE, N. Y.

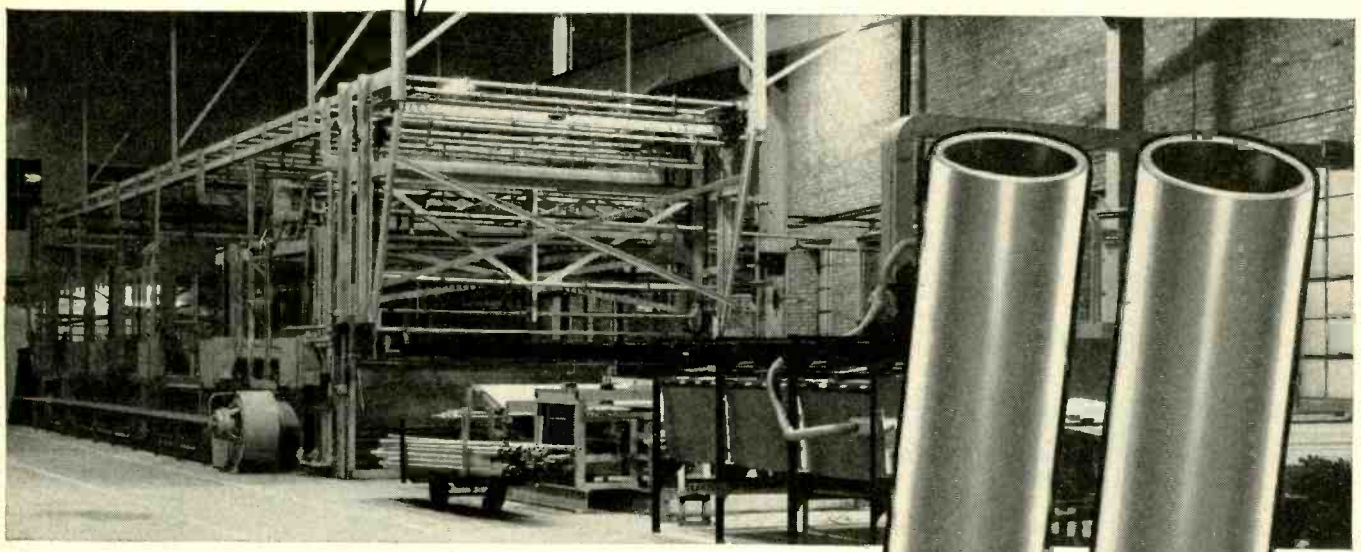
Ask your Channel Master distributor for complete technical literature.

5 ft. and 10 ft. self-coupling

MASTS

Television

prompt delivery from your Admiral distributor



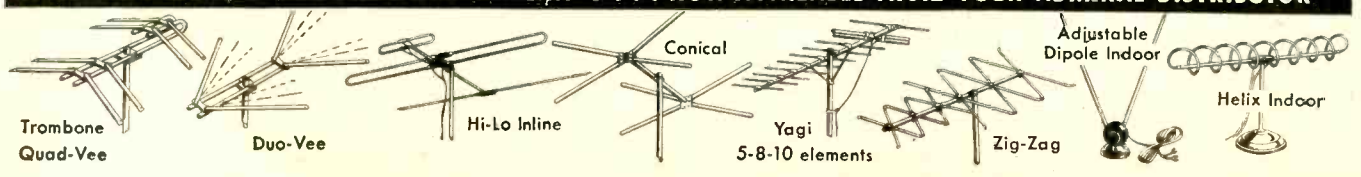
The greatly increased need for outside antennas in new station areas has just about soaked up the supply of masts. Now Admiral is ready to help you meet the demand with these new 5 and 10 foot masts . . . *available now* from your Admiral Distributor.

Admiral's huge production brings you these masts at the industry's lowest prices. Finest quality, too . . . made of cold-rolled seamless steel tubing, heavily electrogalvanized for utmost rust resistance. Both 5 and 10 foot masts are available with one end flared to take extensions . . . eliminates the need for separate mast couplers. Order from your Admiral Distributor by part number:

	20 gauge	*18 gauge*	*16 gauge*
5 ft. plain end	M 40		
5 ft. flared end	M 40A		
10 ft. plain end	M 41	M 42	M 43
10 ft. flared end	M 41A	M 42A	M 43A

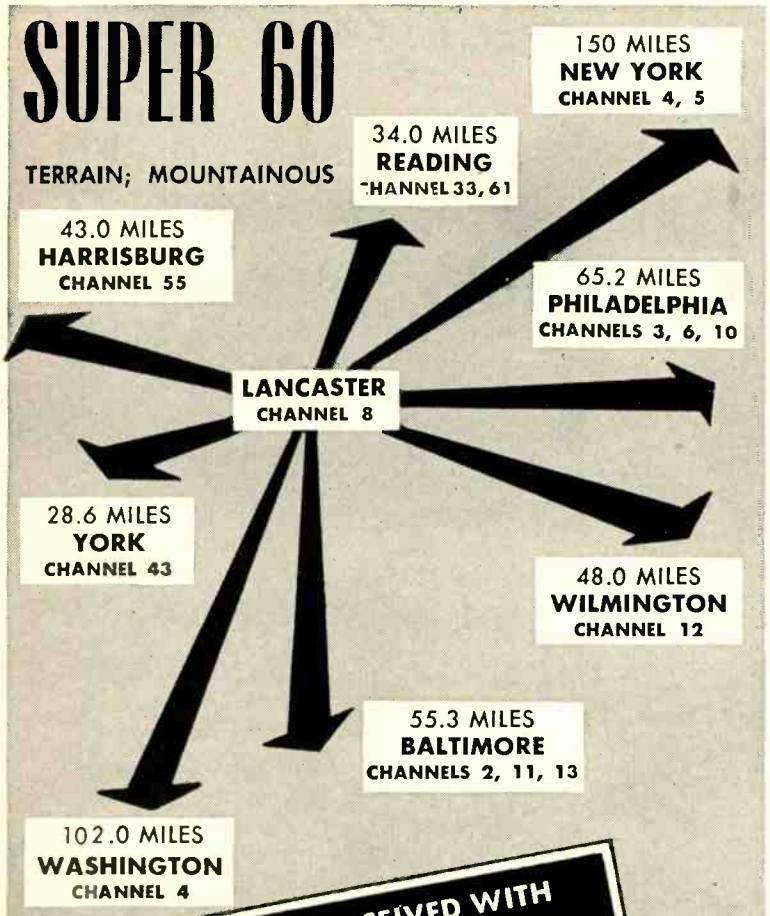
***Admiral* Corporation,** Accessories and Equipment Division, Chicago 47, Ill.

A COMPLETE LINE OF ADMIRAL TV ANTENNAS . . . NOW AVAILABLE FROM YOUR ADMIRAL DISTRIBUTOR



TRY THIS AMAZING TEST IN *Your* AREA

LANCASTER TEST *Proves* SUPERIORITY OF



STATIONS CLEARLY RECEIVED WITH SUPER 60 AT TIME OF LANCASTER TEST

CHANNEL	LOCATION	DIRECTION	AIR DISTANCE
2	Baltimore	South	55.3 miles
3	Philadelphia	East	65.2 miles
4	New York	Northeast	150.0 miles
4	Washington, D.C.	South	102.0 miles
5	New York	Northeast	150.0 miles
6	Philadelphia	East	65.7 miles
8	Lancaster	"0"	0.0 miles
10	Philadelphia	East	65.2 miles
11	Baltimore	South	55.3 miles
12	Wilmington	Southeast	48.0 miles
13	Baltimore	South	55.3 miles
33	Reading	North	34.0 miles
43	York	Southwest	28.6 miles
55	Harrisburg	West	43.0 miles
61	Reading	North	34.0 miles

70-07 QUEENS BOULEVARD
WOODSIDE 77, NEW YORK

ALL CHANNEL ANTENNA CORP.,

In an effort to substantiate the amazing findings in our laboratory, it was necessary to test the All Channel All Direction Super 60 in the "field". This was a problem in itself as many locations presented no problem for this high gain UHF-VHF all channel antenna. A spot, suitably surrounded by both UHF and VHF stations, at great enough distances, was finally located in Lancaster, Pennsylvania. Lancaster also entered a challenging condition by being located in the mountainous terrain of Pennsylvania.

Standard type UHF and VHF antennas using rotor motors were used for comparison purposes — a stacked conical, a stacked bow tie reflector, a corner reflector and a stacked combination UHF-VHF antenna.

All the antennas were mounted and assembled in accordance with the manufacturer's exact instructions. The Super 60 was used with the brand new four conductor matched impedance line, the brand new low loss switch, and the new low loss insulators.

The All Channel All Direction Super 60 was hand oriented to the best overall stationary position and left there throughout the test. It was, however, electronically oriented by use of the low loss electronic orientation switch while the antenna always remained in the same original stationary position. The map and chart indicate the various stations received in clear, commercially viewable condition by the Super 60 antenna at the time of the Lancaster test.

1—Only on Channel 3, the stacked conical gave an equally clear, sharp, viewable picture to the Super 60.

2—Only on Channel 6, the stacked conical gave a picture with better contrast but with a great deal of interference. The Super 60 lacked slightly in contrast but had no interference.

3—Only on Channel 8, the stacked conical and the combination UHF-VHF antenna gave an equally clear, sharp, viewable picture to the Super 60.

4—Only on Channel 33, the corner reflector gave an equally clear, sharp, viewable picture to the Super 60.

5—Only on Channels 43 and 61, the stacked bow tie reflector and the corner reflector gave an equally clear, sharp viewable picture to the Super 60.

ON ALL OTHER STATIONS, THE ALL CHANNEL ALL DIRECTION SUPER 60 GAVE CLEARER, SHARPER, PICTURES THAN ALL THE OTHER ANTENNAS.

The Super 60 antenna also brought in Channel 5 from New York City as well as Channel 4 from Washington, D.C. and Channel 4 fram New York City. Since this test was made, Channels 49 in York, Pennsylvania, 51 in Bethlehem, Pennsylvania, 57 in Eastan, Pennsylvania, 60 in Baltimore, Maryland and 29 in Philadelphia, Pennsylvania have been added making the Super 60 even more desirable. The standard antennas had to be rotated by expensive rotar motars and the waiting time was considerable. They also required filters that introduced added losses and expense or they required individual transmission lines and switches all at an additional expenditure of money and time, etc.

Similar tests have been and are being made in other omnidirectional areas and subsequent reports will follow.

CONCLUSION:

1—Super 60—one antenna for UHF and VHF equal to or better than existing antennas or combinations.

2—Super 60—requires no rotor motor to achieve all direction reception.

3—Super 60—is simpler and quicker to install, requiring no additional switches, transmission lines, filters, accessories, etc.

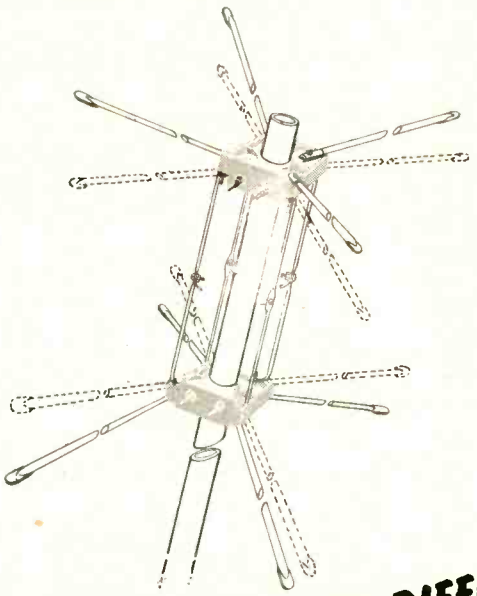
MONEY BACK GUARANTEED

TO RECEIVE *All* UHF and *All* VHF STATIONS IN *All* DIRECTIONS FOR 60 MILES

WITHOUT A ROTORMOTOR OF ANY KIND!!

WORLD'S MOST POWERFUL UHF—VHF TELEVISION ANTENNA

While antenna reception is guaranteed for 60 miles, perfect pictures have been consistently received as far as 160 miles from stations.



MODEL

SUPER 60

***All* NEW DESIGN FOR '54**

- LOW-LOSS SWITCH
- LOW-LOSS PHENOLIC INSULATORS
- USES NEW 4-CONDUCTOR MATCHED IMPEDANCE LINE
- ONLY 10 INCH SPACING BETWEEN ANTENNA BAYS

ONE INSTALLATION ONE ANTENNA
ONE TRANSMISSION LINE

SO NEW! SO DIFFERENT! IT'S PATENTED!

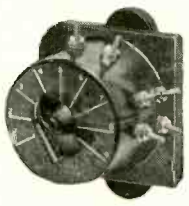
#2,585,670
#2,609,503
#2,625,655
#2,644,091

Money Back Guarantee

IN ALL LOCATIONS IN EVERY AREA
WITH STATIONS IN ALL DIRECTIONS

The new All Channel Model Super 60 is guaranteed to bring in, immediately on installation, every UHF and every VHF station within 60 miles in any direction, giving clearer and sharper pictures than any antenna or combination of antennas with or without rotor motors.

If, immediately on installation, it fails to do this, we agree to refund to the jobber to whom we sold and shipped it, his full purchase price.



The 9 position selector switch electronically rotates the antenna in a stationary position.

LIST PRICE
$36.75
SEE YOUR LOCAL JOBBER.

PRICE INCLUDES
Complete stacked array • 4 stacking bars • 9 position switch • Switch-to-set coupler • 3 - 7½" stand offs • Individually boxed in mailable carton

BE READY NOW — FOR THE FUTURE

ALL CHANNEL ANTENNA CORP., 70-07 QUEENS BLVD. WOODSIDE 77, NEW YORK

MAKE IT EASY FOR YOURSELF

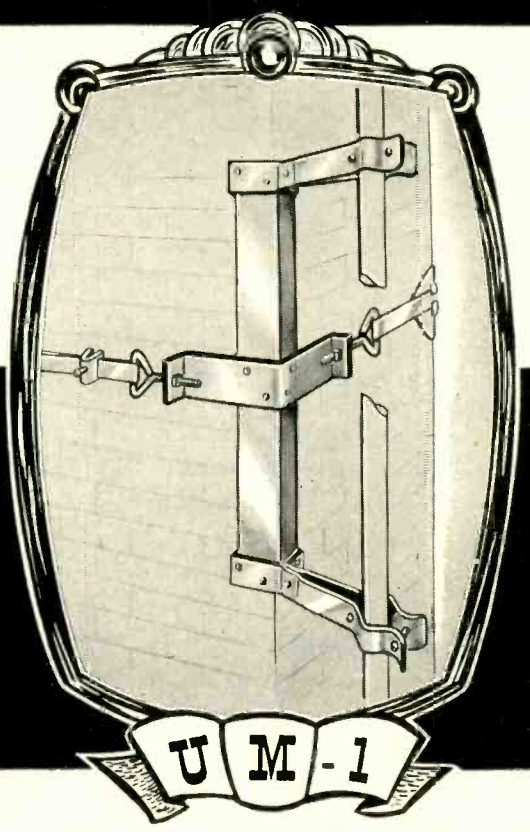
...Better for your Customers

BY USING THE NEW

South River CHIMNEY UNI-MOUNT

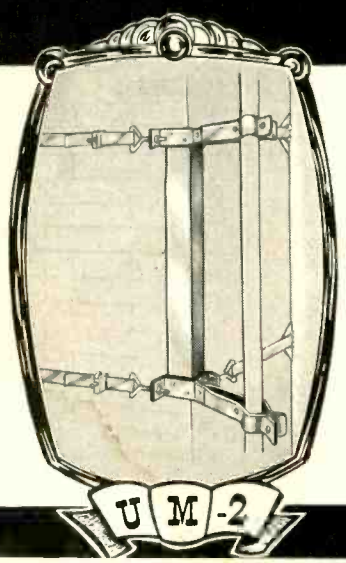
Here's a combination every service man will find unbeatable. The new South River Chimney Uni-Mount offers you every advantage—quicker, easier installation—because of the convenience of a one-piece mount. The snap-in feature makes inserting the mast a simple, quick operation. And, the unique, sure, banding closure—the exclusive South River Kwik-Klip—enables you to speedily tighten the banding to complete a perfect installation.

Your customers will appreciate the solidity, extra rigidity and permanence of the Uni-Mount, with heavy-gauge, stainless-steel strap. You can point with pride to another South River installation that has made money for you and has enhanced your reputation as a first-rate service man.



SOUTH RIVER CHIMNEY UNI-MOUNT MODEL UM-1

is constructed of heavy-gauge steel, riveted for extra strength. It is hot-dip galvanized for lasting weather-proof coating and features the snap-in mast holders with flared lips. Generous 18" spacing between mast holders provides firm support. This model is available with one heavy-gauge, stainless-steel strap, the Kwik-Klip Banding Closure and clever new Chimney Corner Guards.



MODEL UM-2

with two heavy-gauge, stainless-steel straps, is complete with all of the other features listed above.

Sold by leading parts jobbers from coast to coast.

Write for your copy of South River's complete 1953 catalog.

South River

METAL PRODUCTS CO., INC.

South River, New Jersey

In Canada—A. T. R. Armstrong Co., Toronto

PIONEER AND OUTSTANDING PRODUCER OF THE FINEST LINE OF ANTENNA MOUNTS

NOW

N.U.

transistors and diodes

available in production quantities

PNP JUNCTION TRANSISTORS
Designed for applications where low noise, high gain and low power drain are important.

POINT-CONTACT TRANSISTORS
Designed for high speed switching and general-purpose applications.

UNION DIODES
For high current, high voltage applications beyond the capabilities of point-contact diodes.

POINT-CONTACT DIODES
Twenty types covering general-purpose, computer and home entertainment fields.

From the electronics engineers who helped pioneer the research and development of transistors and diodes come N. U.'s commercially applicable products.

N. U. Transistors and Diodes are produced to rigid standards under exacting laboratory conditions and have uniform and lasting characteristics. You may be confident of their mechanical and electrical excellence and their performance under severe service conditions.

NATIONAL UNION RADIO CORP.

HATBORO, PENNSYLVANIA

LETTERS
To the Editors

Those Fly-by-Nights

EDITORS, TECHNICIAN:

Our major problem here is the cut-rate serviceman who works at some other business during the day and fixes TV sets at night. He has little or no equipment and is usually poorly trained; he takes the easy calls and leaves the others. Servicemen of this kind hang the "incompetent" label on the legitimate TV service industry. Is licensing the answer?

Minnesota — H. W.

Getting A Fair Price

EDITORS, TECHNICIAN:

How are we ever going to teach our customers that a fair charge for work and material is not overcharging? People just don't realize all the training and time that goes into the making of a good TV technician.

Ohio — D. M.

Wholesalers Selling at Retail

EDITORS, TECHNICIAN:

I'd like to hear some suggestions as to what can be done about those parts jobbers and distributors who retail to consumers. We ought to make such jobbers realize that by selling direct they are kicking around their real customers, the regular, established service men.

New York — H. J. T.

Too Many Lines

EDITORS, TECHNICIAN:

I think the TV manufacturers ought to get together on producing only one line a year instead of the many that now come out. It would be a great help to the dealers who have to market them, and to the technicians who do the servicing. It seems to me that then everybody would be pleased.

Maine — P. J. M. Jr.

Tone Them Down

EDITORS, TECHNICIAN:

I wish I could have those fellows who write the fancy ads for TV sets come in to my shop for a few hours. They make the most fantastic claims and then I'm the poor guy who has to face the music when the customers come in after buying the set. Just as many TVs could be sold without those blown-up, grandiose claims and everybody would be much happier.

Wisconsin — B. A.

Antenna Give-Away

EDITORS, TECHNICIAN:

Wouldn't you say that the practice of giving a TV antenna free with the purchase of a TV set is the height of something-or-other? Some dealers down here are now stooping that low.

Mississippi — M.S.P.

Numbering Batteries

EDITORS, TECHNICIAN:

Has anybody ever suggested to the makers of such items as batteries, vibrators, etc. that they get together on a common numbering system for the same item? The tube manufacturers have already done this, so it's not impossible. It would do away with the need for so much paper work and make life simpler for the overburdened servicer.

Kansas — R. G. H.

Test Equipment Instructions

EDITORS, TECHNICIAN:

We're constantly being told by the manufacturers of test equipment how wonderful their gear is and how much time is saved by its use. When you get it, however, the instruction books and literature are so skimpy and incomplete that it takes several days of experimenting to figure it out. Sometimes, the full use of the equipment is never obtained. Do you think some letters to test equipment makers would remedy this situation?

Indiana — J. K. D.

Better Tube Sockets

EDITORS, TECHNICIAN:

I think that the tube-socket manufacturers are doing us a disservice by not designing a miniature socket that will do a better job. You have no idea how many hours of each day are wasted trying to insert a miniature tube in a socket that cannot be seen. All that would be needed, I think, is a small groove above each pin hole.

Texas — J.J.B.

Gas-Station Competition

EDITORS, TECHNICIAN:

Out here we're being bothered by gas stations and similar unrelated retail outlets selling radio and TV sets. Naturally, they sell at cut prices and make all sorts of false claims for the merchandise. This kind of practice tends to give a bad name to the legitimate radio and TV shops. Distributors had better wake up and do something to stop what will ultimately boomerang to hurt the entire industry here.

California — W. T. Jr.

Bargain Service

EDITORS, TECHNICIAN:

When will people learn that honest TV service cannot be purchased at bargain-basement prices? Those ads for $2 and $3 service calls with the inference that any repair should be able to be made in the customer's home, are what I am talking about. Invariably the customer is heavily overcharged and so he gets down on the entire service industry. The net result is to make it

(*Continued on page* 18)

Editors' Note: In order to insure the freest possible comment on trade conditions and evils, without causing individual embarrassment or local repercussions, names have been omitted from these letters from readers. States of origin, however, have been retained to show wide distribution of the problems discussed.

LETTERS

(*Continued from page 17*)

hard for the honest, conscientious technician, when he is called, to get a fair price for his services. The public must be educated to the facts.

California C.J.G.

Fix-It-Yourself Books

EDITORS, TECHNICIAN:

How about some action on the part of TV-set manufacturers to educate consumers on the evils of those "Fix-It-Yourself" books? They only serve to confuse set owners who go ahead and make complicated, expensive jobs out of normally simple ones. Then, when the TV technician is called in, he is called a "robber" or "gyp" because of the price he must ask to straighten out the mess. The set manufacturers could help with a good educational campaign.

Wisconsin M.C.J.

Mail Order Prices

EDITORS, TECHNICIAN:

This business of mail-order houses selling phono and high fidelity equipment direct to the public at net prices has really hurt the dealer-serviceman. Net prices have become list prices and it is almost impossible to make any kind of a profit on these types of items. Does anybody have any ideas about how to remedy this situation?

Pennsylvania P.K.J.

Lower TV Prices

EDITORS, TECHNICIAN:

With the price of some new TV sets down to $99, how is the serviceman going to make a decent living? It costs me just as much for a new CR tube for one of those $99 affairs as it does for a set that sold for $199, but how the customer screams! Can't the component manufacturers and those $99 set makers get together and do something about this?

Illinois A.E.

Complaints on Set Design

EDITORS, TECHNICIAN:

My complaints are all against manufacturers who do the following:

1. Manufacturers who use special parts that are hard or almost impossible to obtain.

2. Manufacturers who produce crowded chassis assemblies that require the removal of several parts in order to replace a defective component. Getting a test probe inside is also a major project.

3. Manufacturers who place 2 or 3 tubes under the TV chassis, making it necessary to remove the chassis to replace a $2 or $3 tube.

Maine W.D.

Some People Have Crust

EDITORS, TECHNICIAN:

My temperature always goes up when I'm approached by price-chiseling dealers in my town to render service at cut-rate prices on the sets they have sold. The percentage of profit on TV sets is low enough without the price-slashers reducing it further. And then to have them come around and ask the serviceman-dealer to slice his service charges to them. Isn't that the limit?

Missouri — J.M.

And Wait Around, Too!

EDITORS, TECHNICIAN:

Not only do our local parts jobbers sell at retail to consumers but in such crowds that whenever I go in, I have to waste my valuable time waiting around to be served. Maybe we ought to petition the jobbers to set aside a separate counter for the serviceman-technician trade if we can't keep them from selling direct to our customers. What do you say, fellows?

Washington — C.S.

The Trouble With Life

EDITORS, TECHNICIAN:

You would think that a big magazine like *Life* would have enough to keep it busy without trying to make life tougher for the serviceman-dealer. But they go right ahead, in a recent story on high fidelity installations, and advise the public to buy the equipment at discounts. Come on, *Life* magazine, we don't bother you, so why step on us?

California — C.G.

Schematics With Sets

EDITORS, TECHNICIAN:

Why don't the TV manufacturers keep the serviceman in mind when they design a set? They should realize that every set will have to come out for service at some time. The big mail-order houses like Sears Roebuck do it and others can, too. The need is particularly great with the off-brand makes because service information is so hard to obtain. Can you use your influence here?

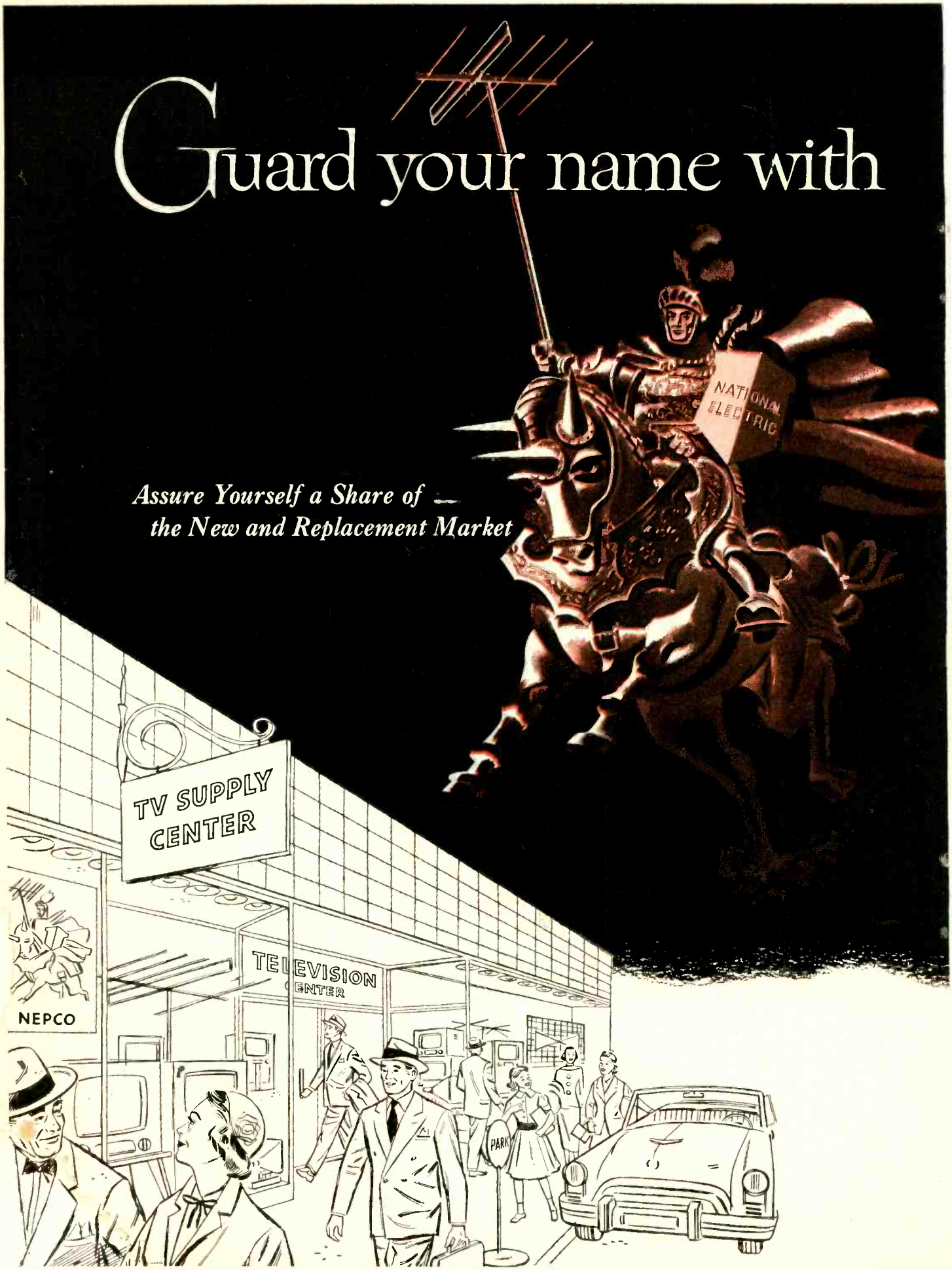
Illinois — J.R.D.

Cooperation Needed

EDITORS, TECHNICIAN:

I believe that the unwillingness of most manufacturing and selling segments of the industry to admit to the public the complicated nature and limitations of TV is wrong. It has resulted in the widespread distrust of the TV service man and lack of appreciation of the essential position he occupies. Unless this is reversed, most of the honest, competent men will be forced out and the field will be wide open to the chiselers and fakers. The cooperation and mutual respect of all segments of the industry could change this and provide healthier, more profitable business for all concerned.

New Hampshire — J.H.C.


Guard your name with
NATIONAL ELECTRIC
Assure Yourself a Share of —
the New and Replacement Market
TV SUPPLY CENTER
NEPCO
TELEVISION CENTER
PARK

the Nepco Line

Your name and reputation depends on *your* customers' satisfaction. That's why it pays you to take a tip from the growing list of dealer-installers who have turned to the NEPCO LINE to make sure of quality materials that won't let them down. They've learned this complete line of TV Antennas, Mountings and Accessories provides built-in ruggedness . . . meets the test of time and weather and assures them of a reputation for good work.

You Get EXTRA "Dividends" with the NEPCO Line!

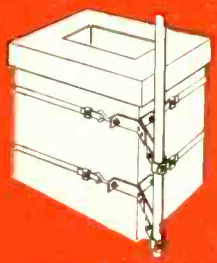
Quality materials with the strength to stay on the job . . .

- All parts heavily zinc-coated plus baked enamel finish.
- Rigid heavy gauge ⅛" steel used in all mounts.
- Two 15' *stainless steel* chimney bands (ample even for the larger chimneys), ⅝" eye bolts, and four heavy gauge banding clips with patented imbedding screws available with each chimney mount.
- All hardware corrosion-protected in the same complete manner as the mounts.
- Every item in the NEPCO Line is engineered, tested and field proved to assure long service on the job.

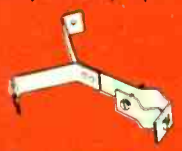
Plus features for fast, easy installation and handling

- Unique adjustable mast clamp with one bolt mounting.
- Exclusive antenna mast clamp with positive alignment in all planes.
- Slotted hex-head bolts for screw driver or wrench installation.
- Versatile mounts that accommodate all types of installations.
- A line designed with your handling problems in mind . . . strong compact boxes easy to move and stack.
- Large easy-to-read illustrated package labels.

CHIMNEY MOUNTS

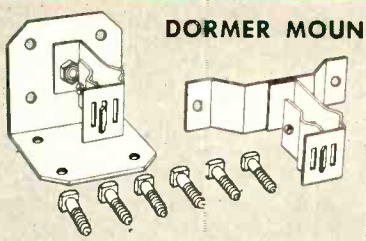


New "Y" Type Chimney Mount for extra rigidity using ⅝" eyebolts, extra heavy banding clips.



Complete with installation hardware and two 15' coils of stainless steel banding.

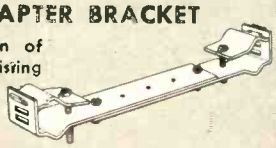
DORMER MOUNT



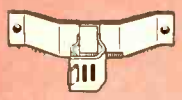
Used with 4" wall bracket for mounting masting to homes with dormer where other roof type installations would be hazardous. Furnished with 6 lag screws.

MAST ADAPTER BRACKET

For quick installation of UHF antennas on existing mast. Two to a unit.

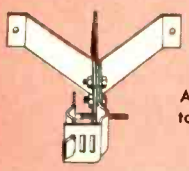


WALL BRACKETS



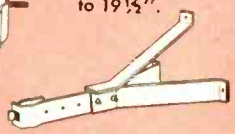
Allows 4" clearance.

Allows 6" clearance.

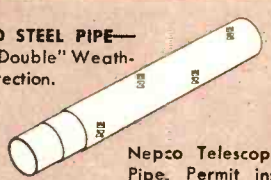


Adjustable clearance of 9" to 13½".

Adjustment range 12" to 19½".

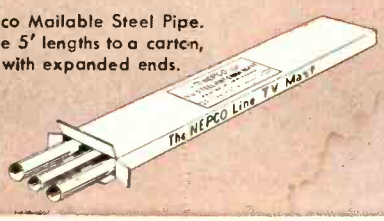


NEPCO STEEL PIPE— With "Double" Weather Protection.



Nepco Telescoping Steel Pipe. Permit installations up to 40'.

Nepco Mailable Steel Pipe. Three 5' lengths to a carton, two with expanded ends.



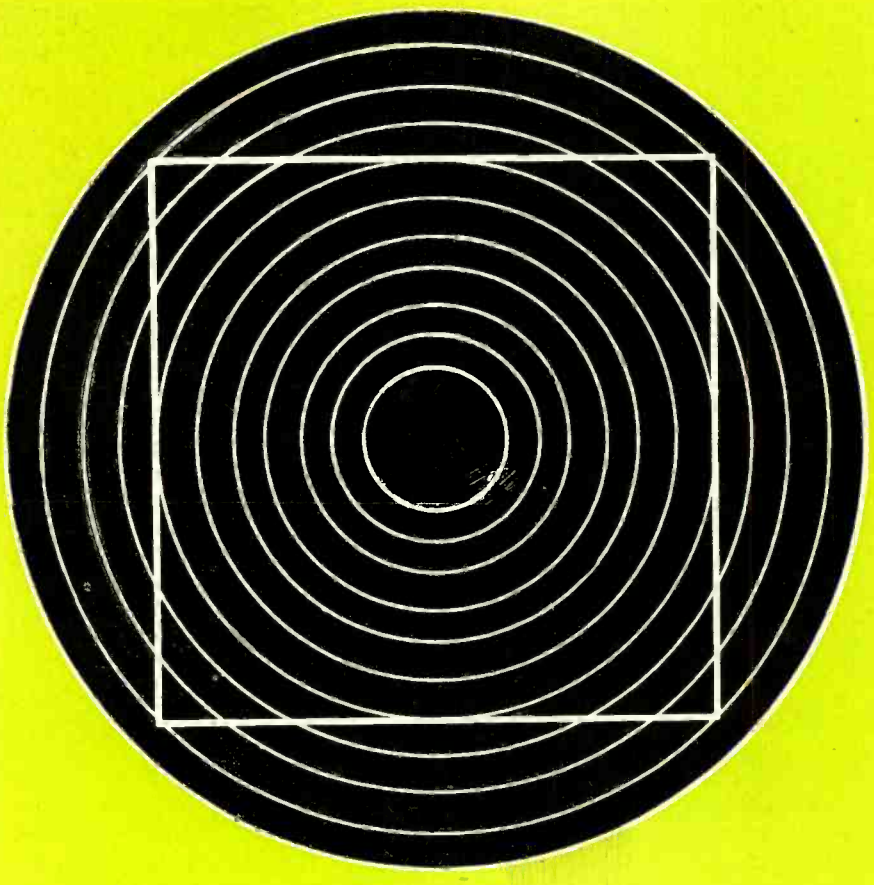
DEMAND THE **NEPCO** LINE

THE **COMPLETE** LINE FOR FAST, PERMANENT INSTALLATIONS

Write for the Name of Your Nearest Jobber Today
Catalog on request.

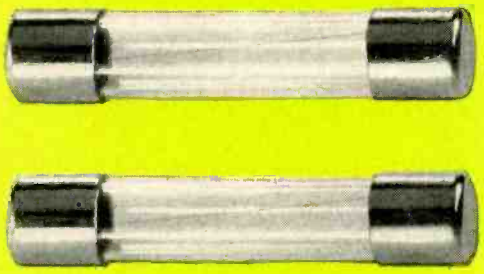
National Electric Products

RADIO & TELEVISION DEPARTMENT, PITTSBURGH, PA.



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

TECHNICIAN

CALDWELL-CLEMENTS, INC., 480 LEXINGTON AVENUE, NEW YORK 17, N. Y.

This New Magazine—"TECHNICIAN"

Its Opportunity, Scope and Editorial Plans

With the coming of television, the radio serviceman has enjoyed a rapid rise in his status:

1. Technically, in the expansion of his expert knowledge of equipment and circuits.
2. Personally, in community importance and earning power, and
3. Industrially, as part of a $1\frac{1}{2}$-billion annual business servicing some two billion sockets in 25 million TV sets, 120 million radios, and many thousands of pieces of industrial electronic equipment.

Today the local serviceman has investment in instruments, equipment, replacement parts, and special automobile trucks, that puts him well to the front, dollar-wise, among other business men in his community.

And with the advent of color-TV (now imminent), the serviceman will see another big boost in his standing locally and nationally, as the importance of correct installation and expert service soars. Color-TV, UHF and Hi-Fi all require technical servicing of engineering grade that would tax the holder of a diploma from M.I.T., Purdue, or Cal Tech.

Covering the New Technical Art

To meet these new needs, TECHNICIAN now steps into the national picture with a complete monthly package of technical, business and equipment information for the serviceman, covering TV, home radio, auto radio, Hi-Fi, recorders, record changers, public address, industral electronic applications, etc.

TECHNICIAN will bring each member of its big service readership technical articles covering the current repair problems that are bothering him—keeping him up-to-date on the rush of new ideas, new principles, new circuits, new test equipment, new tools and new products that are pouring into the field.

TECHNICIAN will bring him new circuits and chassis information, continuing the important CIRCUIT DIGEST sections that have received such tremendous acclaim.

TECHNICIAN will cover business principles and business methods important to the serviceman's financial success.

Management and Earnings

TECHNICIAN will bring counsel on how to solve manpower problems, how to find competent bench and outside men, how much to pay them, how many calls to expect per man per day, what daily billings an outside man must cover to earn his pay.

TECHNICIAN will protect the local servicer with advance knowledge of licensing ordinances, city installation requirements, and special legal problems in this field.

TECHNICIAN will keep the serviceman informed on new outlets for his electronic skills, in industrial electronic applications, PA, medical equipment, juke boxes, etc.

Overall, TECHNICIAN proposes to grow to fill all the needs of this great new industry of expert service and professional skill, which is now insuring the day-by-day technical foundation for the new TV tempo of American life in millions of U. S. homes.

M. CLEMENTS
Publisher

O. H. CALDWELL
Editorial Director

Tuning In the

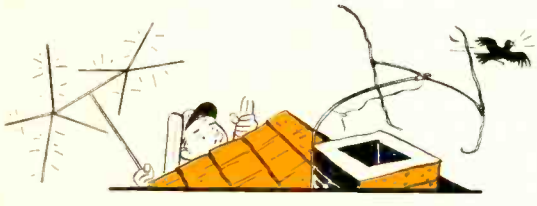
TRADE FINDS COLOR-TV TALK hurting sales of black-and-white sets right now. While such a situation does have a bad effect on selling, it has a silver lining for the technician because a great many people are patching up their old receivers and making them do for the time being.

HERE'S ADIVCE from Russ Hanson of Motorola: Get $50 *per day per skilled serviceman. Don't let payroll exceed 40% of gross sales.* Keep records of service requests, jobs completed, payroll and productivity of each man, backlog of work and how long job was in shop and why. Work on a monthly budget with real cost records. Review accounts receivable at least monthly. Figure *80 to 82% of calls to be home jobs,* 18 to 20% to be shop jobs.

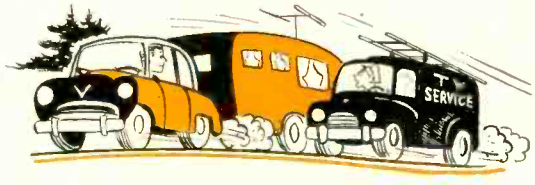
GUESSTIMATING SOME BUSINESS AHEAD for service departments: By the end of '54, it's possible that the total bill for labor alone on TV-radio will run up to $600,000,000 at retail level. (Excluding service on broadcast and commercial equipment) . . . Look for 20 per cent increase in repair work on record changers, recorders and clock-radios for '54. . . . And look for a 40 per cent increase in service on Hi-Fi equipment, and units the customer calls Hi-Fi, as more and more makers pour out such products, with many more likely to crash the field next year.

TV-TECHNICIAN LABOR MARKET TIGHT AS A DRUM and no signs of any immediate easing. Good men are hard to find, harder to hold at both dealer and manufacturing levels.

THE END-POINT OF ANY REPAIR JOB is the job itself. Does the TV set or radio operate to the customer's satisfaction? Is the charge acceptable? Such qualities are necessary. But, there are important way-pavers on the path to the end of the job and they have to do with the man who makes the home calls or greets the customers in the store. The whole transaction will go smoother in cases where the technician makes a good appearance, talks intelligently, acts courteously, and does his repairs efficiently. No matter how good the work is, the customer will mark up three strikes against the uncouth guy or the fellow who's sullen or rude, even if he's a wow at fixing those ailing sets.



ANTENNA CHECK-UP—It's not too early to suggest an "antenna check-up" to your customers, to insure good TV reception this coming Fall and Winter. See that masts are in good shape and securely positioned, antenna elements are well-insulated and standing free, screw connections make good clean metallic contacts, lightning arrestors are clean and well-grounded, and rotators, if used, are working properly. Remember—old down-leads often become cracked and develop conductive cross-paths, attenuating the incoming signal; replacement is necessary in such cases. Antenna arrays deteriorate with time and weather, especially in smoky industrial areas and on chimney mounts where acid gases and moisture pour across them. Many early dipoles are now ready for replacement with new, more efficient antennas that are capable of bringing in better pictures. You'll be surprised how many customers' installations need fixing up—or complete replacement! Remember to remind the customer that satisfactory TV reception hinges to a very large extent on a good antenna system.



CIRCUIT-SHARK SAM tells of that awful afternoon a trailer owner, passing through town, called on him to fix the trailer's TV set. The cops wouldn't let the trailer park in town, and Sam had to chase the trailer clear into the next county before they could find a place to pull up for TV repairs. The stars were out and Sam's supper was cold when he finally got back home.

MONEY-MAKING IDEAS: Progressive Midwestern service manager keeps portable batteries in his trucks. Has technicians suggest "fresh" batteries to customers on all home calls . . . For 10 years a dealer in suburban Boston has kept a sparkling service department out in the open on the show-room floor. Finds it's paid off handsomely. . . . On the premise that many customers will call in another technician when calls are not answered promptly, a Southern service department posts a daily "call" sheet on the wall in front of the girl who answers the phone. Latter is required to ring up all customers when dates can't be met. Manager claims 99 per cent of all service biz is "held" via this method.

TREND TO 12-VOLT auto radios is on the upgrade. Manufacturers report the 12-volt model is leading their auto receiver line in sales this year. The current Buick Super and Roadmaster, Cadillac, Oldsmobile, Chrysler Crown Imperial and most foreign cars have 12-volt electrical systems; advance dope is that at least three additional U.S. makes will have them in '54. Technicians who are on the ball are now obtaining appropriate service data, 12-volt tubes and vibrators, as well as necessary test equipment so that future customers with new cars won't drive off when radio trouble develops.

SO LONG AS PRESENT TIGHT-MONEY SITUATION EXISTS you fellows won't be working on many of those 24-inchers-and-larger. Look for 17's and 21's as sizes to be most commonly in use for some months ahead.

Picture .....

UHF PROBLEMS IN "OLD" UHF AREAS—Portland, Oregon—for instance, are just about completely licked by local technicians. It doesn't take these boys long to find all the answers through actual experience in the field, and they have to do it the hard way because many of the theories and instructions on paper just don't work out in actual practice.

MONEY IN REPAIRING THOSE OLD "DOGS" which customers keep for sentimental reasons. Most of the vintage receivers are very easy to put in order since components are spaced well apart, and circuitry is simple. A New York technician fixed up an aged and failing console model for a New Yorker and got a $10 tip over and above the charge. Another servicer had advised the owner that "it ain't worth repairing." Don't worry about the antiquity of the set if the customer is willing to spend the dough.

ORCHIDS TO THOSE MFRS. spending real dough these days to "sell" you fellows to the public as efficient, honest technicians—and good citizens to boot! Some biggies are passing out plenty of shekels for ads boosting TV servicemen—in publications, time on the air, and direct-mail pieces. It's about time the serviceman got something besides a black eye, in the public eye,—as will be effectively shown by a big Raytheon advertisement in Life for Sept. 20, including admirable pledge for servicemen:

ODD-BUT-TRUE DEPARTMENT: Dissatisfied woman customer refused to let technician remove his tool and tube kits from home. He tried to pull 'em away from the irate dame, and was yanked into court charged with simple assault. Judge dismissed case . . . Eastern magistrate told TV repairer that a set "should stay fixed for at least six months." . . . One way to raise the technician's standards: Veteran radio repairer is now mayor of a city of about 30,000 in New England . . . Huge flocks of starlings, arriving in New York City in the Fall, raise hob with TV reception in Manhattan's West Side. The sky-darkening hordes cover antenna elements, ruin local business establishments. Electronic "scare" devices haven't worked, nor have stuffed predatory birds, such as owls and hawks.

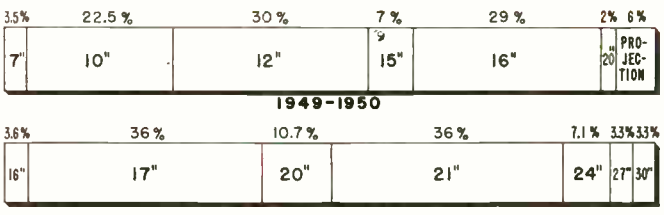
HARD-TO-GET-AT COMPONENTS driving numbers of servicers nuts. Plenty of technicians have good ideas re parts set-ups in modern TV sets. Let's hear from you fellows. We'll pass on your suggestions to the manufacturers.

SMART SERVICERS CHECK all new TV receivers before they deliver them. A sure way to invite future grief is to have to perform services of a major character on a brand-new set in the customer's home. One dealer estimates that 30 per cent of all the models he sells require pre-delivery service of some sort, while another, a real tough guy, claims they all do!

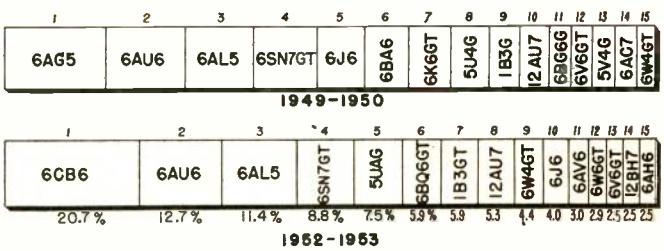
BRAIN POWER—A successful Park Avenue psychiatrist had a complete custom installation of TV set, high-fidelity radio and phonograph, and a tape recorder installed in his plush apartment. About a month after the installation, he excitedly called his serviceman. "Come quickly and bring your instruments," he pleaded, "the patient—er—I mean the whole system has developed a nervous breakdown. Nothing at all works." The serviceman arrived to find that the power plug had slipped out of the wall receptacle. The patient—or rather, the system—enjoyed a rapid recovery.

What Types of Picture and TV Receiving Tubes Should You Stock Up On?

PICTURE TUBE SIZES



TUBE TYPES MOST SPECIFIED



Circuit analysis of TV receiver schematics published in TECHNICIAN'S *Circuit Digest* during the past six months indicate that the average TV set contains 17.5 tubes, exclusive of rectifiers and picture tubes.

The breakdown of picture-tube sizes shown above should prove helpful when the time comes to renew your supply of cathode-ray tubes. The five most specified picture tube types are 21FP4A, 17HP4, 17LP4, 17YP4, and 20HP4A. Note the tie in popularity of 17-inch and 21-inch CRT sizes. In the receiving tube category, the 15 most popular types noted above account for 84.6 % of the total.

Servicing Interlace Problems

Pairing of Lines, Touching Lines. Sources of Trouble in Various

By Peter W. Orne

• The present trend towards larger and larger screens, and the customer's insistence on sitting close to his TV set, make the problem of proper interlace more important than ever. Improper interlace causes a loss of picture detail. In servicing sets in which a loss of interlace is present, a thorough knowledge of the way in which interlace is achieved, and the factors that can disturb it, is necessary. This article will review the theory behind interlace, then consider some of the service problems associated with it.

Present television standards call for the scanning of 30 frames per second. Each frame consists of two fields interlaced into one. Thirty complete pictures are transmitted every second. Such a transmission rate is sufficient to give the illusion of continuous motion; it is not sufficient in itself, however, to prevent flicker.

Flicker may be defined as the eye's ability to perceive changes in light intensity. The eye is extremely sensitive in this respect, and can detect changes in light intensity at picture repetition rates as high as 40 per second. To be on the safe side, the over-all light of the television picture is changed *sixty* times a second. This is accomplished by showing first the *odd* lines and then the *even* lines of every frame. Each set of even or odd lines, respectively, comprises a *field*. The odd and even lines of a frame must mesh perfectly; the meshing is known as an *interlacing*.

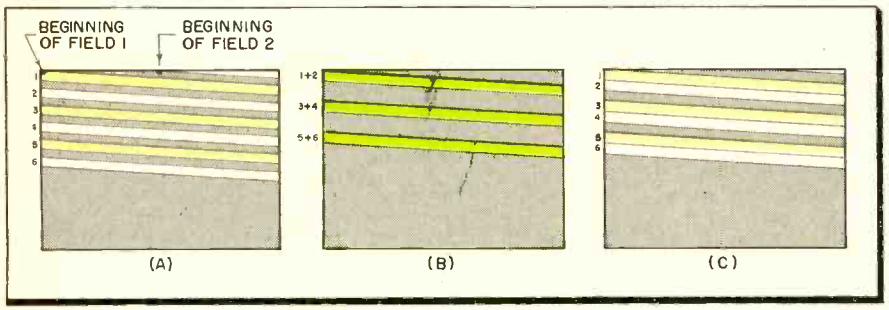
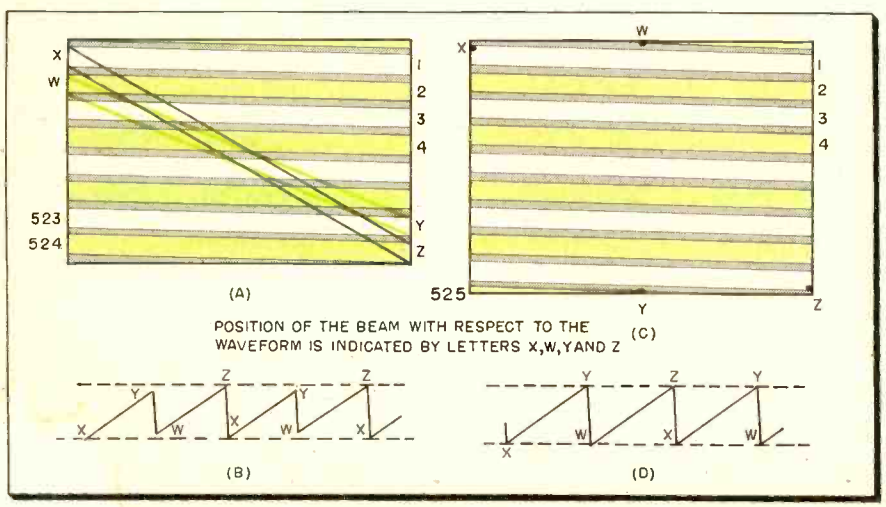


Fig. 1—a) Proper interlace. b) Complete loss of interlace; lines overlap. c) Pairing of lines; lines touch. Only a few of the scanning lines are shown.

Fig. 2—Why an odd number of lines is needed in the TV picture. (a) Shows how an even-line picture would interlace. Diagonal lines indicate retrace paths, if no horizontal deflection occurred during the vertical retrace. At the completion of line 523—(assuming line 523 is the last odd-field line)—the beam starts scanning line 2. At the completion of line 524 (last even-field line) the beam begins to scan line 1 again. The corresponding sweep signal necessary for such an interlaced sweep is shown in (b). Note the variation in amplitude of the sweep signal during successive fields. Set designers would find such a variation difficult to achieve. In (c) and (d), the interlaced raster and corresponding waveshape for an odd-line picture are shown.



The alternative to an interlaced picture would be to show 60 complete pictures every second. This would require twice the present band width for each channel, and would permit fewer stations to be on the air. The system of interlacing in current use thus saves space in the frequency spectrum; it also makes the use of a complicated vertical synchronizing signal necessary.

In order to properly interlace the two fields of each frame, it is necessary that both fields start at exactly the same horizontal level at the top of the picture (see fig. 1a).

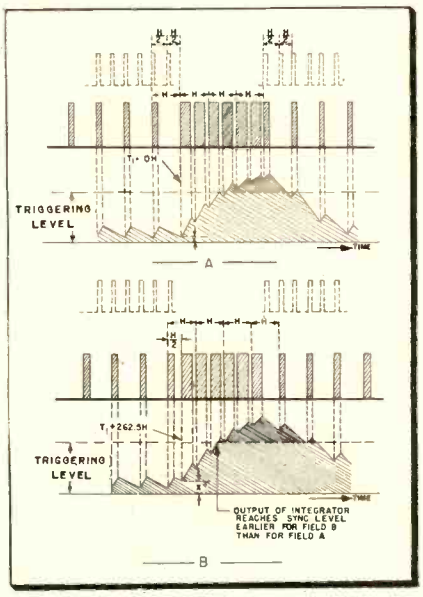


Fig. 3—Output of integrator in absence of equalizing pulses. The vertical oscillator is triggered at different times during each field, upsetting interlace. (Drawing courtesy of GE.)

To calculate the accuracy required, let us examine a case of complete loss of interlace. If an even line falls on top of an odd line (see fig. 1b) we have complete loss of interlace. Now, there are 262½ lines in each field, of which approximately 240 lines are visible; the displacement which causes an even line to fall on top of an odd line would constitute 1/500 of the vertical trace, or approximately .2%.

"Pairing of lines" is the term usually used for the condition where the lines of alternate fields are touching (fig. 1c). If we assume the lines to be approximately twice as thick as the spacing between properly interlaced lines, then pairing

in Television Receivers

Receiver Sections. Typical Symptoms. Test Procedures.

will take place when the vertical sweep is displaced 1/3 as much as when complete loss of interlace occurs, or approximately .06%. The high degree of accuracy required for proper meshing of the two fields of a frame indicates why minor defects in sync stages often affect interlace without impairing vertical synchronization.

Before we consider how interlace is upset, we should review some aspects of the sync system, since proper interlace depends on proper synchronization. Equal-amplitude sync pulses are used for both vertical and horizontal synchronization; they differ from each other chiefly with respect to frequency and duration. Since an odd number of lines must be used for the picture in order to make the two fields equal in vertical amplitude (see fig. 2) one field must start at the *beginning* of a line while the other has to begin in the *center* of one.

Now, the RC integrator network which separates the vertical from the horizontal sync pulses, has a residual charge built up in it by the last horizontal sync pulse preceding the vertical sync pulse. This residual charge will be different for the two fields, since the time between the last horizontal sync pulse and the beginning of the vertical sync pulse is different by half a line, or approximately 30 microseconds, in each case (see fig. 3). In order to equalize these residual charges, six equalizing pulses are transmitted before the vertical sync pulse. These equalizing pulses insure that the charge present in the integrator at vertical sync pulse time becomes the same for both fields; if it didn't, interlace would be upset.

For proper synchronization, it is necessary to separate the sync information from the video information. This is basically accomplished in a limiter circuit. When the synchronizing information has been made available in clean form, the vertical synchronizing pulse must be separated from the horizontal synchronizing pulse. This is accomplished by the use of an integrating network in every set presently on the market.

An integrating network is a low-pass filter that accepts the low-frequency vertical pulses and rejects the high-frequency horizontal ones. It is made up of RC networks; usually three such networks are used in cascade. The time constant of

(*Continued on page 45*)

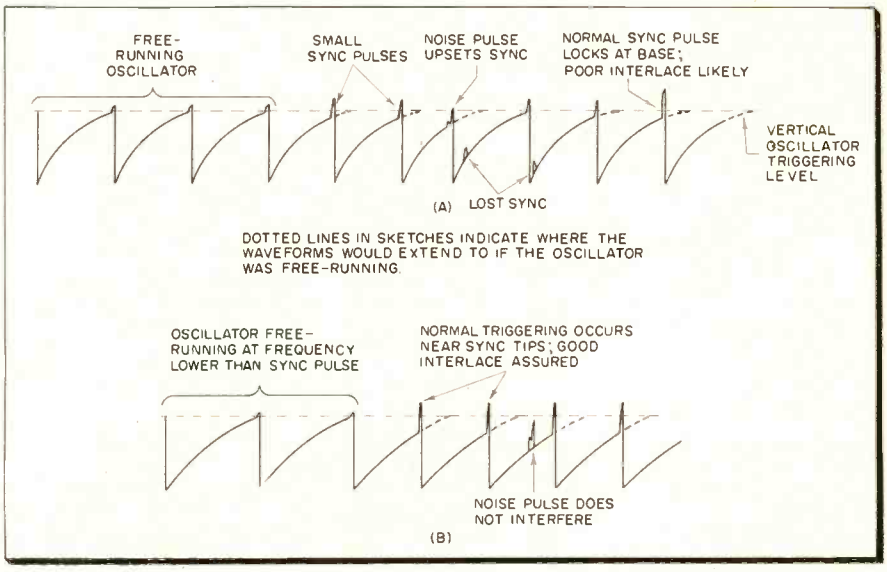
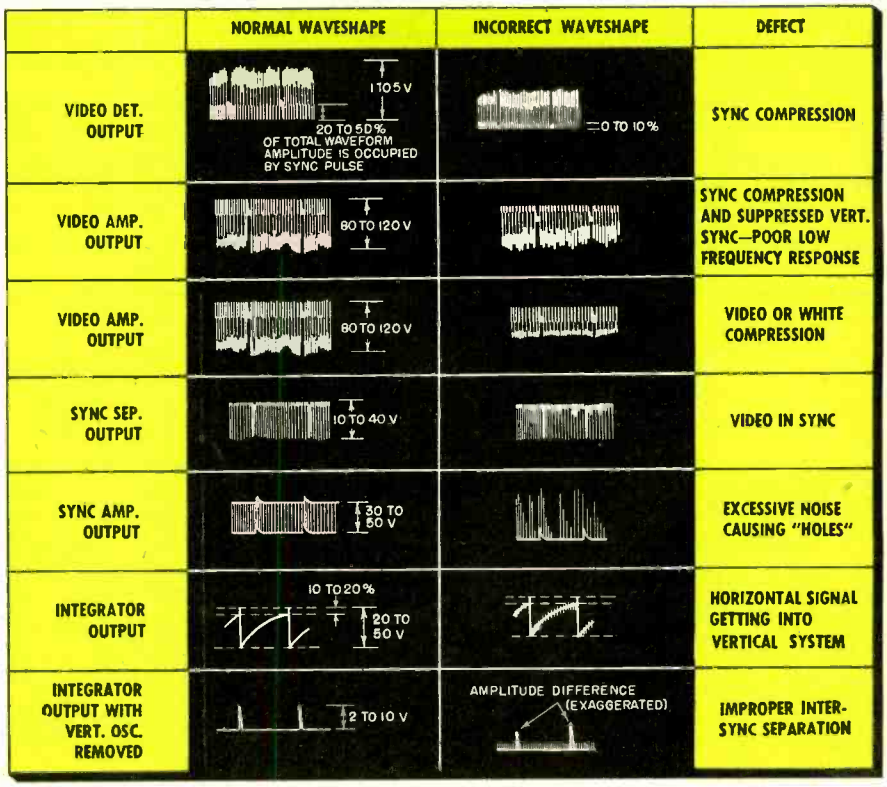


Fig. 4—Effect of different settings of the vertical hold control on synchronization and interlace. The control is set correctly for very weak stations in (a). A setting that will give better noise immunity and interlace, when incoming signals are stronger, is illustrated in (b).

Fig. 5—Normal and abnormal waveshapes associated with poor interlace. Scope setting is 30 cycles. The range of peak-to-peak-voltages indicated is normal for the majority of present-day TV sets. Variations of less than 10% should be noted between comparable sync section wave-form voltages in two identical-model receivers. Detector and video amplifier voltages will vary with the incoming signal strength; the video amplifier signal will also vary with contrast control setting.



Eliminating Vertical Retrace

How to Add a Blanking Network to a Set Without One

By M. G. Goldberg

• Many TV set owners who purchased receivers from three to five years ago are still holding on to them for various reasons, in spite of the small-size screens with which most of these sets were equipped. The majority of these sets were made without retrace blanking circuits.

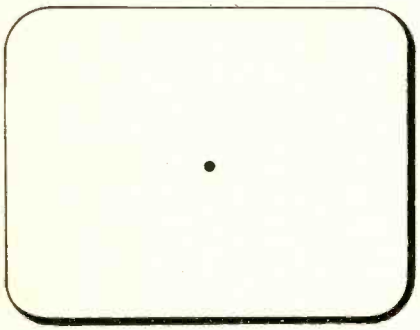


Fig. 1—Spot of light seen when horizontal and vertical deflection are absent, but circuits operate normally in other respects.

Result: if the owner of an old set of this type likes a bit brighter than average picture, he is confronted with a series of annoying lines.

Most set owners would not be willing to pay any considerable sum of money to eliminate this condition. When the chasis is brought into the shop for other service work, however, such a circuit can be installed in most cases at comparatively little cost. Few customers would raise any objection to a nominal charge for this work, and the improved performance would make for better customer-serviceman relations as well as serving as a constant reminder of the technician's competence. Many large-screen receivers also have been built without special retrace blanking circuits; in these cases it should not prove difficult to get the customer to approve the incorporation of such a circuit into his set.

To sum up the relevant facts: 1—Several million TV sets in current use are without retrace blanking circuits. 2—The entire job of adding such a circuit, once the chassis is in the shop, requires less than thirty, and many times less than fifteen minutes of actual work. 3—Only two or three new components generally need to be added. 4—Five to fifteen dollars may be added to the repair bill for this bit of circuit re-design.

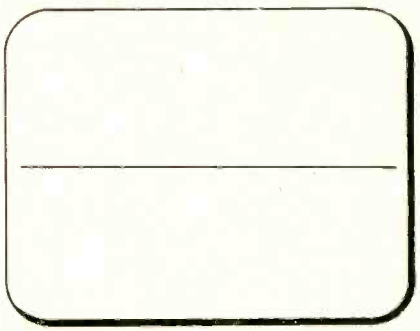


Fig. 2—Line visible when horizontal deflection is present, but vertical deflection is absent.

Before considering *what* to do and *how* to do it, let's first discuss some of the *whys* and *wherefores*. In a normal TV receiver, if both horizontal and vertical deflection circuits were made inoperative, but high voltage was still applied to the 2nd anode of the CRT, there would be present at the center of the screen a bright spot of light (fig. 1). If the horizontal circuit was now fully activated, this spot of light would trace a line horizontally back and forth across the screen 15,750 times per second (fig. 2). This is the condition present when the vertical oscillator or output tube is removed from its socket, or burns out.

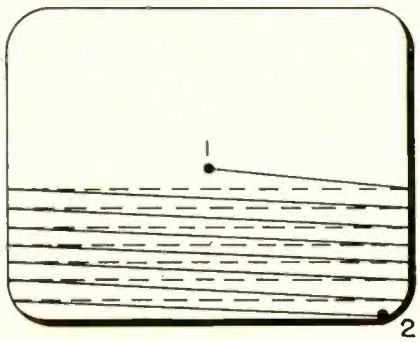


Fig. 3—When vertical and horizontal sweep fields both deflect the beam, the latter is moved downward, and from left to right.

Now assume that the vertical circuit has been restored to normal operation (fig. 3). If the vertical sweep voltage at this instant is half way up the slope of sawtooth waveform (point 1 in figs. 3, 4), it will start moving the spot of light down-

Fig. 4—Waveform representation of vertical sweep cycle. Trace plus retrace interval has a duration of 1/60th of a second.

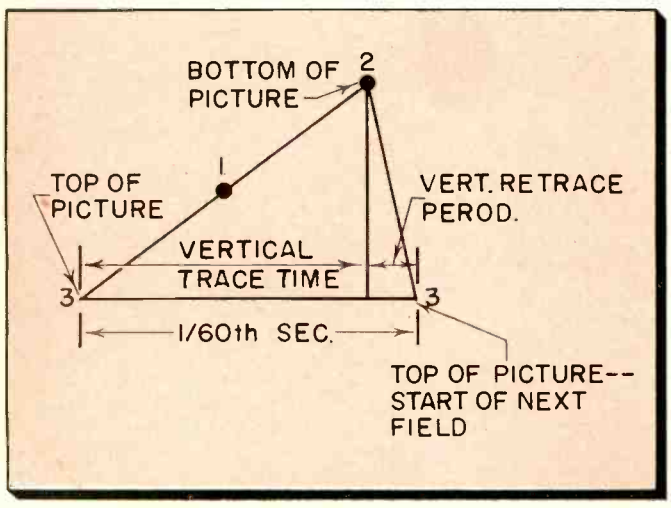
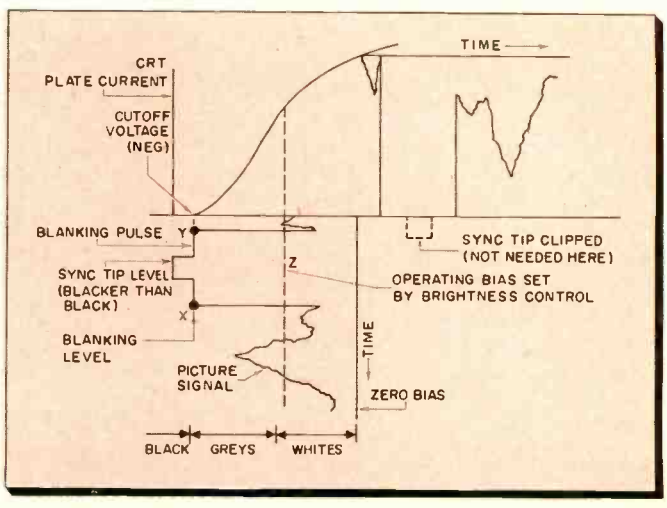


Fig. 8 (a)—CRT input and output signals when circuit operation is normal.



Lines in Television Receivers

in Less Than Thirty Minutes, Using Only Several Components

ward at the same time that this spot is moving horizontally back and forth across the screen. After reaching the bottom of the screen, the beam is quickly returned to the top and the cycle is repeated. The time taken to scan the entire screen from

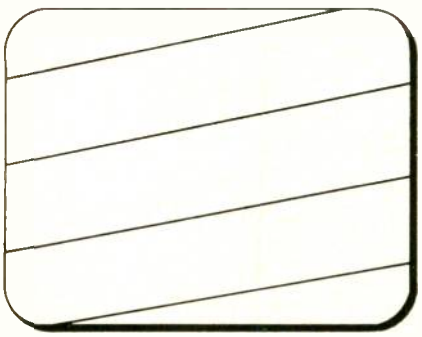


Fig. 5—Lines formed during fast vertical retrace.

top to bottom is slightly less than 1/60th of a second. The remainder of this 1/60th-second interval is used up in the beam's return to the top. This very short period of time—approximately 8% of the time duration of one vertical field—is called the vertical retrace period. It is this retrace interval with which this article is mainly concerned.

Since the horizontal sweep circuit is operative during the period of vertical retrace, the beam moves horizontally across the screen at the same time it is traveling upward; the scanning lines formed during the vertical retrace therefore slant upward (see fig. 5). The retrace lines are also much fewer, and they make a steeper angle with respect to the horizontal axis, than the trace lines formed during the downward movement of the beam. This is so because the beam returns to the top 12 to 15 times as fast as it moves downward, and in some fast retrace circuits this rate may be doubled.

The speed of retrace (see figs. 5, 6, 7) is indicated by the steepness of the upward slant and the number of retrace lines showing on the normal raster. If only 4 or 5 lines are evident (fig. 5), a very fast return is indicated; a slower retrace speed is present if 7.8 or more lines are visible (fig. 6). Some of the first 7-inch receivers had such a slow re-

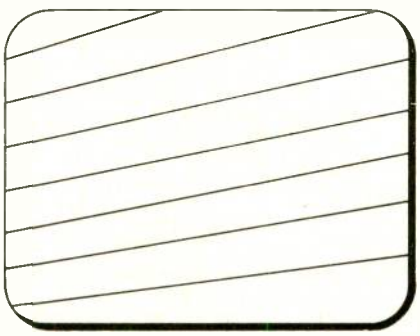


Fig. 6—Lines formed during a slow vertical retrace.

turn sweep that the blanking period was over before the beam reached the top of the raster; several annoying white lines were, in consequence, visible at the top of the picture, and many customer complaints resulted. The annoyance was aggravated because the lines were of full brightness (since blanking had already been completed and the CRT bias had thus decreased).

Figure 8 shows what happens

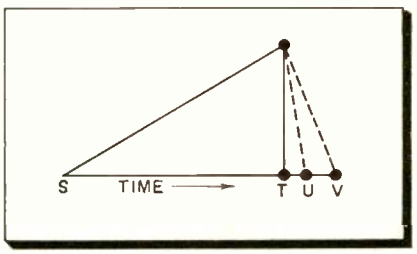


Fig. 7—Waveform representation of fast and slow vertical retrace periods. Section S-T represents vertical trace period; T-U is the time taken by a fast vertical retrace; T-V represents the duration of a slower vertical retrace.

when the customer turns up his brightness control beyond normal, as might happen during the showing of a "murky" cowboy movie. Fig. 8a shows the normal condition of operation with the brightness control set just right, so that the blanking pulse from the station blacks out the screen between points X and Y, and the bias is correct at Z. (Assume there is no DC restorer in the circuit and that the video signal is coupled from the output stage to the grid of the CRT grid through a coupling capacitor.)

(See next page)

Fig. 8 (b)—Input and output signals when the brightness control setting is beyond normal (reduced CRT grid bias).

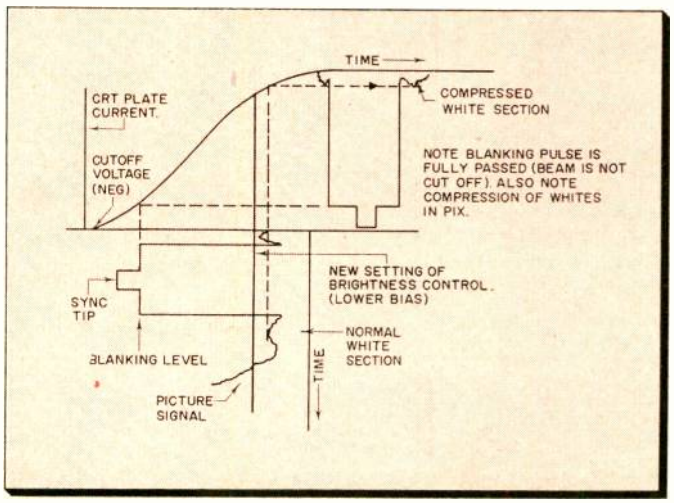
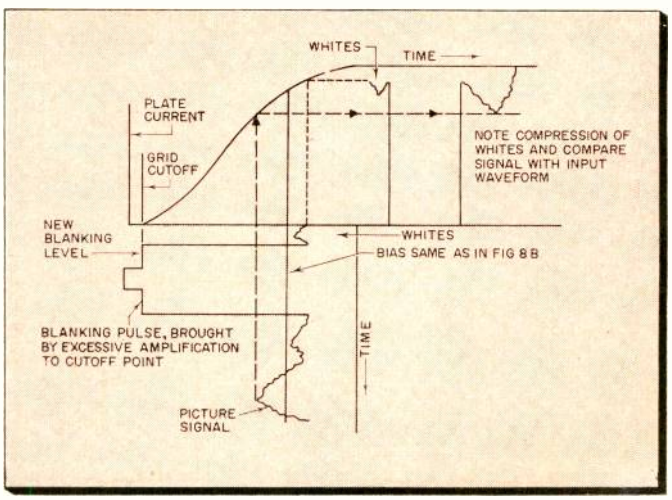


Fig. 8 (c)—Effect of increasing input signal to CRT, in attempt to eliminate retrace lines made visible as result of lowered CRT bias.



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Eliminating Vertical Retrace

When the set owner advances the brightness a little he is unknowingly reducing the CRT bias (fig. 8b). Lowering the bias brings the blanking level below the cutoff point of the pix tube characteristic; the blanking signal from the station is now shifted toward the white area under the curve, and it no longer blacks out the horizontal lines during the vertical retrace period.

If the contrast control is advanced to feed a greater signal to the grid of the CRT grid and thus extend the height of the blanking pulses, bringing them once again beyond cutoff, the video output stage may be overloaded, possibly introducing distortion and increased grain in the picture (fig. 8c). (A "grainy" picture is one in which noise spots, and short streaks and dots are apparent. The condition is generally caused by an excessive contrast control setting. A shimmering, hard-to-watch background is also apt to be present under the circumstances.) Dark greys also tend to become black with an excessive contrast setting, and small letters such as "o's" and "a's" fill up solid. In addition, sync clipping at the input to the sync amplifier may occur, producing picture instability.

Look once more at Fig. 8b, showing conditions present when the customer has lowered the bias too much. If by some means we could increase the negative bias on the CRT grid *only during the retrace period* we would get rid of the retrace lines, but the picture would remain unaffected. This is what is done by means of the circuits to be described. A negative voltage is tapped off from some point in the vertical oscillator or vertical output circuit. This voltage pulse is applied to the grid of the CRT; or else a *positive* pulse is applied to the cathode of the CRT; either method will achieve the desired result.

Several different methods of retrace blanking will be described. The serviceman can use his common sense in choosing a suitable circuit for the job he may have at hand.

Consider first the retrace-blanking circuit used in Motorola TS-14 and TS 23 chassis (see fig. 9a). The video signal in these sets is applied to the cathode of the CRT. Note that the brightness control is in this cathode circuit. In some earlier models the grid was returned to B—, and no blanking circuit was present. With regard to these earlier models, a very simple change (see fig. 9b) makes it possible to incorporate retrace blanking.

All that is necessary is to replace the single 8200-ohm resistor with one 5600-ohm and one 2700-ohm unit, and connect a wire from the junction of the two units to the grid of the CRT (which has been disconnected from B—.) The voltage divider thus formed is in series with the discharge capacitor in the 6J5 vertical oscillator circuit. The negative spike of approximately 25 volts which appears across the 2700-ohm resistor is applied to the CRT grid. More pulse voltage can be secured, if needed, by reversing the position of the two resistors; at least 60 volts is available (if needed) across the two in series.

The writer has found it good practice NOT to attempt retrace blanking on the same tube element to

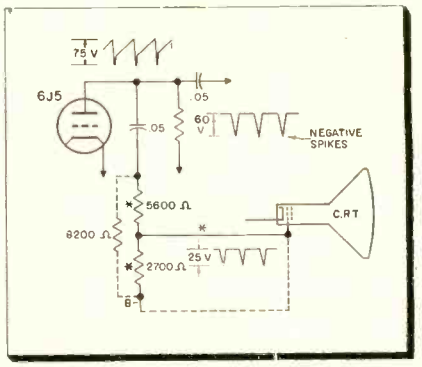


Fig. 9 (b)—Partial schematic of early Motorola TS-14 and TS-23 receivers. Original wiring is shown in dotted lines. Parts and wire added to introduce retrace blanking have an asterisk beside them.

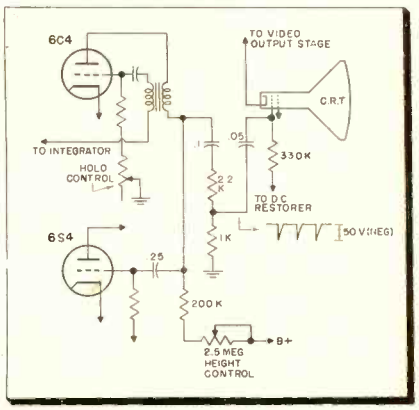


Fig. 10—Retrace blanking in Trav-ler TV receivers.

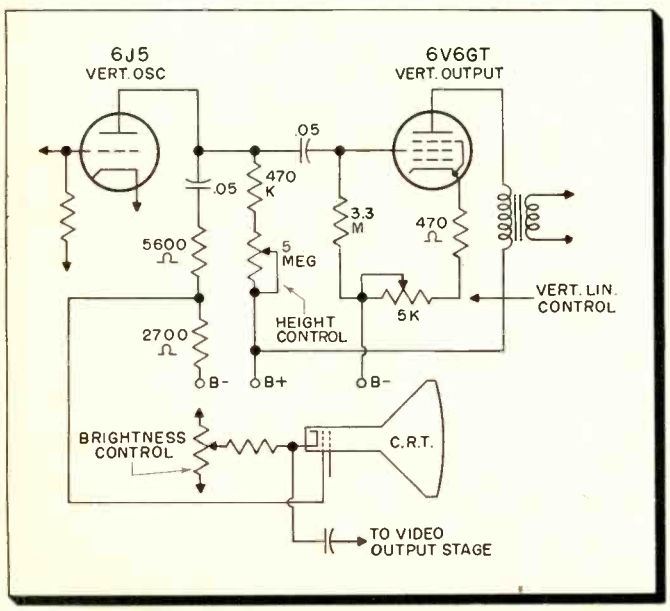
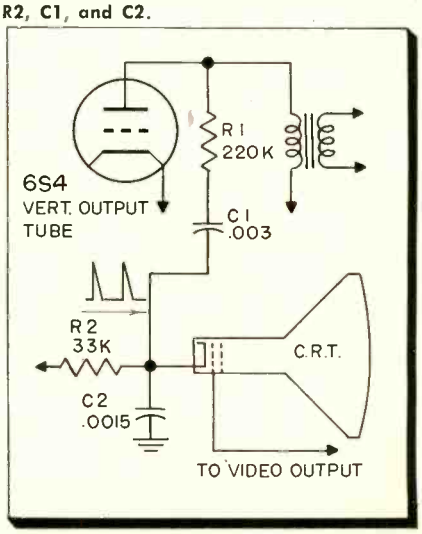
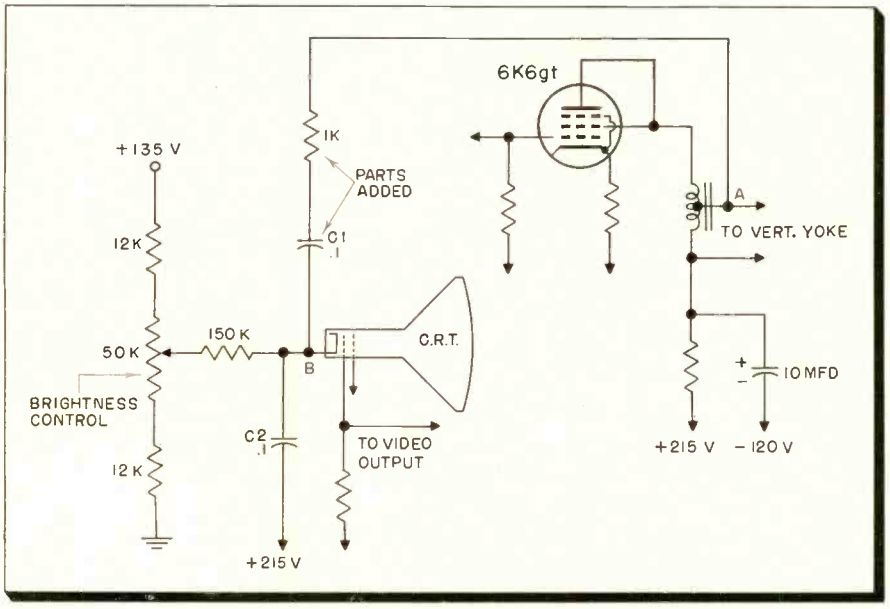


Fig. 9 (a)—Part of vertical deflection and CRT circuits in Motorola TS-14 and TS-23 chassis—late types—with retrace blanking incorporated.

Fig. 11—Retrace blanking circuit used in some Philco receivers. Parts added are R1, R2, C1, and C2.



Lines — Adding Blanking Network



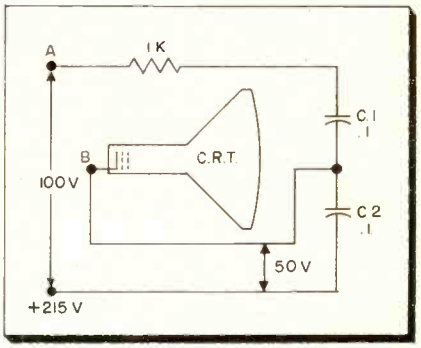


Fig. 12 (a) left—RCA models with vertical auto-transformer circuit modified for retrace blanking. The two added parts are indicated by arrows. Fig. 12 (b) above—Voltage-divider circuit of (a) redrawn to make its action clearer.

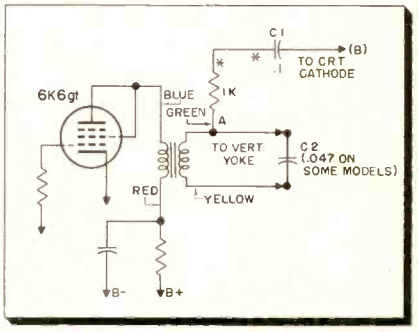
which video signal is applied, as any increase in capacitance caused by added leads or components is apt to cause smear in the picture (due to increased shunting of higher video frequencies to ground.) In other words, if the *cathode* of the CRT is being fed from the video output stage, work the blanking circuit out in the *grid* circuit and vice versa. The brightness control may remain in either circuit without affecting the action.

The Motorola circuits of figs. 9a and b use a form of multivibrator; in contrast, the Trav-ler models whose vertical circuit is shown in fig. 10 employ a blocking oscillator. Here again the video signal is applied to the cathode of the CRT; and the brightness control is also in this circuit. A negative spike voltage of approximately 50 volts is applied to the grid of the CRT through a .05 MFD capacitor. This voltage appears across the 330 K CRT grid resistor, which leads to the DC restorer circuit. The method of tap-off for this vertical spike is similar to that shown in fig. 9; only the component values are different. This circuit, with a 6C4 used as oscillator, is incorporated in Trav-ler models 12L50, 16R50, 16T50 and 16G50; a 6S4 is the vertical output tube in these sets. The method of blanking employed may be used for similar circuits in other makes of receivers.

With regard to the incorporation of retrace blanking, PHILCO receivers fall into two groups: earlier single-chassis models, and later dual-chassis sets. In the latter models, the RF, IF audio and video circuits are on one chassis; the deflection and power circuits are on another and separate chassis. The two chassis are sufficiently separated to permit inclusion of a UHF tuner between them. Interconnections are by means of plugs, sockets and cables, and very careful attention should be paid to these connections when making any changes. Because of the additional complications introduced by the dual-chassis models, any serviceman interested in installing retrace blanking in such sets should contact Philco Service Headquarters in Philadelphia and ask for the copy of *Philco Service Supervisor* in which the necessary changes are plainly described, step by step.

An example of the changes recommended is illustrated in fig. 11. This is a skeleton schematic, and indicates the new parts to be added between the vertical output and the

(*Continued on page 88*)



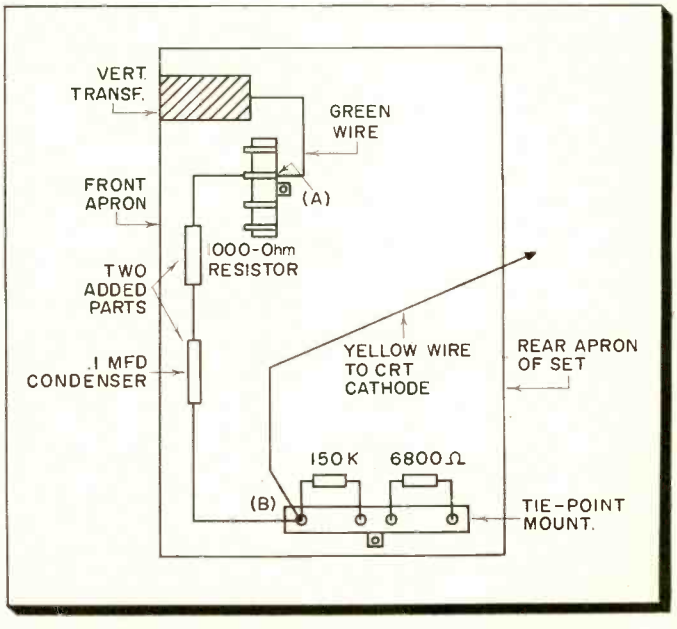


Fig. 13 (a) above, right—Dual-winding vertical transformer circuit used in some RCA receivers. Parts to be added for vertical blanking are asterisked. Fig. 13 (b) right—Pictorial sketch, showing how vertical blanking units are wired into RCA '51 receivers. Bottomside view of chassis is shown.

Round-Up of Service Data

Elimination of TVI, Alignment Touch-Ups, Tube Replacements,

• UHF converters are coming off the production lines in increasingly large quantities. It is consequently becoming necessary for technicians to familiarize themselves with the service problems arising in these units. To fill this need, at least in part, we are presenting a round-up of some of the troubles and trouble-shooting procedures connected with UHF converters.

TVI in UHF Converters

In some cases, an undesired heterodyning of signals from the UHF converter and VHF receiver oscillator may take place. A UHF oscillator fundamental and VHF oscillator harmonics may beat together and produce a signal that is accepted by the VHF front end, causing interference lines to appear in the picture. Sometimes the trouble can be eliminated by setting the receiver's fine tuning control to a point where no interference is noted in the picture, then resetting the appropriate UHF oscillator tuning adjustment for best sound and picture at that point.

In a second method, the TV receiver is switched to another channel (to which the UHF converter can tune); suitable alignment adjustments are then made on the UHF oscillator to bring in good sound and picture at this new channel setting.

When a weak UHF signal is coming in, and a strong VHF signal, operating at or near the VHF receiver's channel setting, is also present in the vicinity, interference from the VHF signal may be received. Use of a shielded cable between the UHF unit and the TV receiver front end will often clear up such trouble.

In some locations, interference may be evident when the converter is tuned to either of its design output frequency settings—channels 5 and 6, usually. If the incoming UHF signal is strong, the converter output circuit may be tuned to a lower-frequency channel. The VHF receiver station selector is, of course, set at the same channel. Elimination of the TVI is attained at the expense of a considerable loss in signal.

Touching up UHF Alignment

If optimum reception of picture and sound does not occur somewhere near the center setting of the fine tuning control, the oscillator tuning adjustment(s) may be manipulated with a non-metallic screwdriver until the desired condition results. Only a slight adjustment should be necessary. A suitable alignment tool may be made up by obtaining a short section of polystyrene or nylon rod, approximately $\frac{1}{8}$-inch in diameter, and slotting one end, or otherwise shaping it to fit the type of adjustment screw present.

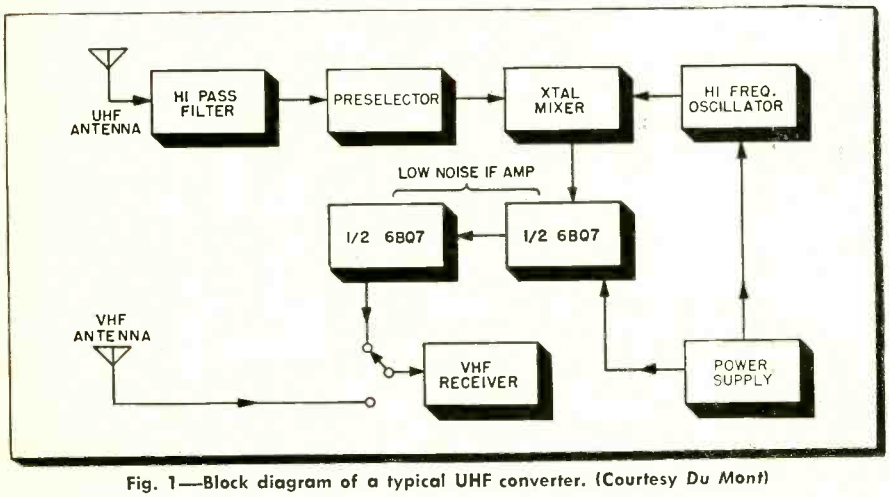


Fig. 1—Block diagram of a typical UHF converter. (Courtesy Du Mont)

Tube Replacements

When the rectifier or IF amplifier tubes are replaced in a converter, the alignment of the latter should not be appreciably affected. Substitution of an oscillator tube, however, may in some cases necessitate a complete realignment of the converter. If a number of oscillator tubes are tried out, one may be found whose interelectrode capacitances so closely resemble those of the original tube that little or no realignment may be necessary.

Some oscillator tubes will function satisfactorily over only a portion of the tuning range, dropping out of oscillation over the remaining part of the range. It is therefore necessary to check converter operation on all available channels, when the oscillator tube is replaced.

Notes on Crystals

The most likely source of trouble in a UHF converter—outside of the tubes—is the crystal (or crystals) present. Crystal mixers are common in converters.

Although some types of crystals may be substituted for others in certain converters, it is generally best to be on the safe side and replace the original crystal (when defective) with an identical unit, and thus avoid the need for converter realignment. We may note that when a 1N72 is present, and some snow is seen on UHF channels, replacement of the unit with a 1N82 may improve the picture and remove the snow. Realignment may not be necessary in such cases.

Make sure to note the position of the original crystal before removing it, to avoid connecting up the replacement in the wrong polarity. Polarity reversal need not necessarily eliminate picture and sound; an increase in noise, manifesting itself as snow in the picture is, however, very apt to result under the circumstances.

A thin film of sealing wax at the terminals of the crystal may cause poor electrical contact at these points, reducing the gain of the circuit and causing poor picture contrast. "Working" the crystal in its socket may improve the contact and eliminate the symptoms.

When a crystal is soldered or unsoldered, some means of absorbing the excessive heat of the soldering iron should be employed to prevent

on UHF Converters

Notes on Crystals, Tuning Difficulties, Troubleshooting Procedures.

damaging the crystal. In one method, a damp cloth is placed over the crystal while it is being soldered; another method involves placing metal clips at the crystal terminals to conduct away much of the heat from the crystal itself. In a third method, a pair of long-nose pliers is placed between the body of the crystal and the solder joint (see fig. 2) to conduct away some of the heat.

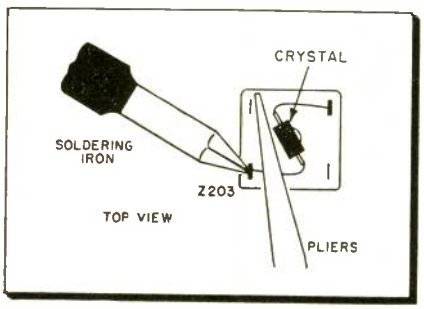


Fig. 2—Using long-nose pliers to dissipate heat applied to crystal during soldering.

The story goes that a defective crystal may look the same as a good one, even under a microscope. Measurement of a crystal's front-to-back resistance ratio is often of little use in determining the unit's condition. The only reliable check is substitution.

When a crystal is changed, make sure that the lead length on the new unit is the same as on the old one, and that the position of the replacement is identical with that of the original.

Tuning Difficulties

Marty Bettan of RMS says, regarding converters with which he has dealt : "With half the UHF stations on three-quarters of the tuning dial, and the other half on one quarter of it, you've got to have sandpaper fingers and work like Jimmy Valentine when you get to Channel 60."

Localizing Trouble to the UHF Converter

When trouble in a converter is suspected, localization tests may be made as follows:

If VHF stations are being transmitted in the locality, tune in one or more of these channels. If VHF stations are satisfactorily received, while UHF channels are not, trouble in the UHF converter or its antenna system (if a separate antenna is used for UHF) is indicated. When only one UHF transmitter is operating, make sure that a defect at the transmitter is not the source of the reception trouble.

When no VHF stations are transmitting in the area, check the raster for defects (contrast control setting at zero). If the size, shape, brightness, focusing or other characteristics of the raster is not normal, trouble in the VHF receiver should be looked for. If no raster abnormality is evident, turn the contrast control to maximum and observe the amount of snow (black and white noise signals) that appears on the screen.

No snow points to trouble in the IF, video detector or video amplifier stages of the receiver. If *very little snow* is present, trouble in the VHF tuner seems likely. Presence of a *normal amount of snow* means that the fault *may* lie in the UHF converter; it may also, on the other hand, be present in the VHF tuner, UHF antenna or UHF station. Perhaps the best and fastest check is to substitute a self-powered UHF converter for the one present.

Converter Troubleshooting Tests

When trouble has been definitely traced to the converter, a fast but thorough inspection check should be made for improper seating of tubes, poor socket contacts, defective or improperly connected UHF input leads, broken leads in other circuits, defective switches, burnt or broken resistors, and similar faults that are obvious when looked for.

Trouble in the preselector stage can be localized, if strong signals are coming in, by touching one side of the antenna lead-in to various points in the crystal input circuit. When normal or near-normal reception is obtained by touching the lead-in to one such circuit point, whereas reception remains absent or unsatisfactory at a *directly preceding* circuit point, trouble in the first-mentioned section of the circuit should be looked for.

When an Inductuner tuning unit is present, checks for loose stops and trouble in the switch linkage should be made. Shorting bar contacts should also be examined, to determine whether proper contact is being established, and whether the alignment of the rotor units is correct.

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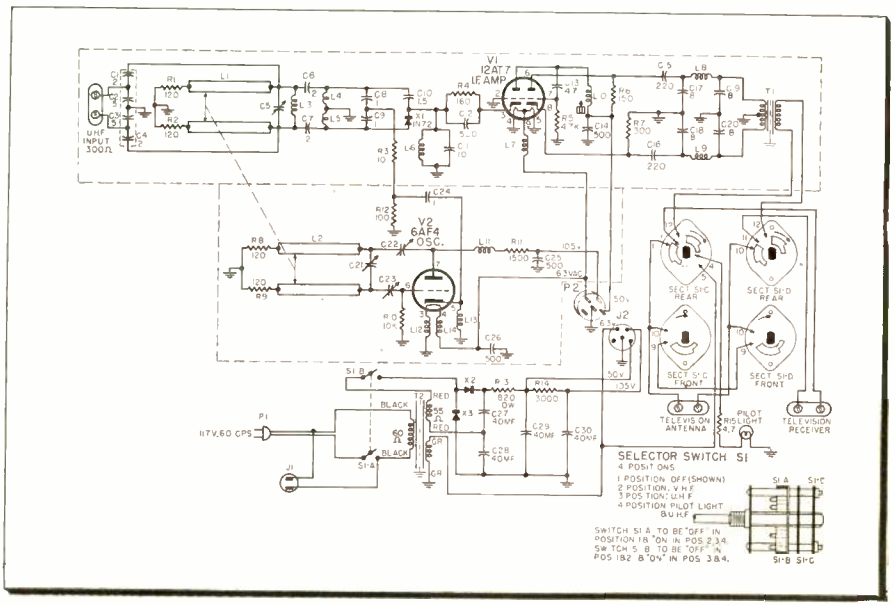
Fig. 3—Representative converter circuit (GE UHF Translator, Model UHF-101).



Changes Servicemen Would Like

A Technician Who Has Studied 6,000 Television Receivers

By Charles R. Maduell, Jr.

• A set designed by a TV engineer is often a beautiful piece of work when it leaves the test rack. Unfortunately, the production department generally tears the design to pieces, and by trying to save a penny here, and a dime there, gives the assembly line a piece of equipment that in quality of parts may bear little resemblance to the one that left the designer's work bench. After all, the sets are being made for the general public, and competition is high. A set that incorporated the same grade of parts used in electronic equipment built for the armed forces could never be sold to the general public—the price would be too high.

Television sets leaving the factory must of necessity give trouble to the serviceman. Yet he seems to be forgotten in their design. Normally it is not necessary to think of a serviceman as an important factor in the design of a product, since technicians are easy to train. In television, however, a different condition exists. Already in cities having TV there is a scarcity of good television technicians. Since the thawing out of "the freeze," TV is reaching many cities where radiomen have given little thought to preparing themselves for TV. A much more severe shortage of competent TV servicemen threatens to develop. It is about time that the factories start making their sets easier to service than they have in the past.

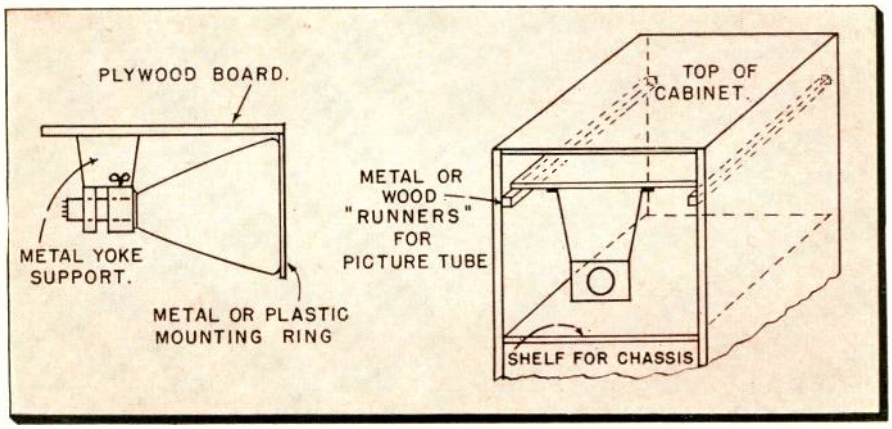
It is only human for a serviceman, when he finds a set is rather hard to set up, to postpone work on that set in favor of one that is easier to service, since profits depend on volume of output. It is not in the interest of the manufacturer, however, to permit such situations to develop with respect to his set.

I don't mean to suggest that the factory should abstain from new designs and improvements, in order to make the serviceman's life easier. The serviceman should, however, be given consideration by making the mechanical and electrical layout of the TV set such as to allow ease of servicing. There should also be made available, *as quickly as possible*, all the information the technician will need to service the set, in the event that unusual troubles develop.

When a serviceman needs special rigs to set up a set on his service bench, or else finds it very troublesome to trace the receiver's circuits, he is apt, if rushed, to put the set aside. The next time he gets a service call on that brand, he may refuse it, if his service bench is crowded with repair jobs; if he *does* accept the call, his price will necessarily be higher than it would if the set presented merely the usual difficulties.

Below are "gripes" heard from some servicemen with respect to several set makes. The servicemen stated, "I don't service the Doe Company's set because . . . .," and cited one or more of these reasons:

Fig. 1—Suggested method of mounting large glass picture tubes and all-metal CRT's.



The picture tube is held in the cabinet by only a flange in front, and the yoke in back. For bench setup, a special rig must be used or servicing with the CRT in the circuit becomes impossible.

The set cannot be turned on its side, when it becomes necessary to service under the chassis, without using special rigs; if such rigs are *not* used, a filter condenser or other component will almost certainly be damaged.

In order to set up the entire set on the service bench, it must be interlocked with other units, or else special adapting plugs have to be made up.

The set has HV as well as other tubes located under the chassis, necessitating the removal of the set from the cabinet when any of these tubes need testing or replacement.

The set has its circuits spread all over the chassis, with no apparent rhyme or reason in the layout. As a result, it is very difficult to trace out many circuits.

The set has such a complicated system for switching it from TV to broadcast radio or FM positions, that even with a diagram, circuit tracing is very difficult.

I use one man on the truck, and he refuses to work on a . . . . make set because it takes two men to take the receiver out of the cabinet, or bring it to the shop.

We'd like to make certain recommendations re how the situation can be improved. The picture tube is the first and most important servicing item to be considered. The set having its picture tube mounted on the chassis is by far the easiest to service, as no special rigs to hold the CRT have to be made. We would therefore recommend that the picture tube, if metal of any size, or a glass type larger than 17 inches, be placed on a separate board, and mounted thereon with its yoke assembly, in such a fashion that the entire assembly can slide in or out of the cabinet (see fig. 1). Sets having the picture tube and yoke mounted in this manner need

To See in the Design of TV Sets

Tells How Manufacturers Can Make Life Simpler for Benchmen

no special rigs, and if they are made to slide in the cabinet on metal or wooden "runners," they can be readily removed from and placed back into the cabinet by one serviceman.

In the case of chassis using 17-inch or smaller picture tubes, we would recommend that the CRT be mounted on the chassis, provided the combined weight of CRT and chassis is not more than 40 pounds. In either case, the entire chassis should be of single construction, with no cabling beyond that required for the picture tube yoke and base (and the additional cabling needed in combination TV-radio-phonographs.)

The construction of the chassis should permit it to be positioned upside down, or on its side, without danger of its tipping over. The chassis should not depend on fragile or delicately-mounted parts (such as filter condensers) for support in any case. This is rather simply achieved. All that is necessary is the placement of the high-voltage can or power transformer on one side near the rear of the chassis, permitting the set to rest on this sturdy unit when it is positioned on its side or turned over; or else a metal bracket or handle may be placed on the chassis (as shown in fig. 2a.)

It is desirable that metal picture tubes be mounted on a separate board, as previously described. Such a procedure may prove expensive, however, in the case of the smaller picture tubes. We can therefore go along with the manufacturer when he mounts a metal CRT of this type on the chassis. He should give some consideration, however, to the service problems that may arise because of his layout.

Several manufacturers have mounted metal tubes on the chassis, then placed the ratio detector adjusting screw, or the horizontal oscillator adjusting screw, right under the metal shell of the tube. It is almost impossible to manipulate these adjustments without getting a severe shock. Insulated tools can seldom be used in such instances—the manufacturer of these "shocking" sets is very apt to "compound his felony" by making the adjustment difficult to manipulate with anything other than a metal screwdriver.

It is highly recommended that the IF adjustments be placed in a single line, or in two lines, on one side of the television set, *never under the picture tube.* It is also recommended that any horizontal coil adjustment present be placed on, or recessed behind, the rear skirt of the set.

Two typical chassis layouts recommended by the author are shown in fig. 2. Note that in either layout, the set can be laid on its side without any risk of its tipping over; also, the IF's can be aligned with the picture tube in the circuit. Everything follows a straightforward signal layout, in keeping with such good construction practices as using short leads in grid, plate and coupling circuits, and keeping power supply components well away from circuits they might possibly interfere with. Note in fig. 2b that the power transformer can be omitted, as in transformerless sets, and the set can still be placed on its side without it toppling over. In the set shown in fig. 2a, the handhold bracket supports the set when it is turned over.

A serious problem that hampers the technician who is working against time is the tube replacement problem. Many service companies will agree that almost seven out of ten service calls can be completed in the home, and involve nothing more complicated than simple tube replacements. The most

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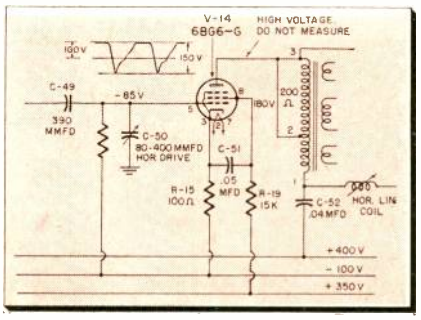
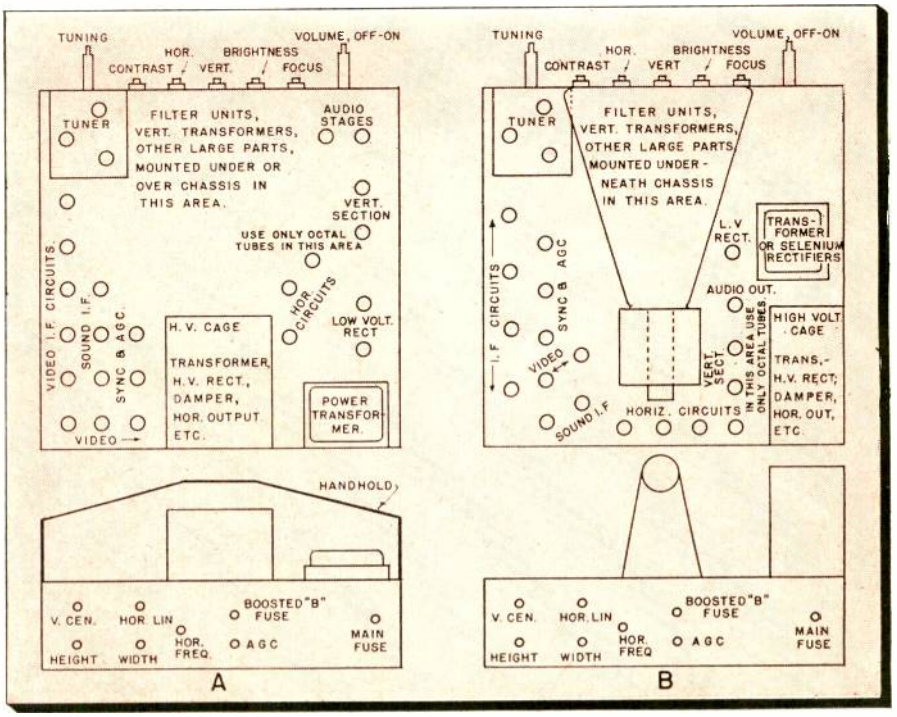


Fig. 3—Schematic of part of a horizontal deflection circuit, illustrating a preferred method of presentation.

Fig. 2—Preferred chassis layouts, from a service viewpoint. a) Suggested arrangement, with pix tube not mounted on chassis. b) Possible layout on transformerless sets, CRT on chassis.



Changes Servicemen Want *(Continued)*

important tube in the set, and the one most often replaced (according to our investigation) is the low-voltage rectifier. Next in importance (with respect to the number of replacements) is the high-voltage rectifier. Only too often the chassis has to be pulled out of the cabinet, and the high-voltage cage disassembled, merely to replace a tube. In some cases, tubes of other kinds are placed in such positions under the CRT that it is nearly impossible to replace them without taking the picture tube out of the chassis.

Reachable Tubes

We feel it should be a first principle with manufacturers that *all tubes be placed where they can be reached without removing the chassis from the cabinet.* Referring again to fig. 2, note that all tubes in both layouts may be easily replaced without pulling the chassis, and that in certain positions on the chassis that would require "fiddling around" to put the tube in its socket, octal tubes only are recommended. You can't see around a high voltage can or transformer; since an octal tube can be replaced without having to see the socket, it is recommended for use behind such units. It is also recommended that for the smaller 7 and 9-pin tubes, sockets be used having raised centers, so that the tube can be replaced with a minimum of trouble. The midget center acts as a finder, in the same way as the key on the octal tube; all you have to do is turn the tube until it drops into place.

The layouts shown in fig. 2 offer still a third advantage to the service technician. This advantage lies in ease of tracing the signal through the set. Note that sections and stages are in a logical order; there is no skipping around the chassis to find the next stage. It's discouraging to a serviceman when he tests a vertical oscillator, for example, to find that the vertical amplifier he wants to check next is located in some unexpectedly distant area. On some chassis, it would seem that the designer, when called upon to lay out the set, just placed the chassis in one corner of a room, backed off to the other corner, then threw all the parts into the chassis, while a helper soldered them in wherever they fell. Some major manufacturers seem to have as much reasoning behind their placement of parts as just this.

Credit should be given to the engineer whose idea it was to place controls auxiliary to front-panel adjustments behind a removable panel at the front of the set. Adjustment of such controls may be much more simply and accurately made than when the same controls are at the rear of the receiver, and require the aid of a mirror to set.

Controls that the customer is not supposed to handle can be recessed, or made accessible only to an alignment tool or small screwdriver; those meant to be used by the customer can be made with small knurled shafts.

Controls and adjustments such as drive, AGC, horizontal oscillator transformer and so on, should, if not available at the front of the set, be readily accessible from the rear, with no necessity of removing the set from its cabinet to get at them. The same ease of adjustment should, of course, be possible for external CRT units, such as the yoke.

It would be advantageous to both customer and serviceman if the front safety glass could be removed by the withdrawal of two or four screws (placed in such a position that the cabinet would not be scratched while they were being taken out.) The safety glass could then be removed, and the face of the picture tube cleaned, with no necessity of removing the CRT from the cabinet. Such thoughtful little design features are practical and inexpensive, and go a long way toward keeping customers and servicemen satisfied with a product.

So far we have discussed the physical layout and mechanical construction of the television set. Two items of equal importance to the technician are circuitry and service information.

With respect to TV-phono-radio combinations: the manufacturer could save himself and the service technician a lot of headaches arising from the incorporation of intricately-wired switches, and at the same time provide more customer satisfaction if he built the radio and TV units on separate chassis. When the television set comes to the shop for repairs, too often the associated radio and phonograph sections cannot be used because they are on the same chassis as the TV unit, or so interconnected with the latter that special adapter plugs, or even an amplifier, would have to be used to operate them in the absence of the TV section. A similar situation is encountered when the radio is being serviced, and the TV section of the set is left in the cabinet. It should be possible for the radio to be operated when the TV section is being repaired, or vice-versa, without necessitating the use of additional equipment that the serviceman would have to supply; except, perhaps, a small speaker, shorting plug or simple attachment. Our proposal offers these advantages:

1—Twenty or thirty tubes would not have to be lit for the sake of using only three or four (on phono setting); 2—A saving in the cost of a complicated switch for FM, AM, phono and TV would be effected and 3—The customer would not be disposed to bear the serviceman or manufacturer a grudge, on learning that no part of the combo can be used, when one section of it requires shop repair.

The Fuse Fuss

Another situation that demands attention is that respecting fuses. It is discouraging when a technician has to remove a chassis from its cabinet merely to change a fuse. All fuses should either be placed behind a small door, enabling them to be replaced without pulling out the chassis, or else put into a fuseholder in an accessible spot on top of the chassis, or positioned on the rear skirt of the chassis.

While it is undoubtedly advantageous to have a fuse in the high-voltage (boosted B) line, it seems rather strange that the set manu-

(Continued on page 54)

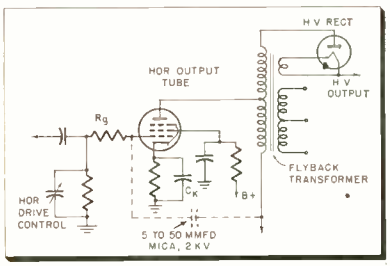
Servicing Sweep Stages

Suggestions from Readers on Troubleshooting Deflection Circuits

• Troubles breed in sweep circuits like mosquitoes do in swamps. Here are some representative problems and remedies sent in by contributors:

Ringing Due to Mismatch

Occasionally, replacement of a flyback transformer or yoke will introduce some degree of mismatch. Ringing is apt to result, manifesting itself as one or more vertical, bright, ribbon-like lines that are substantially affected by the manipulation of the drive adjustment. Methods usually employed to reduce this effect include inserting a resistor of about 100 ohms in series with the grid of the horizontal output tube;



changing the values of this tube's cathode resistor and by-pass capacitor; or substituting different values for the output tube's cathode resistor and by-pass capacitor. A less known, but sometimes very effective method is to connect a capacitor of 5 to 50 MMFD between the grid of the horizontal output tube and the low end of the flyback primary (see sketch). The lowest value capacitor that will correct the trouble should be used. A 2 KV mica unit is preferable to other types.

Increasing Width

If the problem is lack of width, and it is desirable to remedy the trouble in the customer's home, here is a sure-fire method of doing the job without even removing the chassis from the cabinet. Remove the high-voltage cage and connect a 30 MMFD 6 KV capacitor between the plate of the horizontal output tube and ground. (A number of such capacitors may be purchased and kept on hand for use on similar service calls). In the case of most popular tubes used as horizontal amplifiers, the plate is the top-cap connection, making the entire job very simple and fast. Two precautions must be observed: 1—Keep the 30 MMFD 6 KV capacitor away from the glass envelope of the horizontal output tube, to minimize the heating of the capacitor. 2—In cases where chassis is not the electrical ground, connect the capacitor between the plate of the horizontal output tube and B-.

Horizontal Singing

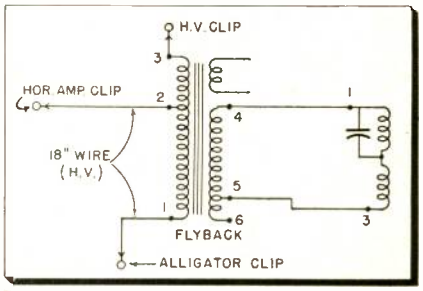
Tightening up the horizontal output transformer failed to stop a loud, bell-like 15,750-cycle tone. Careful checks revealed no obvious source of trouble. Momentarily stopped, because I could find no other possible transducer, my elbow accidentally hit the horizontal output tube (6AV5). Much to my surprise, the singing stopped. Tapping the 6AV5 caused the tone to intermit. Apparently the glass envelope of the tube was resonant to 15,750 cycles.

Damper Change to Increase Width

Increased width may be obtained without resort to special high-voltage, low-capacitance condensers, by connecting a small-capacitance mica condenser—approximately 100 MM FD, 2000 V—between the plate and the cathode of the damper tube. The optimum value of capacitance (which, luckily, is not too critical) can be determined by actual trial. Within narrow limits, the larger the value of capacitance, the greater the width. (Too large a value of capacitance may decrease the high-voltage too greatly, and/or introduce horizontal non-linearity—Ed.)

Flyback Test Unit

In many cases involving loss of high voltage, the culprit turns out to be the flyback transformer. One of the windings may open up, possibly only under load. Ohmmeter measurements may not reveal the trouble, and a flyback substitution is frequently made, when other possible sources of the symptoms present have been eliminated. When the original flyback transformer is non-standard, a substitute may have to be purchased; not infrequently, the substitute is, after much laborious testing, found to be the wrong one. The following test unit will verify whether or not the horizontal output transformer present is faulty, avoiding an unnecessary purchase, as well as other complications. A sketch of the unit is shown here. Any



matching yoke and flyback may be used. The two components may frequently be purchased very cheaply from some dealer who does conversions, and has some spare parts lying around that have been removed from a converted set.

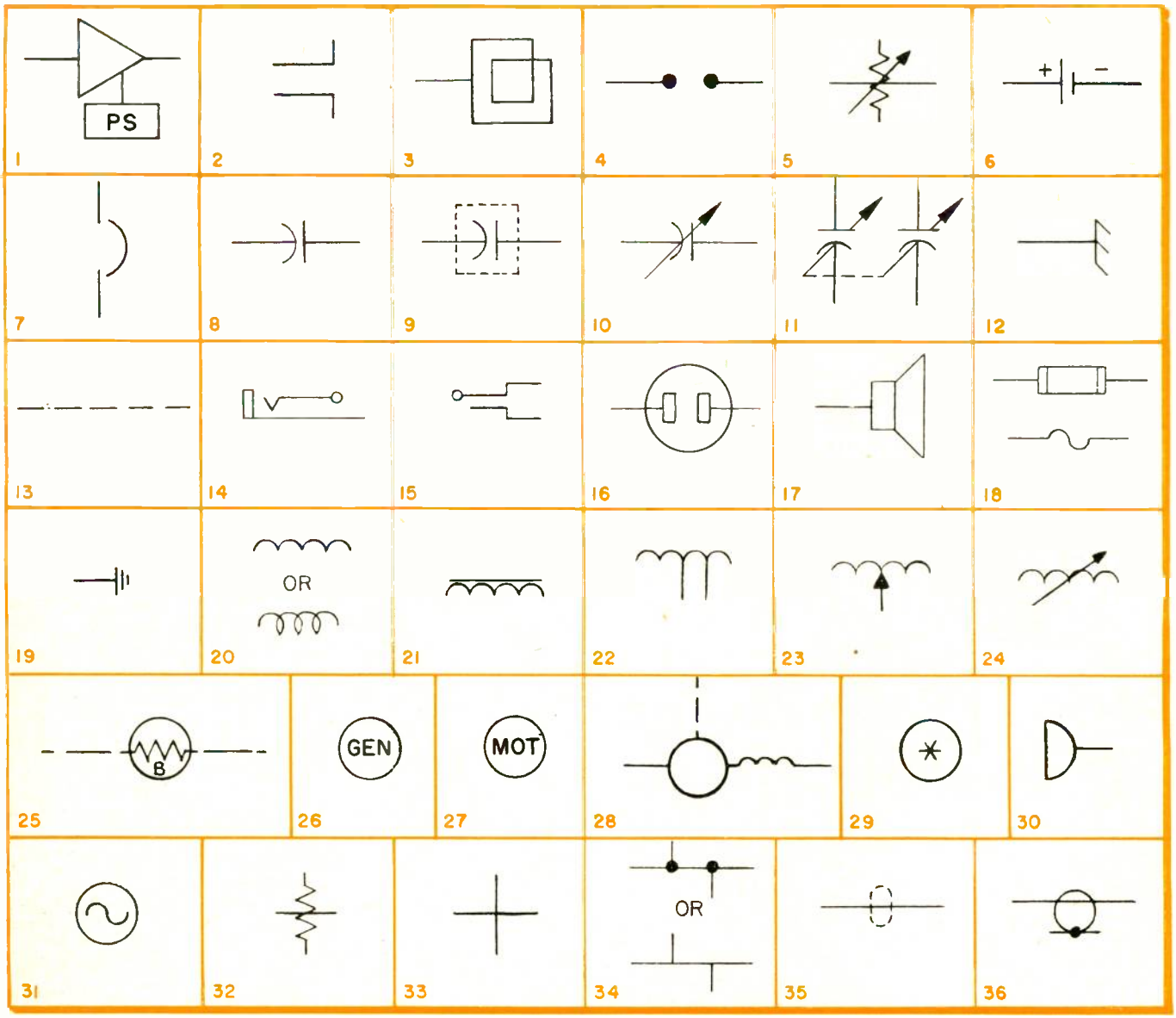
Mount the components inside a fibre box for protection. Connect them as shown in the diagram below. Attach an 18-inch length of insulated wire to terminal 1 of the flyback. Solder an alligator clip to the other end of this wire. Lengthen the horizontal amplifier plate lead to about 18 inches, using high-voltage wire. Tape any bare spots with high-voltage tape. Tack the HV rectifier wire to the top of the fibre case.

To use the unit, remove the horizontal amplifier plate cap, and disconnect the B-plus lead from the flyback in the set. Substitute the horizontal amplifier plate cap from the test unit, and attach the alligator clip from the test unit to the B-plus wire. Turn the set on. If the original flyback was bad, you will now be able to draw an arc from the high-voltage rectifier clip at the top of the fibre box.

The above suggestions were contributed by the following readers: B. O. Riis, Miami, Fla. (Increasing Width; Ringing Due to Mismatch; Damper Changes to Increase Width). F. Mattioli, Racine, Wis. (Horizontal Singing). S. Marsh, New York, N. Y. (Flyback Test Unit).

Latest Circuit Symbols for

Preview of a 700-Unit IRE Standard That Is Coming Soon.



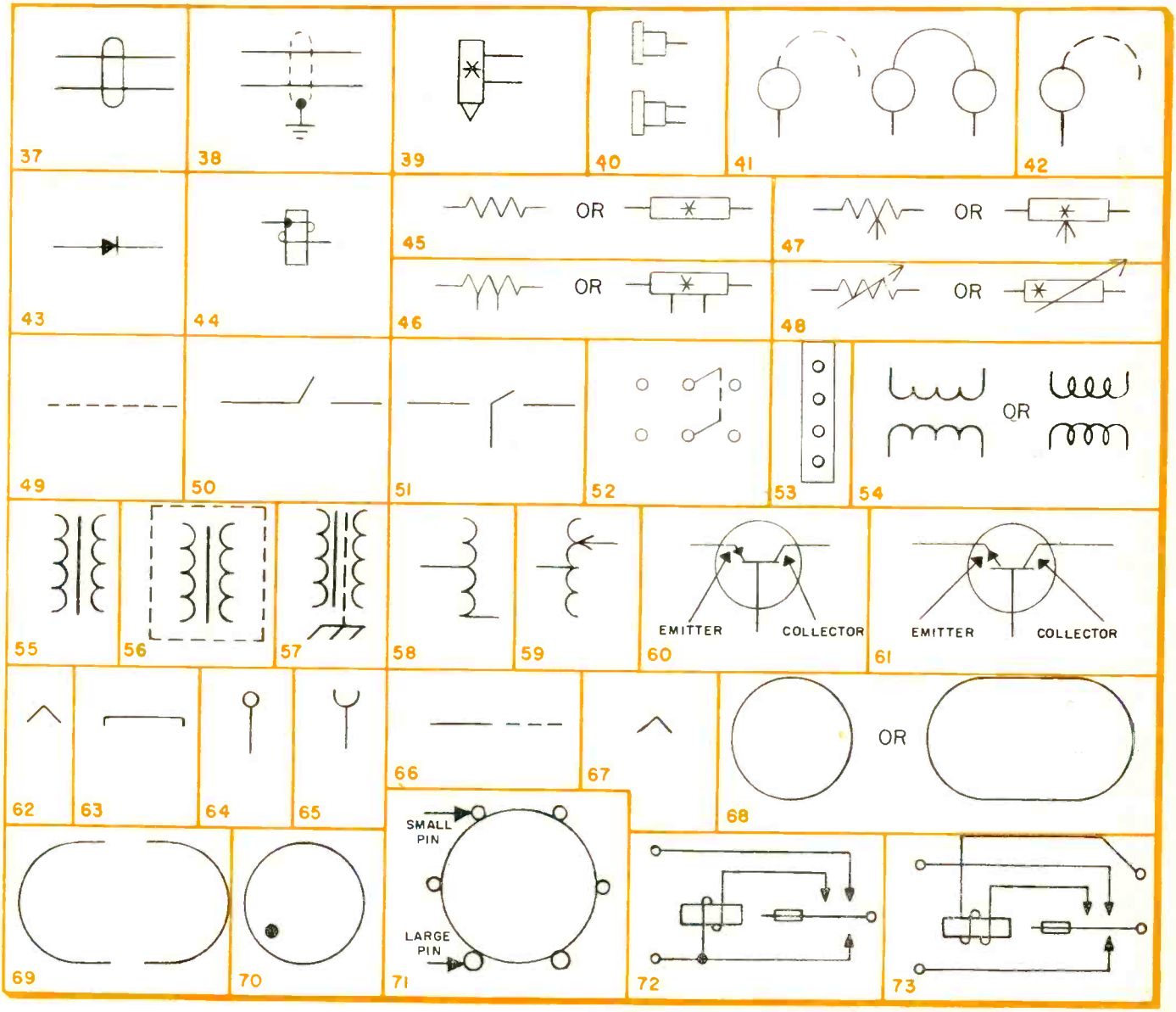
The symbols shown above come from a new IRE standard now undergoing final review. This IRE standard, which will contain over 700 symbols, is expected to be available in the near future. Either "single-line" or "complete" symbols are employed. Single-line symbols are used when it is desired to show the essential equipment components in a system in simplified form; complete symbols are used to show the complete electrical circuit.

Listed at right are the explanations of the symbols. These are numbered to correspond with the numbers on each symbol sketch.

1: Amplifier with associated power supply.
2: Dipole antenna.
3: Loop antenna.
4: Lightning arrester.
5: Attenuator.
6: Battery.
7: Circuit breaker.
8: Capacitor.
9: Shielded capacitor.
10: Variable capacitor.
11: Mechanically-linked variable capacitors.
12: Chassis connection.
13: Mechanical connection (short dashes).
14: 2-conductor jack.
15: 2-conductor plug.
16: Power supply outlet (non-polarized).
17: Loudspeaker. (Where specific identification is required, the following letter combinations may be added: *LS—loudspeaker, **EM—electromagnetic, **PM—permanent magnet).
18: Fusible element.
19: Ground connection.
20: Inductor winding.
21: Magnetic core inductor.
22: Tapped inductor.
23: Adjustable inductor.
24: Continuously-adjustable inductor.
25: Ballast tube.
26: Generator.
27: Motor.
28: AC series motor.
29: Meter or instrument. *Letter is placed within circle to indicate function of instrument.
30: Microphone.
31: Oscillator; general AC source.

Schematic and Block Diagrams

73 Symbols of Interest to Servicemen Are Illustrated Here.



32: Pad.

33: Crossing of paths of unconnected conductors. (Crossing is not necessarily at a 90-degree angle).

34: Junction of connected paths of conductors.

35: Shielded single conductor.

36: Coaxial cable.

37: 2-conductor cable.

38: Shielded 2-conductor cable.

39: Pickup. (*Suitable words or abbreviations may be written within or adjacent to the rectangle).

40: Headset, general.

41: Headset, double.

42: Headset, single.

43: Metallic rectifier; filled arrow-head shows direction of forward (easy) current as indicated by DC ammeter or milliammeter.

44: Relay coil; dot indicates inner end of winding.

45: Resistor.

46: Tapped resistor.

47: Resistor with adjustable contact.

48: Continuously variable resistor.

49: Shield; shielding (short dashes).

50: Single-throw switch.

51: Double-throw switch.

52: 2-pole double-throw switch with terminals.

53: Terminal board (number and arrangement of terminals may vary).

54: Transformer.

55: Magnetic-core transformer.

56: Shielded transformer with magnetic core.

57: Transformer with magnetic core, with shield between windings connected to frame.

58: Autotransformer.

59: Adjustable autotransformer.

60: Transistor: 3-element, N-type; crystal triode.

61: Transistor: 3-element, P-type; crystal triode.

62: Directly-heated tube cathode.

63: Indirectly-heated cathode.

64: Cold cathode.

65: Photoelectric cathode.

66: Grid (also beam-forming electrode).

67: Heater of tube.

68: Tube envelope.

69: Split tube envelope.

70: Gas-filled tube.

71: Tube base terminals.

72: Shunt-drive vibrator.

73: Series-drive vibrator.

A Good Guarantee Policy

Old Problem That Calls for New Solutions

● The subject of guarantees by repairmen has probably been debated since the beginning of time. For thousands of years, customers have been requesting skilled servicemen to make worn or broken-down manufactured products work like new. Always in the back of the customer's mind has been the hope that the repair would now permit the product to perform perfectly for many years, possibly for the lifetime of the user. It is this hope that lies at the root of the guaranty problem.

The electronic service technician faces the problem in a new way. Never before have millions of consumers owned a product as complicated and delicate as a television receiver. And never before has there been a product with so many parts (each one a potential source of many troubles) whose owner has had so little understanding of the interdependence of these parts.

The complexity of the TV set does not mean that the radio-TV servicer should shun the giving of guarantees on his work. Not giving one, especially when it is requested, can appear to be a vote of no confidence by the technician in himself, his work and the materials he uses; when this becomes known in the community, the technician's career may be adversely affected. Giving a guaranty, on the other hand, is a way of saying: "I've done a good job and I'm proud of it. The workmanship is first-class, the materials are the best obtainable. I stand behind these statements because I value your patronage and that of your friends and neighbors. Please understand, though, that nothing lasts forever. I hope you will call me again when trouble occurs." There can be no doubt which policy will produce the best results.

Servicemen's Choice

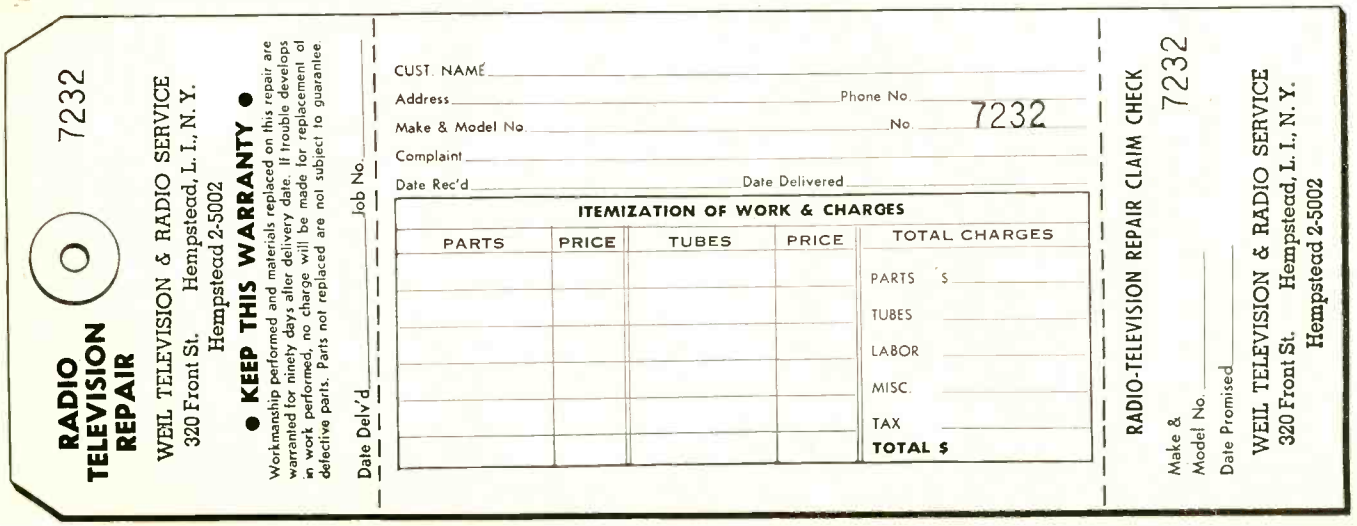
The most popular guarantee—among servicemen, that is—is one which promises to replace, free of charge, any and all materials used in making a repair, for a period of 90 days after the receiver is returned to the customer. This includes the labor and time consumed in making such guarantee-covered replacements.

When a new CR tube is involved in the repair job, the new CR tube alone is guaranteed for one year. The guarantee covers only the work and materials for which the customer is charged. It does NOT include the complete receiver and antenna system, or any booster or converter present, unless the customer has requested specific repairs to one of these items, or a complete overhaul of the receiver and/or its auxiliary units. This type of guarantee is also used for radio receivers, phonographs, tape recorders, or similar electronic products.

The guarantee may be made verbally when the receiver is brought in by the customer or picked up at his home; or it may be given when the repaired set is delivered. The customer should understand clearly what is said so that the guarantee will not become a source of friction.

In a second form of guaranty, a tag or sticker it attached to the repaired equipment. Printed on the tag or sticker are words to this effect: "We guarantee our work for —— days," followed by the date of delivery and the company's name, address and telephone number. Any additional information which may clarify the guarantee can also be printed on this tag. When the receiver is delivered, the serviceman should call the customer's attention to the guaranty and explain its limitations. Any questions regarding the guarantee should be answered courteously and truthfully. A non-technical explanation, pointing out that a large number of parts and circuits are involved in the proper functioning of a receiver, and that only one, or a small number of these units, have been repaired or replaced, should prove helpful.

This three-section tag has a claim check (right) a fill-in section for shop record, with the customer's name on top for easy filing (center) and a tie-on tab for attachment to the repaired chassis (left). The workmanship and materials warranty is printed on this tie-on portion.



Can Pay Off in Dollars

Is Considered from Several Angles

Calling the customer's attention to the guarantee will also help him to remember you and the service which you have rendered; future business is promoted in this way.

A third method used by some servicemen in giving a guarantee is to provide it in the form of a printed statement at the bottom of the bill. Directly above the guarantee notice is an itemized account of the materials used and the services performed. This method is desirable because it leaves little room for doubt in the customer's mind about what the serviceman is guaranteeing. If any dispute arises, it can always be settled quickly by reference to the customer's bill or the serviceman's copy of it.

A fourth method of indicating that you stand back of the work you do lies in the use of printed "television service report" forms. These forms are commercially available. As their name indicates, they are designed to give the customer detailed knowledge of the original condition of his receiver from the antenna to the CR tube and loudspeaker, and indicate the repairs, adjustments and part replacements that have been made. At the bottom of the form is the guarantee notice, as well as a warning note that the guarantee covers only the materials and services for which the customer has paid.

Let Your Ads "Talk"

A final method of telling your customers—and more important, potential customers—of the guarantee you give, is to talk about it in all your advertising. One service shop in a town of about 25,000 people has the line "All our work is guaranteed" at the bottom of each of three advertisements in the local telephone directory. This shop is the only one out of a dozen others running ads in the same directory, that offers such a guarantee.

The owner of the shop attributes more new business directly to this line than to anything else in his advertisements. People phone and say, I am calling you because you guarantee your work. Will you please come up and see what is wrong with my television set?" The man claims that his is the fastest growing radio-television service business in the community.

Some servicemen say, "This guarantee business is over-rated. Of course I back up my work but there's no point in shouting about it. That only leads to trouble. People will bother you to fix all sorts of defects not even distantly related to the repair you've made, if you talk too much about guarantees. You're asking for trouble when you give a guarantee to a customer."

This brings up the question of what to do about call-backs on troubles other than the one which the serviceman has repaired. When the call-back is of the "nuisance" type, a common practice is to spend a few minutes touching up the rear panel controls. Then, an explanation is made to the customer that there is nothing really wrong and that the controls have been adjusted to bring the receiver to the peak of its performance. Finally, a tactful hint is dropped that such service calls are not really covered by the guarantee.

(*Continued on page* 86)

This form has the guarantee spelled out twice at the foot of the sheet, once on the main report section and again on the customer claim check. The Television Service Report form shown here is copyrighted by Oelrich Publications and is available from parts distributors.

TELEVISION SERVICE REPORT No. L 87150

DATE | JOB NO

SET OWNER | MAKE | MODEL | SERIAL NO

ADDRESS | SERVICE CONTRACT | PARTS WARRANTY | EST MATE

CITY | APT | PHONE | BROUGHT IN BY | REPAIRED BY ☐ IN HOME ☐ IN SHOP

ANTENNA ☐ BUILT IN ☐ INSIDE ☐ OUTSIDE | CABINET | DATE PROMISED | VIA ☐ OUR DELIVERY ☐ CUSTOMER PICK UP

CUSTOMER'S COMPLAINT

VERTICAL ☐ OK	HORIZONTAL ☐ OK	SOUND ☐ OK	GENERAL ☐ OK
☐ Hold ☐ Drift ☐ Sweep	☐ Hold ☐ Drift ☐ Sweep	☐ Hum ☐ Noisy ☐ Weak	☐ Blows Fuses ☐ Corona
☐ Linearity ☐ Centering	☐ Linearity ☐ Centering	☐ Distorted ☐ Dead	☐ Channel Switch
☐ Size ☐ Dead	☐ Size ☐ Dead	☐ Intermittent ☐ Fading	☐ Picture Jiggle

MINOR SERVICE CHARGE $

Minor service is performed on each set brought in for repair and is charged to you at the flat fee shown above. The minor service procedure prepares the set for major service. If defects can be remedied by minor service only, no major labor charge will be made. Any materials used in minor service will be charged to you in addition to the minor service charge. Any other services rendered are also additional.

DETAIL OF CHARGES

QUAN	PARTS TUBES MATERIALS	PRICE

PRELIMINARY

- ☐ Check and replace any tubes that are dead, gassy, weak, shorted or noisy
- ☐ Check for overheated parts
- ☐ Check and replace any blown fuses
- ☐ Check ballast tube and replace if open
- ☐ Check interlock cord for intermittent or open
- ☐ Check picture tube for gassy, arcing in gun, or dead
- ☐ Check anode lead for proper contact.
- ☐ Check grid and plate caps for proper contact
- ☐ Check tubes for proper socket
- ☐ Remove dust from cabinet and chassis
- ☐ Clean face of picture tube and cabinet window

MINOR SERVICE

Check and adjust the following controls

HORIZONTAL ☐ Hold ☐ Width ☐ Linearity ☐ Centering ☐ Size ☐ Drive

VERTICAL ☐ Hold ☐ Height ☐ Linearity ☐ Centering

- ☐ Focus ☐ Contrast
- ☐ Background ☐ Brightness
- ☐ Check tuner for proper audio video tracking
- ☐ Check channel switch for positive action
- ☐ Check picture for flicker, distortion, snow, contrast, proper interlace, brightness, linearity, smear.
- ☐ Check sound for hum, noise, weak, fading, intermittent, distortion
- ☐ Check picture tube centering in cabinet
- ☐ 30 minute final quality test (in shop only)

FINAL INSPECTION

TOTAL - PARTS, TUBES, MATERIALS	
TAX	
MINOR SERVICE (see explanation and check list at left)	
MAJOR LABOR CHARGE (see below)	
☐ Pick Up and Delivery ☐ Service Call	
R. F. ALIGNMENT ☐ Picture ☐ Sound	
ANTENNA REPAIR	
TOTAL CHARGE (OUR TERMS CASH ON DELIVERY)	

DETAILS OF MAJOR LABOR ____ hrs. ____ min. X ____ per hr (labor rate) = $

Set owner please note: The above charges cover this specific repair job only. We guarantee all parts installed by us for ninety days after date of repair, but do not guarantee or pretend to guarantee other parts in your set. If new repairs become necessary in the future they are subject to our regular rates.

The above is an accurate statement of minor and major services performed and material used to restore this set to proper working condition.

TELEVISION SERVICE ENGINEER ____ DATE ____

GUARANTEE

All work performed by qualified technicians. All materials used in repair of this set are of first quality and guaranteed for a period of ninety days after date of set repair.

TELEVISION SERVICE REPORT No. L 87150

CUSTOMER'S CLAIM CHECK - NOT RESPONSIBLE FOR SETS LEFT OVER THIRTY DAYS

Servicing FM Receivers

Limiter and Discriminator Checks; Drift; Dynamic Signal Tracing

By Edward W. Kesgen

● The technician who is thoroughly familiar with the servicing of AM receivers should experience little difficulty in servicing FM sets. There are three FM stages that will not be found in AM receivers: the limiter, discriminator and ratio detector.

The limiter stage has no AM counterpart; its function is to strip the noise pulses which may be superimposed on the FM carrier. This is not possible in an AM receiver, as any clipping of the AM carrier would result in severe distortion.

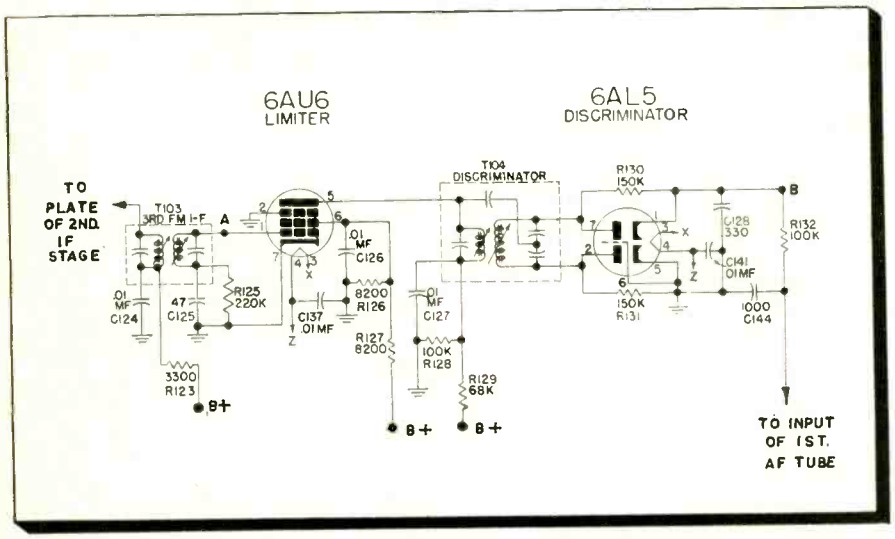


Fig. 1—Typical limiter circuit and discriminator.

The discriminator stage is similar in function to the AM second detector stage; its circuitry, however, is completely dissimilar. The discriminator translates the frequency deviations of the RF carrier back into the original audio signals that produced these deviations. Clipping the carrier peaks will have no effect upon frequency variations; consequently there will be no audio distortion due to limiting.

The ratio detector is a combination limiter and discriminator; it requires no preceding limiter stage, as the discriminator does.

A typical limiter circuit is shown in Fig. 1. Fig. 2 shows limiter input plotted against limiter output. Note that when the knee of the curve (point A of Fig. 2) has been reached, no further output can be realized regardless of the magnitude of the input signal.

To check the limiter stage, connect a suitable signal generator to point A, Fig. 1. Its frequency should be the center IF or resting frequency. Attenuate the generator output to a small value. Connect the negative DC input of the VTVM between the half-load point of the discriminator and ground. Increase the output of the signal generator slowly. If the limiter stage is functioning normally, the second is that the signal generator output is insufficient to saturate the limiter. If the latter possibility is suspected, connect the signal generator to the preceding stage —i.e., the grid of the IF amplifier preceding the limiter.

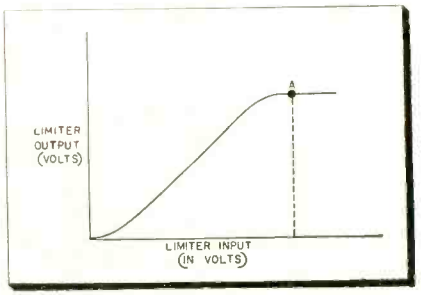


Fig. 2—Characteristic curve showing how output of limiter changes with input.

The voltage required to saturate the limiter is the algebraic sum of the DC voltage measured at point A and the peak value of the positive alternation of the signal generator voltage.

If the limiter still cannot be saturated after moving the signal generator back a stage, routine troubleshooting of the limiter stage is in order. It is worth noting that relatively low voltages should be encountered at the limiter plate and screen grid. This is to facilitate early saturation. Two limiter stages are sometimes used in cascade to improve limiting action.

To check the discriminator, connect the VTVM between point B (Fig. 1) and ground; the signal generator is applied between limiter grid and ground. The needle of the VTVM is set to center zero, if the meter provides for such an adjust-

(*Continued on page 70*)

If saturation does *not* occur, there are two possibilities. The first is malfunctioning of the limiter stage; the VTVM will continue to indicate upscale until the knee of the curve (point A, Fig. 2) has been reached. Saturation will then occur, and the VTVM will register no further increase in voltage.

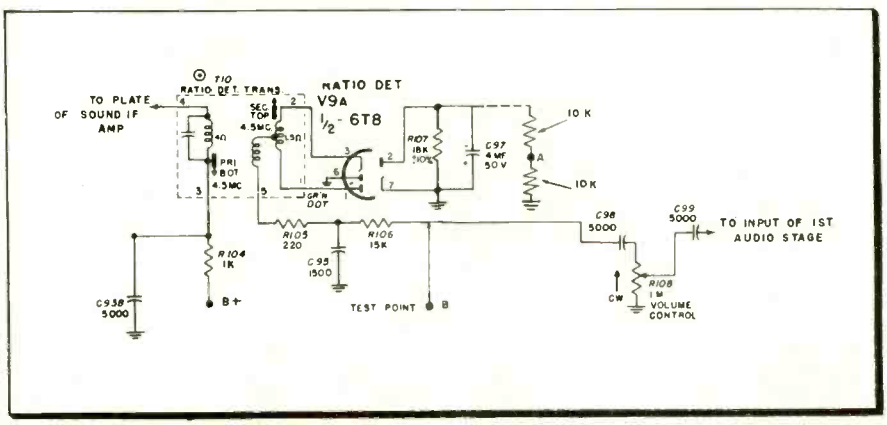


Fig. 3—Representative ratio detector circuit. In checking or aligning this detector, two 10K resistors are first added in parallel with R107, as shown in sketch at right.

Servicing Interlace Problems

(*Continued from page 27*)

these networks is generally the same, although the values of the individual components often vary. In most modern receivers, one printed circuit is used for the six integrator components. After the vertical sync pulses have been separated, they are applied to the vertical oscillator.

Let us now consider some service problems associated with interlace. Many receiver sections can affect the vertical synchronizing pulse and thus impair interlace. To begin with, an overload condition anywhere in the RF or IF system can cause sync clipping or compression (see fig. 5). The overload condition can be caused by AGC failure, bad tubes or defective components. Instead of getting sync pulses of normal amplitude we would get inadequate or no sync information under such conditions.

When the overload condition is appreciable, symptoms more severe than overlapping or pairing of scanning lines will be noted. If a *slight* overload is present, however, only the impaired interlace (readily observed by inspecting the lines of the picture) may be evident. The impairment of interlace may be steady or intermittent. If the overloading reduces the sync pulses to an amplitude incapable of providing proper sync separator action, the resultant entrance of video signals into the integrator will tend to impair interlace at irregular intervals.

Overloading in the video amplifier may similarly be the source of poor interlace. Depending on the picture phase of the video amplifier output signal, overloading may cause either sync or video compression. If sync compression occurs, a loss of synchronizating information will result. When the overloading and sync compression are slight, interlace alone will be affected.

In the sync separator, proper separation of sync and video information must take place. If any defect exists in the sync separator, one of two undesired effects may be produced: first, the sync separator may provide an insufficiently large sync pulse output (a weak tube could be responsible for such a condition); second, improper separation may cause residual video information to interfere with synchronization. (Improper bias, excessive voltages and similar conditions may be the cause of improper separation).

In either case, interlace will be affected. When the separator output is too small, the setting of the vertical hold control is apt to become critical, and impairment of interlace due to a misadjustment of this control becomes more likely. When video signals are not removed from the horizontal sync pulses, the integrator charging is not the same for both fields, and interlace is thus upset.

Excessive noise will cause improper sync separation, since the grid of the separator is charged up in varying degrees by the noise, and the sync pulses will, in consequence, not be lined up as they should. This trouble is known as "holes" (see fig. 5). The horizontal AFC circuit present tends to prevent noise from affecting horizontal synchronization; interlace is, however, apt to be impaired if noise-made "holes" occur during vertical sync pulse time.

The integrating network is important as far as interlace is concerned, since any defect in that circuit will tend to cause some of the horizontal information to remain associated with the vertical sync pulse.

The major portion of the TV set, thus, can affect the proper synchronization of the vertical section.

The question may be asked: Can hum cause a loss of interlace? Generally, no. Hum occurs at a 60-cycle rate when its source is in the filament circuit, and at a 120-cycle rate when it is caused by power supply trouble. In both cases, the effect will be the same for both fields, and interlace will thus not be impaired. Very severe hum may cause vertical synchronization of the picture *to the hum*, instead of the transmtted sync pulse. If the transmitter's power source is the same as that of the receiver, a steady, properly-interlaced picture in which the vertical blanking bar is visible, will be seen on the screen in such a case.

For purposes of servicing, one important distinction among interlace problems should be noted. In the case of *steady* loss of interlace, or pairing of lines, the cause must be a signal that recurs at exactly the same intervals. The only signal that can cause such a steady interlace loss is one originating in the horizontal system. As noted previously, the two fields differ by half a line at their starting point. If any horizontal information gets into the vertical sync, the two fields will have a tendency to be displaced, because the residual charge present in the integrating network during one field, is no longer the same as it is for the other.

The culprit may be the horizontal synchronizing signal; stray feedback from anywhere in the horizontal section may also be the source of the trouble. This kind of feedback is often introduced by improper replacement of major components such as the flyback transformer, yoke, or other units. Improper conversion of sets to accommodate larger picture tubes can also introduce stray horizontal pulses into the vertical system.

The important points to watch are: the plate of the horizontal output tube (where a positive pulse of approximately 6,000 V is present); the plate of the high-voltage rectifier (a positive pulse of app. 16,000 V exists here); and the hot lead of the yoke (pulses about 3,000 volts positive or negative, depending on the set, may be found here.) These circuit points, and the leads issuing from them, must be kept away from the vertical section, preferably by shielding or by running components and wiring close to chassis.

A condition where the vertical system jiggles in and out of interlace is due to some cause other than horizontal signals getting into the vertical circuits. Generally, video signals are the offenders; or the vertical section itself may be at fault. If the video is not properly separated from the sync information, some video signals will charge the integrator.

The center of a video line at which one field ends, will have a different content than the finish of a video line that appears at the end of second field. The residual charges built up in the integrator during

(*Continued on page 70*)

The ABC of Transistors

What the Technician Should Know About These New Devices.

• The idea of controlling the flow of electrons in a particle of solid material is almost as old as the radio art itself. In the early part of this century the galena crystal detector was the most popular means of detecting radio signals. This crystal detector consisted of a small chunk of galena (a lead ore), mounted in a lead cup with one irregular surface exposed. A "cat-whisker" wire was used to probe the exposed galena surface for the most sensitive spot, the one which produced greatest audio response. The terminals of this crystal detector were the lead cup and the cat-whisker wire. The modern equivalent of this arrangement is the germanium crystal diode detector unit; the 1N34 is a well-known example.

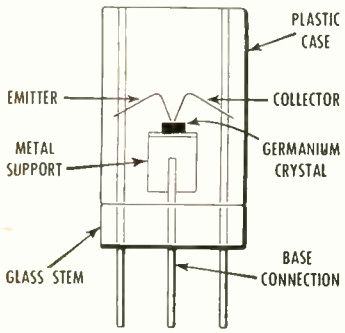


Fig. 1—Enlarged point-contact transistor. The base connection is made to a large-surface crystal area. The emitter and collector wires touch the other large-surface area.

With the development of vacuum tubes in the second decade of this century, researchers turned their attention to these new electronic tools. New circuits, particularly in radar and other high-frequency applications, have pointed up the shortcomings of vacuum tubes in modern electronic equipment. Experimenters, now equipped with a good knowledge of electron behavior in vacuums, have turned again to solid materials to help them to solve problems in modern electronic circuit design. One of the results of current research into the properties of solids as semi-conductors is the transistor.

The first transistor (developed by Bell Telephone Laboratories in 1948) had two cat-whiskers touching the crystal instead of the old single-wire probe. By the addition of a second cat-whisker wire and the use of a different material (germanium), the old crystal detector was made into an amplifier.

Germanium compounds have lent themselves, with relative ease, to modern manufacturing processes which can be controlled to produce desired electronic properties. The structure of the germanium crystal can be altered by these processes so that a wafer of the crystal may become an *N-type* or *P-type* unit. The N-type germanium has an atomic structure which produces a surplus of electrons ready to form a current; it is called N-type because it resembles the negative pole of a battery—the pole with an electron surplus. The P-type germanium has an atomic structure which leaves vacancies or *holes* for electrons. These holes act like positive charges in that they attract electrons from adjacent atoms; thus, there is the effect of the holes moving through the germanium during current flow. The holes move in an opposite direction to that of the electrons.

All transistors may be said to fall into one of two groups: point-contact transistors and junction transistors. Within each of these groups there are different types with different operational characteristics. The point-contact transistor will be considered first.

A transistor of the point-contact group contains a germanium pellet, usually of N-type material, with three electrical contacts made to it. The largest contact is called the base contact; this contact touches the pellet along its large surface (see Fig. 1). The other two contacts are made to the surface opposite the base contact area; they are composed of cat-whisker wires whose points just touch the germanium and are spaced about 1/500-in. apart. One of these wires is called the *emitter*, the other is called the *collector*. The three contacts are firmly positioned and the unit is sealed in a plastic.

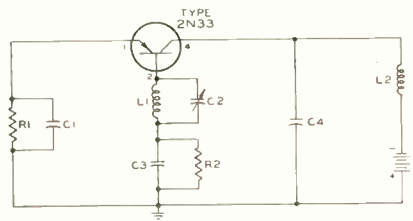


Fig. 3—50 MC oscillator circuit using a point-contact transistor.

In the most elementary point-contact transistor amplifier circuit, the emitter and base connections are made to a DC source in series with the input signal (Fig. 2). The DC minus terminal is connected to the transistor base terminal; the DC plus goes through the signal source, to the emitter terminal. The emitter appears to produce holes in the germanium at the wire contact point. These holes act like positive charges and drift across the small distance to the collector, attracted by the negative voltage (electron

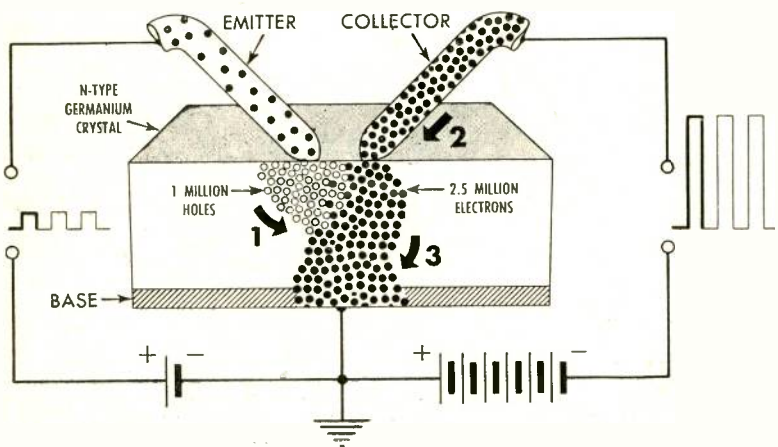


Fig. 2—Enlarged point-contact transistor: If a signal injects 1 million holes at emitter, they will be attracted towards collector (1). Near collector, holes reduce barrier to electron flow (2) allowing some 2.5 million electrons to pass into crystal. Of these, 1 million neutralize the holes ;the others flow to base (3).

for TV and Radio

Their Incorporation into Compact Chassis Is Not Far Away.

surplus) on the collector. The collector and base are connected to a second DC source in series with the output circuit. The plus terminal of this second DC voltage source is connected to the transistor base connection; the DC minus goes through the output circuit to the collector. The hole drift to the collector lowers the resistance of the germanium

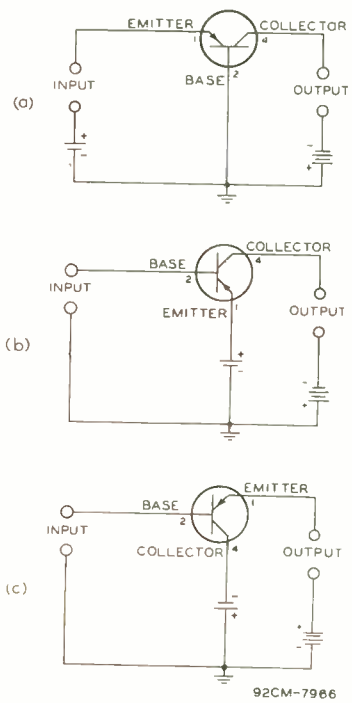


Fig. 4—Three circuits showing how point-contact or junction transistors may be connected for use as amplifiers.

around the collector contact point, and a heavy electron flow in the collector circuit results (see Fig. 2).

The collector circuit corresponds to the *output*, and the emitter circuit to the *input*, of a conventional vacuum-tube amplifier. The current flow in the collector circuit is greater than the flow in the emitter circuit; the difference between the currents represents the gain of the transistor amplifier. Point-contact transistors are able to produce from 2 to 2.5 times the emitter circuit current in the collector circuit. Power gain, however, is greater than this because the collector circuit resistance is much higher than the resistance of the emitter circuit, and the work done in this circuit (I^2R) is correspondingly higher. In practice, point-contact resistors can boost the power of a signal about 20 DB, which represents a signal power gain of 100.

Because some of the collector circuit current from the base connection flows to the emitter wire, current feedback exists in the transistor. Point-contact transistors, therefore, are used as oscillators; oscillator frequencies above 300 MC have already been attained, and this ceiling is being pushed higher in laboratory experiments. The schematic of a transistor oscillator circuit for operation in the 50 MC region is shown in Fig. 3.

In the conventional vacuum-tube amplifier, the cathode is at ground signal potential or "cold," the control grid is at input signal potential or "warm," and the plate is the "hot" electrode at which the amplified output signal appears. These relative designations ("warm," "hot" and "cold") are different in a grounded-grid amplifier and again in a cathode follower circuit. All three circuit arrangements are possible with transistors (see Fig. 4).

The phase relationships between input and output signals which exist in grounded-cathode, grounded-grid and grounded-plate vacuum-tube stages have their counterparts in transistor circuits. The following phase relationships between input and output signals will be present in such circuits: Transistor base connection grounded—signals are in phase; Transistor emitter grounded—signals are 180 degrees out of phase; Transistor collector grounded—signals are in phase.

Point-contact transistors have their main applications in high-frequency circuits such as FM and television RF amplifiers, oscillators and IF amplifiers; they are particularly useful for high-speed switching and pulse circuits in electronic computers.

Junction transistors are made by constructing a tiny sandwich of three layers of germanium. The sandwich is arranged with a section of N-type, a section of P-type and a section of N-type germanium; this is called an *N-P-N junction transistor*. The *P-N-P transistor* has its sandwich made of sections of P-type enclosing the single N-type germanium layer. For both N-P-N and P-N-P transistors, three connecting wires are brought out, one from each section. The complete germanium sandwich with connecting wires is sealed in an opaque plastic casing. This unit is then enclosed in a slightly larger plastic container with the leads protruding from the base. (*Please turn page*)

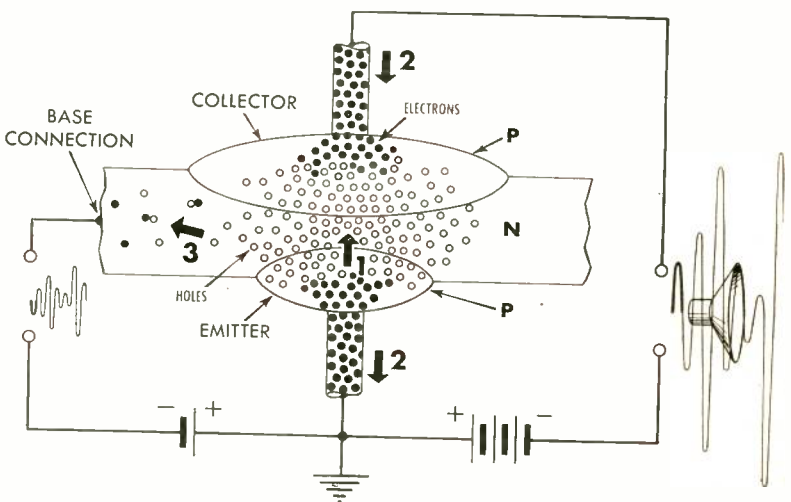


Fig. 5—Enlarged junction transistor. Small signal from phonograph, amplified to activate loudspeaker is assumed. If the signal changes by 1 million electrons, there will be a voltage difference between emitter and base which starts 50 million holes flowing out of emitter (1). All but 1 million holes get to collector, inducing 49 million electrons to flow and carry current in collector circuit (2). The remaining holes flow to the base completing base-emitter circuit (3). (This and other sketches, courtesy RCA.)

The circuit arrangements for both types of junction transistors are the same as for the point-contact type. Electron motion within the junction types is different, however (see Fig. 5). In P-N-P units, electron holes are produced by the emitter. These holes flow through the center crystal layer to the collector contact which is the minus terminal of a DC source voltage. The signal voltage applied to the emitter-base circuit governs the number of electron holes which move from emitter to collector. The number of holes flowing at any instant determines the current conductivity of the collector circuit. In normal operation the collector (output) circuit current is many times that of the emitter (input) circuit.

In N-P-N transistors, the action is similar to that of the P-N-P type except that: 1—the battery polarities to the emitter and collector are reversed; 2—the action of holes and electrons within the germanium is reversed, and 3—the direction of current flow in the emitter and collector circuits is reversed. This opposite but similar electron action of P-N-P and N-P-N transistors makes it possible to develop complementary circuits using pairs of P-N-P and N-P-N units.

Two-Stage Audio Amplifier

A recent development utilizing these complementary properties has four junction transistors, with no other components, working as a two-stage audio amplifier feeding a loudspeaker.

Junction transistors can boost output signal power up to 10,000 times the power of the input signal, a gain of 40 DB. Junction transistors make more stable amplifiers than do the point-contact variety and introduce much less noise. They are most effective as low and medium-frequency amplifiers and require much less operating power than point-contact types. Junction transistors will probably be most useful in the low-frequency circuits of radio and television receivers, in all types of audio amplifiers and hearing aids and wherever good amplification of the low-to-medium frequency spectrum is desired.

Transistors are not now directly interchangeable with vacuum tubes and there is little likelihood that they will be for some time. The principal reasons for this are that transistors are low-impedance current amplification devices; their characteristic curves are different (more linear) from those which are associated with tubes; and their input and output impedances and gains vary at different operating frequencies. All of these facts mean that circuits must be redesigned to take advantage of the benefits offered by transistor use. These benefits are:

1. They have no filaments.
2. They consume very little operating power.
3. Heat output is very low because of absence of filaments and low operating power consumption.
4. The life expectancy, in normal operation, will be three to four times longer than for tubes.
5. Physical size is very much less than that of most tubes.
6. No warm-up period is required. Operation starts as soon as power is applied.
7. Rugged construction. Transistors can withstand vibration and shock well.
8. Improved circuit designs are possible because of N-type and P-type germanium characteristics.
9. Simplified circuit design is possible, since fewer components are required when transistors are used, and the latter are readily adapted to printed-circuit arrangements.

Transistor Drawbacks

The disadvantages of transistors are few. The principal ones are:

1. High temperatures will permanently alter a transistor's characteristics.
2. Moisture and dampness will produce similar characteristic changes. This obstacle has been overcome by hermetic sealing of the outer casing.

New Circuits

For most electronic technicians, the commercial use of transistors will mean that new circuits will have to be mastered. There will probably be no sudden revolution, with transistors suddenly displacing all tubes. The indications are rather, that chassis will appear with one or two germanium transistors at first, the number increasing over the next few years. Most important will be the new applications for electronic equipment made possible by new circuits developed around transistors. Small personal radios, TV receivers and two-way communication sets are a few of the products which may appear in the immediate future, as a result of chassis miniaturization using transistors and printed circuits. There is every prospect that vast new fields may be opened up, as happened when vacuum tubes first made their appearance. For the alert technician, this is going to mean new challenges, opportunities and sources of profit.

Famous Last Words

A TV serviceman who had just lugged a large-screen TV set down five flights of stairs was called back from the window when he reached the street. Unable to lay down the set in any safe place, he very reluctantly shouldered it and made his weary way upward again. When he finally got to the top, the woman of the house eagerly opened her door and said:

"Isn't it true you won't fix our set if Jimmy, here, doesn't finish his oatmeal?"

TELEVISION INTERFERENCE AIDS

TVI Causes, Effects and 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: Re-alignment 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 absorbtion filter tuned to the interfering signal. If these measures 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 lead-in 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 and/or lead-in.

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

6. Direct I. F. pickup.

Solution 1: Shield section responsible. (Shielding must be complete).

Solution 2: Realign I.F. (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 I.F.)

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 I. F. traps, I. F. 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 cascode type tuners, may cause cross-hatch pattern on picture tube.

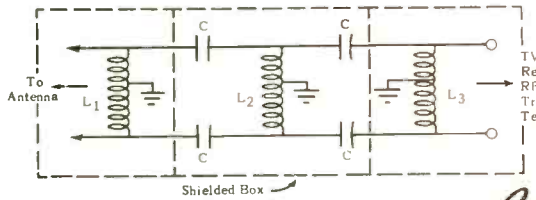
Solution: Locate defective component and replace.

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 k resistor in series with the audio grid lead and 500 mmfd condenser *direct from grid to cathode*. It may be necessary to increase the value of the inserted by-pass condenser to as much as 1000 mmf 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).

A

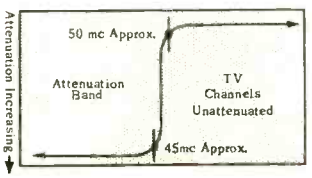
HIGH PASS FILTER FOR 300 OHM TELEVISION RECEIVER INPUT



C = 15 mmfd Ceramic

L_1, L_3 = 1.2 mh (21 Turns No. 24 Enamel Wire Close Wound on ¼" Diameter Polystyrene Rod)

L_2 = 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 absolute minimum of lead, preferably to set ground. Where receiver has AC/DC chassis, ground through 0.001 mfd, 600 Volt mica condenser.

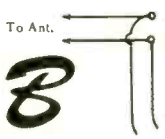
2. Place filter as close as possible to r.f. input transformer.

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 LEAD IN

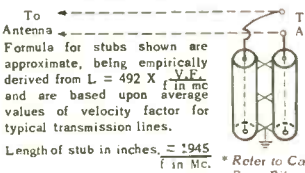


$$\text{Length of stub in inches} = \frac{2450}{f \text{ in mc}}$$

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 $L = 492 \times \frac{V.F.}{f \text{ in mc}}$ and are based upon average values of velocity factor for typical transmission lines.

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

This type of stub has several advantages over 300 ohm tape:

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

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

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

Table of lengths of 1/4 wave open, 300 ohm line covering the FM band:

Frequency in Mcs	L in inches
88	27.8"
98	25.8"
108	22.7"

C

When a television receiver is in a strong field of r.f. close to the intermediate frequency of the receiver, *direct* pickup in one or more of the I.f. stages is likely. For example, a signal on 21.9 Mc would probably be picked up in the i.f. of a television receiver using a 21.9 audio i.f. channel. If a high pass filter is ineffective in eliminating the interference the i.f. should be re-aligned to a frequency different from the interfering signal by a few hundred Kc (As an example, in this case, to 22.2 Mc).

D

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

Channel	Channel Frequency	Pix Carrier	Sound Carrier	Recvr. rf Oscillator (21.9 mc I. F.) Low	Recvr. rf Oscillator (21.9 mc I. F.) High	Recvr. 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

Servicemen's Chart Provided by Washington (D. C.) TVI Committee

Cooperating with RTMA and the Electric Institute of Washington, D. C., the local Television Interference Committee, 129 Joliet St., Washington, has distributed the above chart among service shops in the Capital area, for posting on walls or work benches, to explain causes and cures for TV interference troubles. An accompanying bulletin points out that "the average television receiver owner is not trained either to diagnose or to understand his personal interference situation. He requires honest and intelligent advice from his service technician."

The Washington TVI Committee is an organization which has volunteered to act as a clearing house for interference complaints involving radio amateurs. The Committee maintains close liaison with industry, communication services, the FCC and others. This committee set-up gives both the amateur and the receiver-owner a third party group of experts who will investigate complaints promptly.

In addition to the interference sources listed in the left-hand column above, the chart also includes "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 coaxial 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."

New Audio Gear

Amplifiers, Mikes, Speakers, Hi-Fi Equipment

Beam AMPLIFIER

The Q.C. II control unit and 15 watt amplifier delivers full-range response and low background noise without distortion, according to the manufacturer. The combined control unit and preamplifier provides push-button switching for three separate inputs and up to eight preselected equalizing combinations for phonograph reproduction. Independent linear treble and bass rise and fall controls are provided; also present is an audio harmonic filter continuously variable from level to 50 DB per octave. The amplifier has a special fourteen-section output

transformer to minimize phase-shift, and the need for selected or matched tubes. Power output is 15 watts from 20 to 20,000 CPS within 0.2 DB; and 10 to 50,000 CPS within 0.5 DB. Distortion at 12 watts output, total 3rd harmonic and higher order, is less than 0.1% at 700 CPS; higher order alone is less than 0.03% at 700 CPS. Output impedance, 15 and 7 ohms. Net price for control unit and amplifier is $230; for control unit only, $120; for amplifier only, $130. Beam Instruments Corp., 350 Fifth Ave., New York 1, N.Y.—TECHNICIAN.

Masco HI-FI AMPLIFIER

Masco's high fidelity amplifier, the Custom Ten, has an eight-position equalization switch, bass and treble-compensated volume control and separate bass and treble tone controls. The frequency response is 20 to 20,000 cycles plus or minus ½ DB; ten watts of power output at less than 1% harmonic distortion is available. Inputs are provided for radio, TV or tape recorder output and xtal or magnetic phono pickup. The recorder output jack permits simultaneous recording and listening. A socket and plug are provided for remote pilot light installation; a kit of control extension shafts is also included. Mark Simpson Mfg. Co., 32-28 Forty-Ninth St., Long Island City 3, N. Y.—TECHNICIAN.

Stephens WIRELESS MICROPHONE

A wireless microphone weighing less than four ounces, and no larger than a pack of cigarettes, is being produced by the Stephens Manufacturing Corp. Actually a miniature

FM transmitting unit, the microphone broadcasts to a receiver and accompanying power supply containing a speaker at distances up to 300 ft. A battery pack powers the transmitter. Stephens Mfg. Corp., 8538 Warner Dr., Culver City, Calif.—TECHNICIAN.

Oxford SPEAKER

This high-fidelity 15-in. speaker, model HF15LN, has the following specifications and characteristics: frequency range, 50 to 10,000 CPS; magnet, 14-oz. Alnico V; power rating, 25 watts; voice coil impedance, 8 ohms. The suggested list price is $42.50. Oxford Electric Corp., 3911 So. Michigan Ave., Chicago 15, Ill.—TECHNICIAN.

RC HOME MUSIC SYSTEM

A home music system, the Craftsmen CA1, includes the Craftsmen C10 FM-AM tuner, C400 high-fidelity 10-watt amplifier, and a three-speed automatic record changer, complete with a GE "Triple play" phono pickup cartridge. A 12-inch speaker system with a range of 40 to 16,000 CPS in a recommended enclosure, is also provided. The speaker system includes a wide-angle dispersion, horn-loaded tweeter which

is co-axially mounted in a 12-inch woofer for single point sound distribution. All the units are provided in a single carton, complete with a changer mounting board, all necessary connecting cables, mounting hardware, detailed connecting instructions, and drawings of typical cabinets, including a horn-loaded corner speaker cabinet. Price is $275 net. The Radio Craftsmen, Inc., 4401 N. Ravenswood Ave., Chicago 40, Ill.—TECHNICIAN.

Shure CRYSTAL MICROPHONE

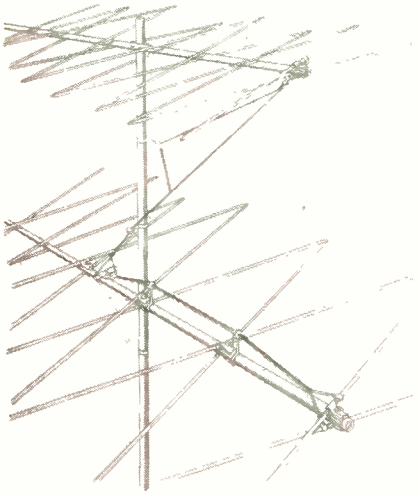
The all-purpose model 777 "Slim-X" crystal microphone has been designed to provide good-quality voice and music reproduction. It can be used on a desk or floor stand, mounted on a "swivel adapter," in the hand, or around the neck, with a lavalier. It has a frequency response of 60 to 10,000 CPS, and uses a 7ft. single-conductor cable, disconnect type. Model 777's list price is $18.95 and model 777S (with switch) lists at $20.95. Shure Brothers, Inc., 224 W. Huron St., Chicago 10, Ill.—TECHNICIAN.

Latest in Antennas

New VHF, VHF-UHF and UHF Models Recently Made Available

Trio RE-ENTRANT NETWORK

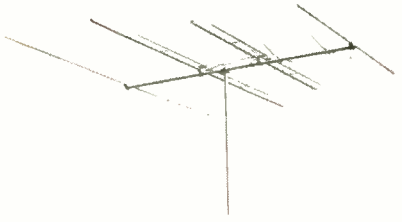
An improvement which boosts the performance of Trio Zig-Zag TV antennas on every channel has been announced by the antenna manufacturer. The Trio re-entrant network is a method of broadening the impedance characteristics of a multi-channel antenna to the point where that impedance remains practically



constant over all the channels covered. The network consists of two paralleled quarter-wave transformer sections coupled to each antenna. The re-entrant unit shows no measurable loss when stacking for all-channel single feed-line operation, and has no insertion loss, according to the maker. Trio Manufacturing Co., Griggsville, Ill.—TECHNICIAN.

W & W VHF ANTENNA

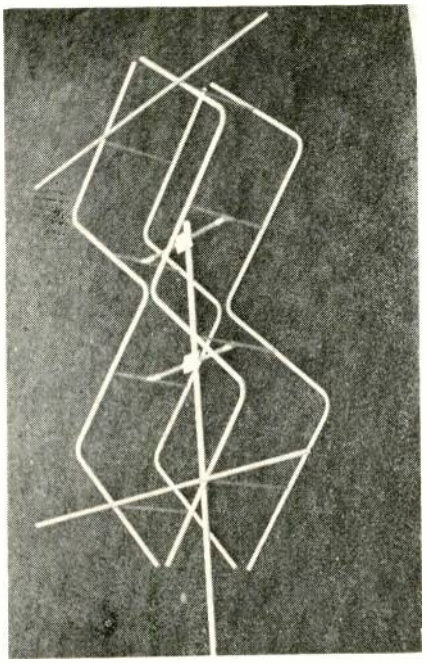
The Model CP-1 Clipper is a high-gain fringe area unit for coverage of all VHF channels. It offers uniform gain, 300-ohm impedance match, one



major foreward lobe and a narrow beam, according to the manufacturer. Wells & Winegard Television Accessory Mfg. Co., Burlington, Iowa. —TECHNICIAN.

Best TV ANTENNAS

Two new designs of broadband TV antennas, one for VHF and the other for UHF-VHF reception, having good directivity and a gain of up to 15 DB over a standard reference dipole, according to the manufacturer. The VHF design, Best Double-Diamond Model 213, covers the range from channels 2 through 13. The three UHF-VHF models are designed to provide a gain of from



10 to 13 DB over the UHF range covered by each model, as well as an average gain of about 6 DB on the VHF band. Best Double-Diamond Model 1440 covers channels 14 through 40. Model 3570 provides high-gain reception on channels 35 through 70, and model 6083 serves the upper UHF spectrum—channels 60 to 83. Best Electronics Corp., 2254 Colby Ave., Los Angeles 64, Calif.—TECHNICIAN.

RMS UHF YAGIS

Five multi-channel models have been added to the RMS Skytrak six-element UHF yagi antenna line. Designated the "A" series, the new units are peaked at the center of their band-widths. Eleven models cover the entire UHF band. Radio Merchandise Sales, Inc., 2016 Bronxdale Ave., New York 60, N. Y.—TECHNICIAN.

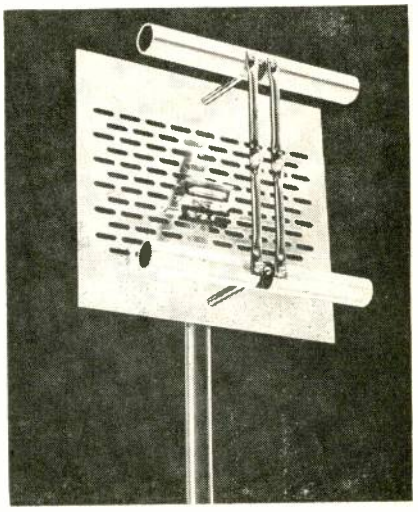
Snyder UHF-VHF Antenna

Named the "3D," this Snyder TV antenna covers all channels from 2 to 83 and provides adjustments in cases of weaker-than-normal indoor

signals. Antenna features a 6-position "beam selector" which uses a criss-cross phasing element in a variety of circuit arrangements. Snyder Mfg. Co., 22nd & Ontario Sts., Philadelphia 40, Pa.—TECHNICIAN.

General UHF ANTENNA

General's model 500-U antenna is designed for TV reception over the entire UHF band. It has low vertical pick-up, a low standing-wave ratio



and 300-ohm terminal impedance, according to the manufacturer. All-aluminum construction. General Antenna Mfg. Co. 1652 Rockwell Ave. Cleveland 14, Ohio.—TECHNICIAN.

Timely Test Equipment

A Variety of Accessories for Bench and Truck

Philco Features "Complete Service Laboratory"

Combining new circuits, accuracy and versatility with low cost, the advanced-design Philco line of test equipment offers the service technician a great variety of units that, when combined, can form a complete service laboratory to meet every VHF and UHF servicing requirement. Among the new Philco test equipments are completely re-designed versions of standard Philco test units, featuring highly-expanded levels of efficiency. Entirely new models, among them the model G-8000 VHF to UHF signal generator adapter, and model G-8002 auto-level sweep generator, lend a new approach to servicing, comprising a complete and available array of test equipments essential to fast and accurate servicing. Philco engineers are continuing to design even newer and more reliable models to cover recent developments in the field of appliance servicing. Philco Corp., Philadelphia, Pa.—TECHNICIAN.

Mallory VIBRATOR TESTER

The Mallory 12VT1D vibrator tester will test directly, without adaptors, either 6 or 12 volt vibrators of the most popular types, and all auto radio vibrators in use since 1940. In conjunction with a filtered DC power supply, the 12VT1D vibrator tester will test accurately either self-rectifying or tube-recti-

fied vibrators of any frequency from 100 to 250 cycles. DC input voltage may be adjusted accurately for both "start" and "condition" tests by use of a pushbutton switch. After passing the "start" test, the condition of the vibrator may be determined by reading on the "good-bad" scale. P. R. Mallory & Co., 3029 E. Washington St., Indianapolis 6, Ind.—TECHNICIAN.

Schauer BATTERY ELIMINATORS

The Electrox model AR 5612 is a fully adjustable DC power supply which provides the technician with a filtered power source having the capacity to operate any type and size automobile radio. DC output is adjustable by means of a silver contact tap switch. A toggle switch is used for changing from 6-volt to 12-volt operation. The model AR

5612 is supplied with 0-20 volt and 0-20 ampere meters. The model AR 4612 Electrox is a non-adjustable model, without meters. A high-low toggle switch changes the unit from 6-volt to 12-volt operation. Both the above units are equipped with bridge-type, full-wave selenium rectifiers and transformers of the two-winding type. Schauer Manufacturing Corp., 4500 Alpine Ave., Cincinnati 36, Ohio.—TECHNICIAN

Lee CONDENSER TESTER

Condenser tester and leakage indicator, model CT-1, features a built-in power supply providing both AC and DC test voltages. Unit contains a neon lamp leakage indicator. The tester permits direct checking of condensers for leakage with DC voltage applied and indicates intermittently-open condensers with AC applied. It is also useful for high-resistance continuity testing of electrical and electronic circuits and parts. Indicates leakage, resistance or insulation breakdown to over 200 megohms. Operates on 110-125 AC. Dealer net: $9.95. Lee Electronic Labs is also manufacturing a miniature electronic power supply, Model PS-1, for use with their Model E-C or E-A circuit analyzers. This new unit provides both AC and DC test

voltages. Will withstand direct shorts. All output terminals may be grounded without damage. Lee Electronic Labs., Inc., 233 Dudley St., Boston 19, Mass.—TECHNICIAN.

Peco SOCKET ADAPTER

The Peco TVS-1 duo-decal test-socket adapter is designed to permit testing while the set is in operation on circuits associated with the television picture tube. It is inserted be-

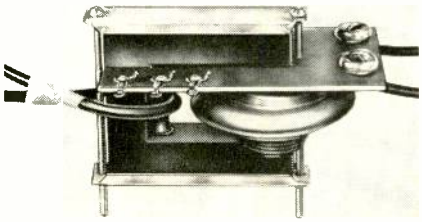
tween the CR tube base and its socket to complete the circuit, and make all connections readily accessible to meter test leads. The dealer net price is $1.95. Pomona Electronics Co., 524 W. Fifth Ave., Pomona, Calif.—TECHNICIAN.

For the Technician

Useful Products for Sales and Service

Ram FLYBACK REPLACEMENTS

The RAM models X070 and X073 transformers are designed for use where the flyback is under the chassis or other compact locations. RAM model X070 replaces Zenith units with part numbers S16566, S17140, S18125, S17939, and S18930. Model X073 replaces Zenith parts numbered



S15709, 15710, S16191, S17265, S15-911, S16204, S17130, S15710-9 and S17927. Model X070 has a 13 KV output and powers CR tubes of 14-in. through 21-in. Model X073 has an 11 KV output, and powers CR tubes in sizes of 7½-in. through 12½-in. Ram Electronics Sales Co., Irvington, N.Y.—TECHNICIAN.

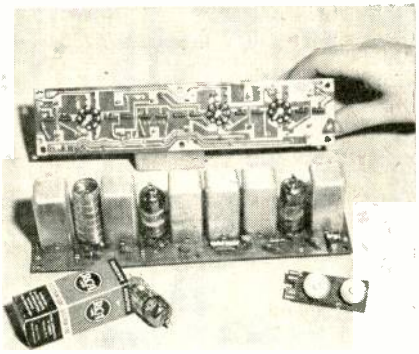
ATR INVERTERS

New models of ATR inverters for operation from 6-volt or 12-volt storage batteries in automobiles, buses and trucks provide 110-volt AC 60-cycle output in various wattage ratings for the operation of dictating machines, tape recorders, wire

recorders, radio sets, test equipment, and other related small electrical or electronic apparatus. Inverter models are also available for operation from other DC input voltages ranging from 6 volts DC to 220 volts DC. American Television & Radio Co., 300 E. 4th St., St. Paul, Minn.—TECHNICIAN.

RCA PRINTED CIRCUIT IF AMP

A complete IF amplifier, prealigned and with printed circuit components, is being produced by the Tube Department of the RCA Victor Division of RCA. The amplifier is intended for sale to TV receiver manufacturers as a finished unit for attachment to the chassis. It will become available to servicemen for replacement purposes in the future. Called a Tandem amplifier, the unit is a three-stage IF assembly for TV receivers which utilize intercarrier sound systems with a video IF of 45.75 mc. and a sound IF of 41.25 mc. It employs printed-



circuit IF transformers, coils and traps; three 6CB6 tubes; and a crystal diode detector, all mounted on a plastic panel. The panel is attached to the TV chassis by six small mounting screws. The printed-circuit components are encased in protective metal shield cans. Tuning adjustments may be made by means of aluminum screw discs accessible from one side of each can. Marked terminals are provided on the plastic panel for input, output, B-plus, AGC and heater connections to the chassis wiring. RCA Victor, Division, Radio Corp. of America, Camden, N.J.—TECHNICIAN.

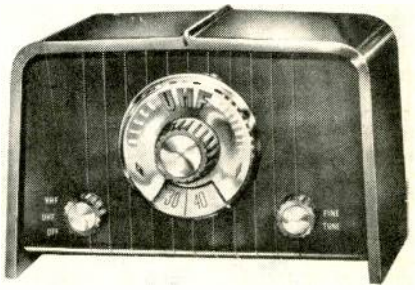
Perma-Power VOLTAGE REGULATOR

TV voltage regulator with a 300-watt rating, designed to insure maximum performance of any television set by returning full height and width of picture when low-line voltage has decreased these pix dimensions. Unit's list price is $6.75. The same manufacturer is also producing a C-301 TV "tube brightener" for use on sets with parallel or series-wired filaments. This isolation-type transformer gives normal 6.3-volt

output or 7.8 volts, to increase CRT cathode emission. It lists for $4.45. Perma-Power Co., 4727 N. Damen Ave., Chicago 25, Ill.—TECHNICIAN.

Walsco UHF CONVERTER

The Walsco Imperial UHF converter has a turret-type band-spread tuning unit with a double-tuned pre-selector. This tuning unit has a constant LC ratio. A balanced-line oscillator minimizes frequency drift, according to the manufacturer. The converter covers the



entire UHF frequency spectrum from 450 mc to 900 mc. Antenna input terminals are provided for separate UHF and VHF antennas; they may also be used for combination antennas. The converter is available in a variety of colors to blend with interior furnishings. Walter L. Schott Co., 3225 Exposition Pl., Los Angeles 18, Calif.—TECHNICIAN.

Be sure to see the Circuit Digest opposite last page of book

Changes Servicemen Would Like to See

(*Continued from page 38*)

facturer does not also insert a fuse in the B- line, or the primary of the set's power supply. All sets, we feel, should be fused both in the boosted B line and the B- return, or some other suitable part of the low-voltage power supply.

We know of cases where a fuse was omitted from the low voltage power supply in sets whose filter condensers were not very rugged. Every time the set burned out a filter, the power transformer also went. This was only good for power transformer manufacturers—it certainly didn't build up customer good-will for this receiver make. If the power transformer caught fire, about one-fourth of the entire set had to be rewired. Lack of a fuse cost the customer $25 to $150, depending on the amount of damage done.

Foremost on many servicemen's list of problems is the one of interacting circuits. Many technicians feel that the TV receiver offers enough complications without the additional ones introduced by the feeding of the B-boost voltage to circuits other than the horizontal. If the vertical amplifier needs 400 volts, why not use a 400-volt power supply, rather than depend on the B-boost to provide this extra voltage?

Some manufacturers have also used the "regulated" B voltage appearing at the cathode of the final sound amplifier to feed video IF stages. This circuit kink, which certainly led to some unusual service problems, is fortunately not much used nowadays.

One of the trickiest circuits used in television today is the AGC circuit. Enough problems are introduced when this circuit merely applies bias to the IF tubes; it is undesirable, in our opinion, to link it to the video amplifier as well. When such a complicated AGC system fails, it is very difficult to isolate the source of trouble—the defect could be almost anywhere in the set. Checking components separately provides no practical solution—there are too many of them. If the serviceman is rushed, the set is apt to be tabled until he has more time. There are tricks that help isolate the troublesome part, but this is not the time to discuss them. This *is* the time, however, to ask the manufacturer to refrain from using such a circuit, or else publish complete servicing data about it.

Apropos of service data—the literature made available by the manufacturer should be as complete as possible. In the case of trick circuits that require special adjustments, the adjustments should be fully described. The schematic diagram should show voltages, waveforms and tube pin numbers, at the appropriate points on the diagram (see fig. 3.) Alignment procedures, or procedures recommended for adjusting special circuits, should be presented in tabular form. Model and serial numbers should be prominently displayed on the chassis of the set; the coding used should be readily understandable.

Some manufacturers reading this article may raise the question of cost. Admittedly, in mass production this is a very important consideration. We believe, however, that the expense of making the design changes suggested will not raise production costs per set by more than a few pennies. Actually, many of the design features condemned in this article have been used in the more expensive receivers, while a good number of the recommended features are present in less expensive sets.

It is hoped that this article will bring the manufacturer and set designer closer to the realization that the serviceman is an important person to consider when a TV set is being designed—perhaps as important as the set purchaser himself.

"SERVICE WITH A SMILE"

"But are you sure that set won't bring in any ghosts?"

How's That Again? Dep't.

The customer was troublesome, and the serviceman was losing patience. When the man asked him for the third time what the trouble really was on his set, the serviceman replied:

"The discriminator isn't discriminating, the oscillator is squegging, the ratio detector won't ratiocinate and—and—the set needs retuning."

The customer thought this over for several seconds, then said:

"What do you mean—the set needs retuning?"

Lone (UHF) Ranger

A woman who lived in a town that had just been assigned its first UHF channel complained to the TV dealer who had sold her a receiver:

"Your salesman told me I could get 82 channels with this set, and I'm only getting one."

Servicing a Spelling Problem

A dealer who had bought a shop that specialized in hi-fi installations wrote his first letter to the company that was to supply him with amplifier chassis.

"Dear Sirs:" he penned, "Kindly send me two Kingsley chassises."

Not liking the looks of the last word, he crossed it out and wrote instead: "Please send me two Kingsley chassis's."

Still unsatisfied, he sent out this third and final version: "Dear Sirs: Please send me one Kingsley chassis. Incidentally, also send me another one."

Are Them Days Gone Forever?

We remember the time when a radio student, scanning the ads, summed up one of them as follows: "Wanted—Boy, the size of a man, to do the work of a horse."

Mr. Fix-It—But Good

A TV set owner who had studied a fix-it-yourself book invariably retuned his set whenever trouble developed in it. Just as invariably, the set wound up on the bench of the neighborhood serviceman.

"You know, I find alignment difficult," the set owner confided to the technician."

"Only difficult?" sighed the latter. "I wish you found it impossible!"

Trio Adds Space

An addition to the Trio Manufacturing Company plant at Griggsville, Ill., has been completed. Also added was a new laboratory which will be devoted to product research, testing, development and improvement.

in the tradition of the INLINE*

*reissue patent 23,273

new UHF antennas by AMPHENOL

Following in the footsteps of the fabulous INLINE, now in its fifth year of providing quality reception for all VHF set owners, are a complete line of outstanding AMPHENOL UHF antennas. Created to provide the versatility of types needed for the complicated reception problems presented by UHF, Servicemen and dealers will find them their answers to any local reception worries that they might have.

114-065 BO-TY A broadbanded high gain antenna, equipped with a sturdy reflector to insure rejection of unwanted signals off the back and sides. With its gain of 5.5 db to 8 db* and excellent front-to-back ratio, the single BO-TY is a fine antenna for major signal areas. The BO-TY can also be stacked for the increased gain necessary in fringe areas.

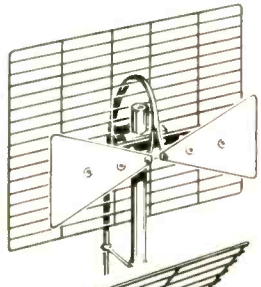
114-058 CORNER REFLECTOR Very high ascending gain and fine directivity patterns make this broadbanded antenna the perfect choice for weak-signal areas. The gain rises from 8 db at 470 mc to 13 db* at 890 mc. The CORNER REFLECTOR features the same sturdy construction employed in *all* AMPHENOL antennas.

114-059 STACKED-V Provides reception across all television frequencies, VHF or UHF. The angles between the V's can be adjusted to three different angles. 70° for all-channel reception, 90° for VHF only and 50° for UHF only. Gain is excellent at 50° (UHF) and very good at 90° (VHF) and 70° (UHF-VHF).

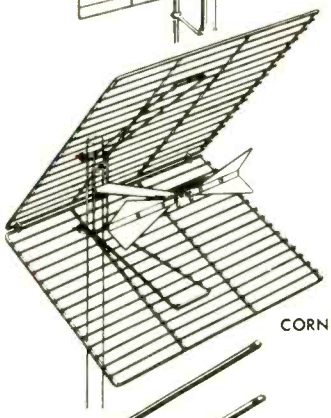
114-060 RHOMBIC An antenna for all UHF channels, 14 to 83. Its high gain, 6 db to almost 14 db*, and sharp narrow forward lobe mean fine reception of every UHF station. The RHOMBIC has an exceptionally sturdy crossbraced construction.

114-054 YAGI A six element all-aluminum antenna ideal for fringe areas, the YAGI features a very narrow forward lobe and high gain of 10 db. AMPHENOL has prepared eleven YAGI models to provide custom reception of specific channel groups: 14-17, 18-22, 23-28, 29-34, 35-40, 41-46, 47-53, 54-60, 61-67, 68-75, 76-83.

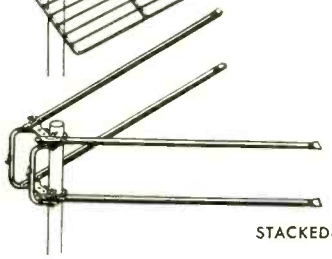
**All AMPHENOL gain measurements are made in accordance with current RTMA standards.*



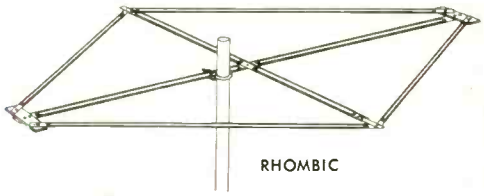
BO-TY



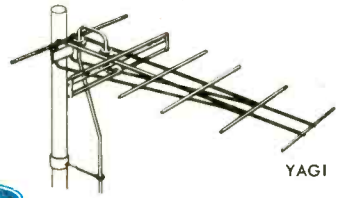
CORNER REFLECTOR



STACKED-V

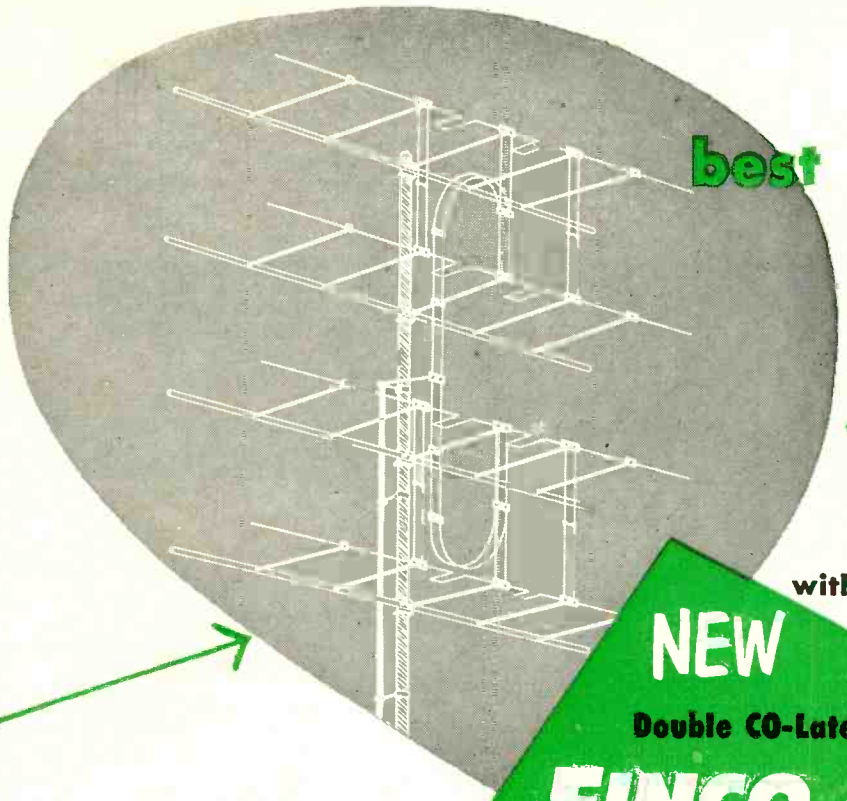


RHOMBIC



YAGI

AMERICAN PHENOLIC CORPORATION AMPHENOL *chicago 50, illinois*



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Improving a Stacked Conical

Using Spider Web Reflector to Increase Signal Pickup in Fringe Areas

By Leo Draus

In near-fringe and fringe areas where a number of VHF channels must be covered, stacked conicals are frequently used. After a lengthy investigation, an inexpensive way of effecting a substantial improvement in the pickup of a stacked conical was discovered by the author. The method involves the construction of a reflector that looks like a spider web.

This unit is a variation of the screen and corner type reflectors. It has provided visible improvements in reception beyond those obtainable by use of a booster amplifier, receiver circuit changes or realignment. Its successful use in the anthracite regions of Pennsylvania bears out the claims made for it in this article.

The operation of parasitic antenna elements is based on the fact that the TV station signal causes eddy currents to flow in these elements. The eddy currents reradiate a field of their own from the parasitic element. By proper spacing of the elements, this field may be made to arrive at the front of the antenna, so as to be in phase with the field produced by the original station signal.

The spider web reflector consists of a large number of parasitic elements that absorb transmitted power and reradiate it with such phase relationship to the original radiation that the fields add in one direction (forward) and subtract in another direction (rear), thus increasing the antenna gain and improving its front-to-back ratio. Snow is reduced or eliminated, picture quality is improved, sync action is bettered and the noise-immunity of the set goes up, with the increase in signal pick-up.

In fringe areas, TV signals are weaker in the winter, due to absence of the refraction phenomena prevalent in the summer. The spider web reflector will increase the TV signal pick-up of the stacked conical antenna at such times, when the greater pick-up is badly needed.

The cost of the parts required is less than one dollar. Approximately two hours of work will be needed, depending on the accessibility of the stacked conical antenna.

The spider web reflector can be made up of about ninety feet of 7/24 bare copper wire, or an equivalent antenna wire, strung in a spider web pattern (see fig. 1). The spider web construction adds mechanical strength to the reflector, better enabling it to resist destruction by high winds and winter icing.

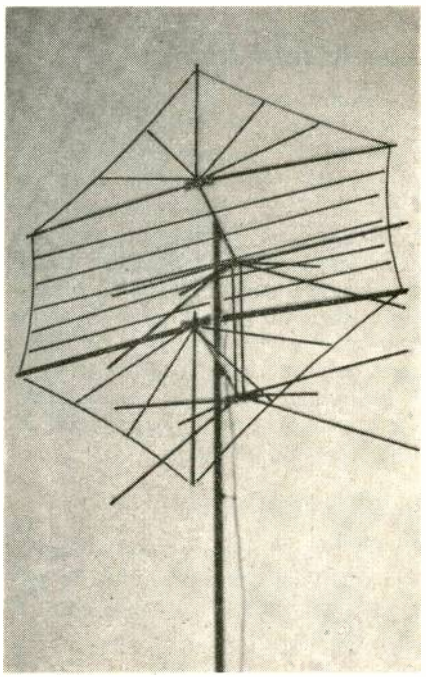


Fig. 2—Photo showing appearance of stacked conical with spider-web reflector added to it.

Two types of reflector which were fool-proof in field tests will be described here. Shown in fig. 1A is the double-X reflector. It is made up as follows:

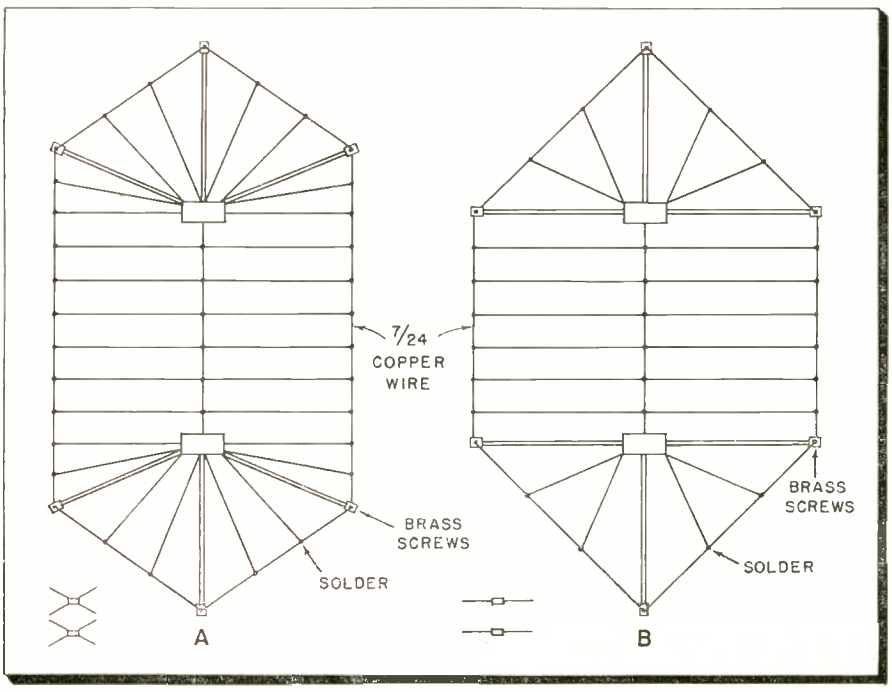
Remove the bottom rods of the top half section of the reflector unit originally present on the conical; also remove the top rods of the bottom section. Fasten one of these rods upright in the center of the top half section of the reflector; another rod is fastened underside in the center of the bottom half reflector section. The remaining two rods are discarded.

Holes to accommodate a 6/32 brass screw are drilled in the far end of each reflector rod. These rods support the spider web wires. The wires are soldered to the brass screws added to each rod. All wires must be taut and soldered securely at cross points and ends.

Shown in fig. 1B is the double-bar

(*Continued on page 80*)

Fig. 1. A—Double-X spider-web reflector. Parts required: 100-foot roll of 7/24 copper stranded wire, 6/32 brass screws, nuts and washers. B—Double-bar spider-web reflector. Parts required: 100-foot roll of 7/24 copper antenna wire, 6/32 brass screws, nuts, washers, and two reflector rods. The latter may be purchased, or made up out of antenna rods.



"Tough Dog" Corner

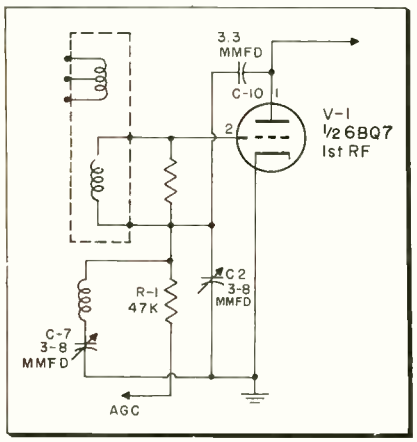
Difficult Bench Repairs Described by Readers

Corona and Arcing

In many cases, the source of corona or arcing in the high-voltage can of a TV receiver is difficult to locate. Often the arc-over is in the can itself. By placing a sheet of good insulating fiber in various positions inside the cage, the exact site of the arc can be located. It is then a simple matter to permanently insulate the spot by painting it with anti-corona paint, or by pasting a piece of insulating material permanently into the appropriate position. *G. H. Doty, Dayton, Ohio.*

Fading Front End

This "dog" of a receiver was a new set. When first installed, it operated satisfactorily, although it



seemed a little "hot" (extremely sensitive). After it had been in use for about fifteen hours, picture and sound reception became considerably weaker, necessitating the advancement of contrast and volume control settings. The advancement needed was progressive; the customer had to keep turning the controls further and further up.

Checking the set, the serviceman who worked on the job before me substituted tubes, readily discovering that the 6BQ7 RF amplifier was bad. He put in a new tube, restoring receiver operation to normal. In a couple of days, the trouble recurred. Another trip, another 6BQ7 RF amplifier tube, and the set was in good order again. When the complaint recurred once more, the chassis was pulled.

On testing the second and third 6BQ7 tubes that had been in the set, it was found that the first RF amplifier section in each tube was dead or nearly so, while the second RF amplifier section was perfectly good. Voltage and resistance measurements were then made on the suspect section of the front end. They revealed nothing; neither did a visual inspection. The writer was then called in.

I inspected the circuit diagram. Pertinent portions of the diagram are reproduced in the sketch. The fact that a 6BQ7 section wore out in about 15 hours indicated that the tube had an excessively low, perhaps even a positive bias; or else its plate or filament voltage might be excessive. Most probably, the condition was one that developed slowly, since the voltages had been tested and found normal when the set was first turned on. On analysis of the circuit diagram, it seemed to me that a short-circuit or leak in C-10 might be responsible for the trouble; or, perhaps, an opening in R-1 was breaking the grid's DC return. The latter possibility, however, seemed remote; a tube with an open grid circuit would tend to give trouble much sooner than 15 hours, or two days. Besides, an open grid circuit would hardly cause the tube section involved to become defective so quickly. A positive grid bias seemed a far more likely source of the trouble; no means of such a bias developing, outside of a leak in C-10, was evident. I could think of nothing plausible that would cause the plate or filament voltage of the tube section involved to become excessive; these defects were therefore ruled out as well.

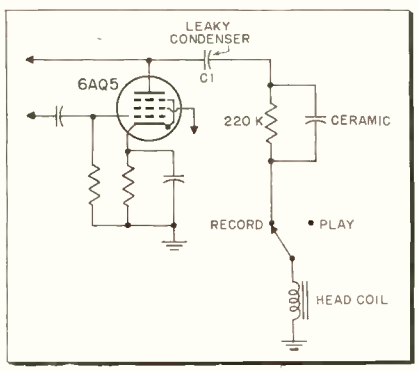
It was decided to set up a monitor on the grid return of the first RF amplifier. The DC probe of a VTVM was connected to the AGC feed, at an appropriate turret spring contact strip, through a 50K isolating resistor; the "common" lead was attached to chassis. The meter polarity switch was set for a negative AGC measurement. After about one hour, the initial AGC negative bias was overcome, and the meter reading reversed, indicating the presence of a small positive voltage. This led me to replace C-10. The set was monitored for several days before it was returned to the customer. No further complaint was received, indicating that the writer had correctly guessed the trouble. *James A. McRoberts, New York, N.Y.*

$ For Your "Tough Dog" Story

Have you tangled with a difficult or obscure service problem recently? Write it up, telling us how you licked it, and send it to "Tough Dog" Editor, TECHNICIAN, Caldwell-Clements, Inc., 480 Lexington Ave., New York 17, N.Y. $10 will be paid for usable material. Unacceptable items will be returned to the contributor

Tape Recorder "Toughie"

The problem on this Ampro 730 tape recorder was that it would not record, and played material recorded before trouble developed. (A similar problem, incidentally, could arise on any recorder using a circuit arrangement resembling the one shown below). We checked the resistance of the head, although it was felt the latter had to be normal, since it operated correctly when



used for playback (no separate head is used for playback on this unit). We then injected a 400-cycle signal at the grid of the first audio stage and followed it clear through the amplifier to the head coil. Everything seemed to be normal. After

(*Continued on page* 80)

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SIGNAL and MARKING GENERATOR for A.M., F.M., and TV alignment.

Exceptional Accuracy and Stability • 1000 pt. vernier calibrating scale • 0-100% Modulation • A.V.C. — A.G.C. substitution-override network • Direct reading 88KC to 120 MC • Complete with Coaxial output cable and technical manual • In matched, heavy gauge steel case 10½ x 12 x 6".

Net Price: $78.50

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Narrow and Wide Band Sweep for F.M. and TV, 0-1MC and 0-15MC • 1500 pt. vernier calibrating scale • Multiple Crystal Marker • 8 tubes including V.R. and rectifier • RG/62U Coaxial Terminated Output cable • Complete with 2 crystals • In matched copper-plated case 10½ x 12 x 6".

Net Price: $139.75

SERIES ES-500A
High Sensitivity, Wide Range 5" C.R. OSCILLOGRAPH

Push-Pull "V" and "H" amplifiers • 1 MC Band Width • High impedance, compensated "V" input Step Attenuator • Z axis modulation • 12 tubes incl. V.R. and 2 rect. • Light Shield and Mask • Heavy Steel Case. 8¼x14½x18".

Net Price: $173.70

SERIES EV-10A
True Zero-Center VTVM—MEGOHMMETER with large 7" meter.

58 ranges to 6000 Volts, 2000 Megs, +70DB, 12 Amps • Direct Reading R.F. VTVM scales via optional RF-10A High Freq. probe • Voltage Regulated bridge type circuit • Constant 13⅓ Megs input resistance to 600 V., 133⅓ Megs at 6000V • Complete with test cables • In matched steel cabinet 10½ x 12 x 6".

Net Price: $99.75

SERIES 612
Modern Free-point TUBE TESTER, and dynamic A-B-C Battery Tester.

Incorporates RTMA recommended circuit principles • 10 lever free-point element selection • Built-in roller chart • Dual short-check sensitivity • Noise, Ballast and Pilot Tests • Free replacement tube test data chart service • Complete, ready to operate • In matched heavy gauge steel cabinet 10½ x 12 x 6".

Net Price: $76.75

BUY PERFORMANCE — NOT SPECIFICATIONS!

PRECISION **PERFORMANCE, ACCURACY, WORKMANSHIP and VALUE have been setting a world-wide standard of comparison for over 20 years.**

Every *PRECISION* instrument is guaranteed for one full year against mechanical or electrical defects.

OTHER MATCHED COMBINATIONS

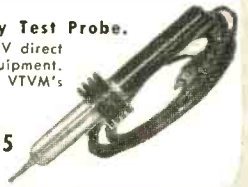
The instruments shown above illustrate one of many possible MATCHED COMBINATIONS of *PRECISION* Test Equipment for the modern TV-FM-AM service bench. Each combination provides a selected, basic and efficient Laboratory at moderate cost.

SERIES TV-4—Super-High Voltage Safety Test Probe.

Extends range of Series EV-10A (above) to 60 KV direct reading, with full safety to operator and equipment. Multiplier cartridges also available to match most VTVM's and 20,000 ohms per volt test sets.

Series TV-4: — Complete, for use with EV-10A.

Net Price: $14.75



TV • AM • FM • TV • AM • FM • TV

PRECISION Performance-Engineered Instruments are on display at leading radio parts and equipment distributors.

PRECISION APPARATUS CO., INC.

92-27 Horace Harding Boulevard, Elmhurst 6, New York

Export Division: 458 Broadway, New York 13, U.S.A. • Cables—Morhanex

In Canada: Atlas Radio Corp., Ltd., 560 King Street, W., Toronto 2B

TV • AM • FM • TV • AM • FM • TV

Convenient PRECISION Purchase Terms can be arranged with your favorite authorized Precision Distributor.

NEWS of the TRADE

RETMA's TV Service Course Starting

Recruitment of students for the first pilot training course for television technicians sponsored by RETMA at the New York Trade School has started and the first class is set for approximately Sept. 15 with 60 students selected from qualified TV servicemen in the New York area.

A mailing has been made to over 14,000 television technicians in the area, advising them of the course and the entrance requirements. Application forms and additional information are to be obtained from local set and part distributors participating with RETMA in the Industry Technician Training program.

The first 250 qualified applicants for the RETMA-sponsored course were to be interviewed by the New York Trade School Industry Advisory Committee and given a written entrance examination. From these the 60 students for the pilot training course will be selected to participate in the industry program for the development of training material suitable for use in other schools throught the country.

Hi-Fi & Audio Show for Philly

The third annual High-Fidelity Conference and Audio Show will be held at the Benjamin Franklin Hotel, Philadelphia, November 3-4. The entire fourth floor will be used by manufacturers to present live demonstrations of their equipment. The hotel's Crystal Room will be used for displays, panel discussions and lectures by leading audio experts.

Electronics Fair Committee

TV servicemen from all over the state gathered at Fort Worth, Texas, to witness the recently-held Radio & TV Service Clinic and Electronics Fair. It was estimated that nearly 1,000 attended the three-day affair which was sponsored by the Texas Electronic Association. The planning committee (above) consisted of W. J. Inman; Leonard Smith, TEA president; and Mose Branum (standing). Seated are R. M. MacDonald; Truett Kimzey; and Luther Bradley.

Mason Set for NEDA Program

The National Electronic Distributors Association has arranged to have Donn Mason appear on the educational program for the 1953 Convention and Manufacturers' Conference being held in St. Louis, September 14-16.

Mason, who has been a sales manager for 27 years, is also a personnel analyst, trainer and counselor in personnel and human relations, and has written several books, including "Executive Leadership," and "Scientific Selling Methods." He has developed specific dealer programs for both manufacturers and distributors, and conducted seminars on selection, indoctrination, training and skillful handling of personnel.

California Electronic Show

The first Annual National Electronic Show will be open from 11:00 AM to 11:00 PM daily, from October 2-11 at the Santa Monica Pier, Santa Monica, Calif. This event is sponsored by the Electronic Employers' Association as part of its continuing program of promoting ethical business conduct and moral business habits in the electronic industry.

Sightmaster Offers Color-TV Conversion

As soon as the FCC approves color-TV transmissions, Sightmaster Corp., New Rochelle, N. Y., offers to convert black-and-white sets to receive color, at an average price of $250 per set. This new service grows out of Sightmaster's experience in converting standard small-screen sets to larger picture sizes.

New color sets, President M. L. Kaplan notes, are expected to begin at about $1,000 for a 14-inch set. Under the Sightmaster conversion plan, he adds, present set-owners will pay "but a small part of that price."

"We estimate the cost should be about $250 on the average to convert your receiver to color. It may be a little more or a little less, depending on the cost of producing color tubes. The plan will be made available to distributors, dealers and service men. Sightmaster is going after a market that entails 23 million sets now in use. Under our program, all sets now in use will be convertible to color at a fractional cost of a new color receiver."

Calendar of Coming Events

Sept. 14-16: National Electronic Distributors Assn. (NEDA) Fourth Annual Convention and Manufacturers' Conference, Chase Hotel, St. Louis, Mo.

Sept. 25-27: First Northern California Hi-Fi Audio Show, Palace Hotel, San Francisco, Calif.

Oct. 2-11: First Annual National Electronic Show, Santa Monica, Calif.

Oct. 9-11: National Alliance of Television & Electronic Service Assns., (NATESA) Annual Fall Convention, Morrison Hotel, Chicago, Ill.

Oct. 14-17: Audio Fair and Convention, Hotel New Yorker, New York, N. Y.

Audio Fair at New York

The Audio Engineering Society of New York will hold its annual Audio Fair and Exhibition, and its fifth annual convention at the Hotel New Yorker, Eighth Avenue at Thirty-fourth Street, New York City, from Oct. 14 to 17th. Arrangements have been made for twenty-eight technical papers to be presented during the sessions, and in addition there will be exhibits by manufacturers.

General topics to be discussed follow: Wednesday morning: Loudspeakers. Wednesday afternoon: Audio System Design. Thursday morning: Disc Reproduction. Thursday afternoon: New Audio Developments. Friday morning: Amplifier Circuit Design. Friday afternoon: Home Music Systems. Saturday morning: Multi-Channel Sound Reproduction.

One Good Reason's Enuf!

"Let's Not Have NINE Reasons Why We Can't Do It. Let's Have ONE Reason Why *We Can!*" says Sid Chertok of Sprague, in a striking wall-card which has been mailed out to the technician-distributor trade.

Signing On Dotted Line

Pictured signing exhibitor contracts for the first annual National Electronics Show, to be held in Santa Monica, Calif., October 2-11, are, left to right: Frank C. Fernandez, president, Carruthers & Fernandez, Inc.; Donald H. Allen, vice-president and general manager, P.C.A. Electronic Co., Inc.; Remy L. Hudson, president, Amelco. Standing are Bill Scott, president, Electronic Employers' Assn., and Gerry Finley, "Miss Industry."

NICE GUY... with an undeserved black eye

If you understood what your
RADIO AND TELEVISION SERVICE DEALER
is up against, you'd buy him a steak for his eye

WE'LL WAGER DOLLARS to doughnuts you approach a TV-Radio Service Dealer with apprehension — feeling sure he's scheming to "do" you out of an unfair portion of your hard-earned money. This mental black eye given the TV-Radio Service profession by the public is undeserved. When TV-Radio Service Dealers were swept into the spectacular growth of the nation's fastest developing new industry, some made mistakes, but the misguided were mighty few. The vast majority of Television and Radio Service Technicians are capable, efficient, thoroughly trustworthy businessmen doing a magnificent job of keeping pace with a rapidly expanding new industry.

And we know what we're talking about. Since 1945 — that's way back before nationwide TV — the Raytheon Manufacturing Company, through several of America's largest surety companies has been Bonding the repair work of Radio and Television Service Dealers. More than 30,000 Registered Bond Certificates have been issued to service dealers all over the United States, and of the millions of jobs these qualified Bonded dealers have handled *we've received less than 50 complaints.* We consider this amazing record a marvelous indication of the skill, integrity and ability of these selected service dealers.

The service dealers that are bonded through Raytheon are nationally known as *RAYTHEON BONDED ELECTRONIC TECHNICIANS.* They must be skilled technicians, have modern, efficient test equipment, and a wealth of experience to qualify for this coveted classification. They adhere to a strict 8-point Code of Ethics designed to protect you. Here it is:

1. Guarantee all Radio and Television repair work for 90 days.
2. Use only parts of recognized quality.
3. Charge not more than list price for parts installed.
4. Test customers' tubes as accurately as possible.
5. Keep labor charges at a reasonable level.
6. Perform only such work as is necessary.
7. Maintain proper equipment for good repair work.
8. Maintain the highest quality service.

Whatever the make and model of your radio or television sets, next time you need service we'd like to suggest you call a *Raytheon Bonded Electronic Technician.* Look for his seal. It's the symbol of a service man whose work, way of doing business, and integrity are above reproach. We're sure he'll satisfy you.

RAYTHEON
Excellence in Electronics

RAYTHEON MANUFACTURING COMPANY, RECEIVING TUBE DIVISION
NEWTON • CHICAGO • ATLANTA • LOS ANGELES

RAYTHEON Bonded ELECTRONIC TECHNICIANS
CONTINENTAL CCC QUALITY CONTROL

RAYTHEON MANUFACTURES TELEVISION AND RADIO TUBES, INDUSTRIAL AND POWER TUBES, TELEVISION AND RADIO SETS, GERMANIUM PRODUCTS, DIATHERMY EQUIPMENT, ELECTRONIC COOKERS, ELECTRONIC MARINE EQUIPMENT, ELECTRONIC DUPLICATORS, INDUSTRIAL EQUIPMENT, ULTRASONIC MACHINE TOOLS AND ELECTRONIC TUBES, SONAR, RADAR AND COMMUNICATIONS EQUIPMENT FOR THE UNITED STATES GOVERNMENT

Raytheon Is Telling Your Side of the Story to over

25,000,000 Readers of LIFE

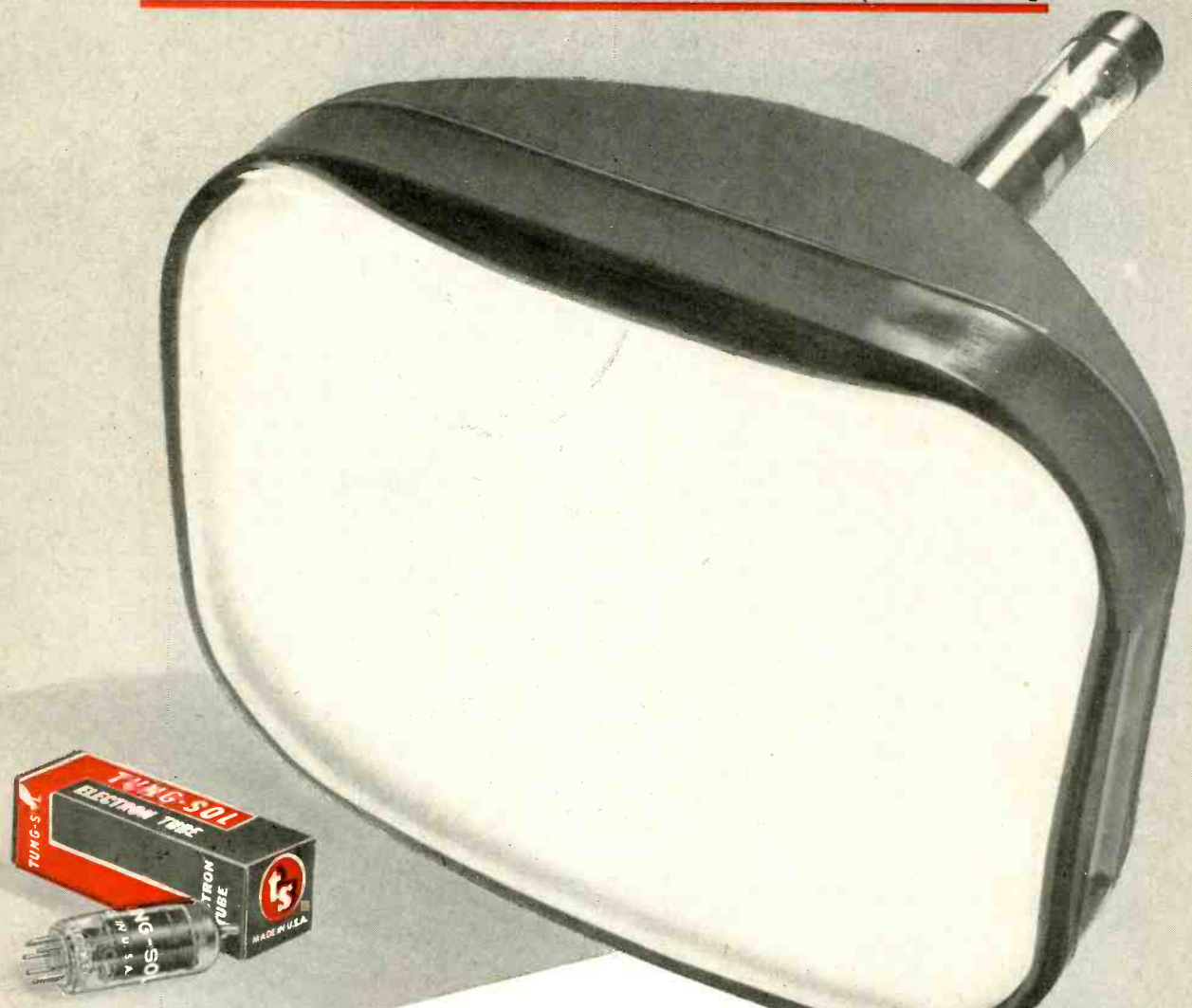
The September 21st issue of LIFE will carry the full page, two color advertisement pictured above, telling your side of the Radio-TV Service story to LIFE'S vast audience. We gladly run this advertisement to help you combat the unjust attacks that have been made on your profession and to give the public a true picture of the really good job you are doing. It's our way of saying "thank you" for your loyalty to *Raytheon Radio and Television Tubes.* We assure you their quality and performance will continue to meet your most exacting requirements.

RAYTHEON
Excellence in Electronics

RAYTHEON MANUFACTURING COMPANY
Receiving Tube Division
Newton, Mass., Chicago, Ill., Atlanta, Ga., Los Angeles, Calif.

RAYTHEON MAKES ALL THESE:
RECEIVING AND PICTURE TUBES • RELIABLE SUBMINIATURE AND MINIATURE TUBES • GERMANIUM DIODES AND TRANSISTORS • NUCLEONIC TUBES • MICROWAVE TUBES

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 double 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.

SERVICE ASS'N. REPORTS

Philly Ass'n. Offers $5.95 Tune-up

Service organizations which belong to the Television Service Dealers Association of Philadelphia are sending prospective customers form letters which include the following:

"In order to acquaint you with the advantages of dealing with a member of the Television Service Dealers Association, our membership is now offering this 'Tune-Up Special.'

1—Check all leads and cables.
2—Reset and clean controls.
3—Check channel selector for overall performance on picture and sound.
4—Check picture tube for maximum brightness.
5—Clean safety glass and picture tube face.
6—Re-focus picture.

ALL THIS FOR ONLY $5.95

"Your patronage of our member's service will assure you of continuous television viewing pleasure.

"We are enclosing a booklet entitled "Facts About TV Service" which we hope will help to answer some of your questions and problems. E. W. Lane, Secretary, 1702 Hunting Park Ave., Philadelphia 40, Pa."

Television Service Association Of Detroit

Despite setbacks, there are service associations such as TSA in Detroit, Michigan, that have been going strong for several years. Under the capable hands of President Harold Chase, this association has proved its worth and strength and it has absorbed smaller groups such as the Macomb Electronic Association. TSA was very proud when MEA joined as a group last November. Since then the 24 members of MEA have proved a very desirable asset. Both groups had one outstanding purpose . . . that of promoting ethical practices among the radio and television industry . . . and by joining hands they have become stronger for that purpose.

This spring TSA became affiliated with the National Appliance and Radio-TV Dealers Association, and Harold Chase was appointed Chairman of the National Service Committee.

TSA puts out an extensive news letter, *TSA News*, which probably has much to do with keeping up the interest of its members. While originally an organ for TSA members, *TSA News*' popularity has increased until it is being sent all over the United States . . . and as far away as Saudi-Arabia. If you would like to receive this interesting and informative association newsletter, write to: Adam H. McNutt, Sr., Editor, 15010 Grand River, Detroit, Mich.

NATESA Convention Shaping Up

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

More than one thousand members of the 35 affiliated state groups are expected to accompany the 70 delegates, with an additional 500 persons representing Chicago area companies, John Cecich, Convention Chairman estimates.

This year's plans call for both an industry convention and product display and an open forum, to which the public is invited, and where leading authorities on television maintenance and repair will give set owners an opportunity to air their comments on TV repair service.

National officers of NATESA in addition to Moch include: J. B. McDowell, Kansas City, Kansas, secretary general; John Hemak, Minneapolis, treasurer; Bertram Lewis, Rochester, N. Y., eastern vice-president; Fred Colton, Columbus, Ohio, east central vice-president; Harold Rhodes, Patterson, N. J., eastern secretary; Francis Fingado, Denver, western vice-president; Vincent Lutz, St. Louis, west central vice-president and W. A. Rosenberg, Wichita, Kansas, west central secretary.

TISA (Chicago) Officers

Pictured above are the men who represent the Television Installation Service Association of Chicago. First row, left to right: Sidney Terman, 2nd vice-president; John Cecich, 1st vice-president; Frank J. Moch, president (and also president of National Alliance of Television & Electronic Service Associations); Rubin Saxner, secretary. In second row, left to right: Jerome Man, treasurer, Fred Levine, sergeant-at-arms.

Utah Association of Radio & TV Servicemen

The Utah Association of Radio and Television Servicemen was officially "born" June 1st of this year, with a charter membership of some 25 percent of the service shops in the Salt Lake City area. They will be statewide in scope and endeavor, and membership will be open in various classifications: House Memberships—covers shops actively engaged in the radio or television service field. (Dues $10 per month). Individual Memberships—covers employees of shops, or managers (not owners) students and others (Dues $3 per month). Associate Memberships—covers those in fields closely allied with the radio and television service industry. (Dues $10 per year.)

The Association will work toward improved working conditions . . . opportunities for better wages . . . insurance and hospitalization protection . . . reduced uniform costs through wholesale buying power . . . educational and informational services . . . legislative representation, etc.

Initial officers elected to serve the Association are: J. F. Burns, Murray, Utah, president; James W. Neilsen, Midvale, Utah, vice-president; Robert J. Magness, South Salt Lake, secretary-treasurer; and Dean Pieper, general manager. Offices are 418 Frick Bldg., Salt Lake City 1, Utah.

Raytheon TV Service Aid

A 12-page booklet, "The TV Owner's Service Saver" has 40 photographs of TV picture faults, each one numbered. The booklet is for distribution to TV receiver owners, to be used by them when calling in a serviceman. The Raytheon service manual for technicians has a corresponding "service saver" section with the same 40 picture conditions shown. Accompanying each photograph are schematics of the circuits which might produce the trouble, hints and kinks to aid in pinpointing the source, and a list of parts and tubes that might be involved. The technician can then respond to the call equipped with necessary tubes and parts, as well as ideas re where to look for trouble. Raytheon claims that the use of the combination by TV owners and their servicemen will save time and money for both.

COLOR SHORTS

Late in July, the National Television System Committee asked the Federal Communications Commission to adopt its proposed new and improved standards (see below). The petition was approved by members of the NTSC on July 21 and subsequently filed by Dr. W. R. G. Baker as Chairman of NTSC. The action cleared the way for early Commission consideration of the whole color-TV question, including the petition filed on June 25 by RCA and NBC, and the expected repeal of the CBS color-wheel standards adopted almost three years ago. NTSC in its petition stated that other companies, in addition to RCA, also would petition the FCC for adoption of the proposed color standards. Already filing are Philco, GE, Sylvania, Motorola and others.

★ ★ ★

Members of NTSC have been working on the new color standards for more than two years. During that time hundreds of thousands of engineering man-hours have been contributed by the most highly skilled engineers and scientists in the electronics industry and in related research groups. Among these engineers and scientists comprising the committee, some 85 television and electronic companies are represented, in addition to independent consulting firms and other groups interested in color television. Dr. A. F. Murray, Dr. O. H. Caldwell and B. F. Osbahr have represented Caldwell-Clements, Inc., publishers of TECHNICIAN, in NTSC meetings.

★ ★ ★

Present sets receive color broadcasts as black-white pictures of even better quality than before. When color receivers are used, there is received and produced a color picture which has a high quality of color fidelity, adequate apparent definition and good picture texture. The standards proposed are an improvement over existing television standards in that they permit the broadcasting of color and simultaneously provide black-and-white sets with a high-quality black-and-white picture. No changes will be necessary in present sets to permit them to continue to receive a black-and-white picture from transmissions in color.

★ ★ ★

More than 100 engineers worked on one type of field test alone, tests which were made over five transmitters, using television sets of 12 different manufacturers.

★ ★ ★

CBS announces it will not only support the move to substitute the NTSC compatible standards for the present incompatible standards but will on Sept. 15 start providing some programs to its affiliated stations on an experimental basis, using the NTSC standards of transmission.

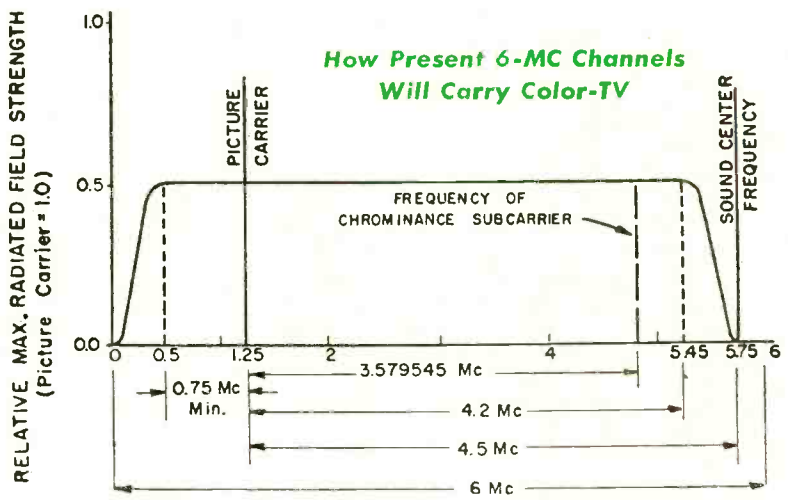


Diagram shows relative amplitude and frequency characteristics of compatible color-TV signal. Note particularly location of chrominance subcarrier at appr. 3.58 MC. In operation, the chrominance signal is vestigially modulated on the subcarrier, but in this case, upper side-bands are removed.

the C·D·R Rotor

sells faster...sells easier

because.....

The best line of TV Rotors money can buy

It is the complete line of quality rotors, with a model and type to best serve 'most every type application.

TV Spot Campaign

To reach the buying public, an intensive campaign on Television in key markets pre-selling CDR ROTORS for you.

Newspaper Advertisements

Also directed at the consumer, a supporting campaign in key city newspapers exploiting the advantages of the CDR ROTOR.

Moving Displays

It's causing excitement everywhere, this display that is an eye and traffic stopper, a silent salesman for the CDR ROTOR.

Envelope Stuffers

Here's another selling tool that may be mailed directly to your customers, selling them the CDR ROTOR in their home.

Newspaper Mats

A full set of completely prepared advertisements for dealers and distributors to capture extra CDR ROTOR business.

Window Streamers

They let everybody going into and by your store know that you have the CDR ROTORS, a colorful and eye-catching streamer.

THE *RADIART* CORPORATION
CLEVELAND 13, OHIO

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

Servicemen!

Field Strength Meter

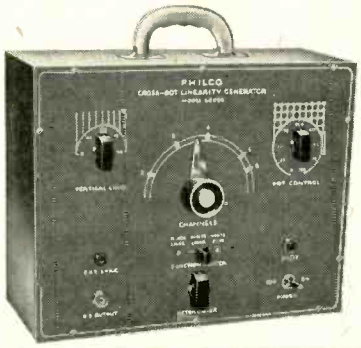
Model M-8104. More new features than any other unit at this popular price. Reads signal strength directly from the dial from 10 to 100,000 microvolts. A serviceman's time saver to measure actual TV picture signal strength.

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-ohmmeter 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 voltmeter.

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 .....

Antenn-gineer For Snyder

The Snyder Manufacturing Co. of Philadelphia has appointed John Schweighauser (above) as a company antenn-gineer. Among his duties, Schweighauser will call on Snyder distributors and service dealers in the capacity of a sales engineer. In addition, he will be engaged in field survey and sales promotional activities.

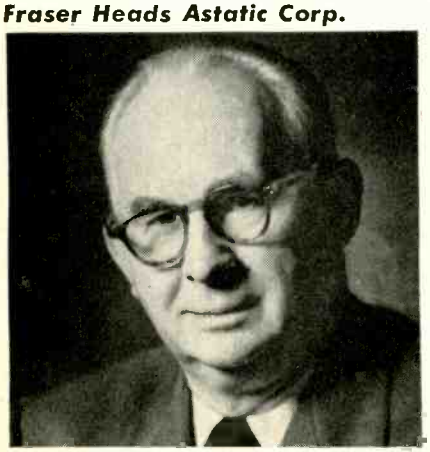
Rohn Names Sales Reps

The Rohn Manufacturing Co. of Peoria, Ill. announces three new appointments for its TV tower and accessories division. They are A. Sidney Hardy Associates of Atlanta, Ga., covering Florida, Alabama, Georgia, the Carolinas, and Mississippi; Logan Sales Co., of San Francisco, for northern California and Nevada; Edward Diamant of Cleveland, Ohio, Pennsylvania, Maryland and West Virginia.

RCP Catalog

RCP has issued a new four-page catalog listing their test equipment. Data is included in this catalog on the company's "do-all" pattern, marker and signal generator. Available from Radio City Products Co., Inc., 152 W. 25 St. New York 1, N.Y.

Fraser Heads Astatic Corp.



George B. Fraser (above) was elected president of the Astatic Corporation, Conneaut, Ohio, by the board of directors, following the annual shareholders' meeting. Fraser was formerly vice-president and general manager. He has been treasurer since he joined the company in 1936 and retains this title along with the top Astatic post. Astatic produces phono pickup arms and cartridges, microphones, TV converters and boosters, and other electronic devices.

CDR Antenna Rotor Promotion

The Cornell-Dubilier Electric Corp., South Plainfield, N.J., and its subsidiary, The Radiart Corp., have made plans for promotion of the CDR Rotors at the customer level beginning early this fall. Plans have already been completed for spot campaigns on television stations in more than 25 cities representing the major rotor markets. This spot campaign will be paralleled with a saturation campaign in newspapers in these same cities, as well as adjacent cities, with dealer listings showing the readers where they may buy CDR Rotors.

Stemm Adds to Staff

R. Edwards Stemm, manufacturers' engineering representative to the electronic trade, 5618 W. Lake Street, Chicago, announces the addition to his sales staff of John W. Butler. Butler was formerly associated with Hallicrafters, Inc. for a number of years; also with Newark Electric. For the last four years, he has been purchasing agent for Radio Craftsmen Co.

Allied Radio's New Modern Building

Described as the world's largest plant for the distribution of electronic equipment, the Allied Radio Corporation has moved into the company's new $2,000,000 home at 100 N. Western Ave., Chicago.

The two-story structure, with a total area of 147,000 sq. ft., covers a square block in the geographic center of the city. Ultra-modern, air-conditioned salesrooms and the warehousing, shipping and receiving sections occupy the first floor area.

A. D. Davis, president, points out that the need for Allied's new facilities was dictated by the phenomenal growth of the electronic parts industry. Shortly after World War II, the company carried about 8,000 separate stock items. Allied's 1954 catalog, to be released in September, will list over 20,000 separate items. An increase to 25,000 items is anticipated within a few years.

Granco Elects Officers

At a recent stockholders meeting, Granco Products Inc. of Long Island City, N.Y., elected a slate of officers. They are: Jack Grand, chairman of the board; Henry Fogel, president; Allan Easton, vice-president and general manager; Seymour Napolin, vice-president and chief engineer; Alexander Theeman, treasurer; and Irwin Green, secretary.

Poff Joins Pyramid

The Pyramid Electric Co., capacitor manufacturers of North Bergen, N. J., announces the appointment of J. K. Poff (above) as sales manager of the jobber division. Poff has been connected with the radio and electronics industry for almost 25 years and is a member of the "Old Timers Club." Before joining Pyramid, he was jobber sales manager with the Erie Resistor Corp., and prior to that was affiliated with the Astatic Corp.

Westinghouse Names R. I. Distributor

The Television Accessory House of Providence, R.I., has been appointed distributor of Westinghouse tubes, it was announced by H. G. Cheney, sales manager for the Westinghouse Electronic Tube Division. Located at 41-45 Broadway in Providence, the new distributor will handle all types of Westinghouse tubes including receiving, cathode-ray and industrial tubes. The new tube distributor's service area includes Rhode Island, eastern Connecticut, and southern Massachusetts.

JFD Names Engineers

Douglas Carpenter (above) has been appointed chief antenna development engineer of the JFD Manufacturing Company, Inc., Brooklyn, N. Y. Carpenter previously served as chief engineer for the Vee-D-X Division of the LaPointe Plascomold Corporation, the Summit Engineering Company and McMurdo-Silver. Jim Hall has been appointed associate antenna test engineer to assist Carpenter in development and field-testing of antennas. Hall was associated with the Civil Aeronautics Authority and aviation electronics operations of the United States Navy.

NEW WALSCO *Imperial*

* PROVEN THE MOST ADVANCED UHF CONVERTER IN AMERICA

UP TO **98%** GREATER POWER GAIN

UP TO **88%** LESS NOISE FACTOR

NEW distinctive cabinet design available in beautiful assortment of COLORS

WITH EXCLUSIVE *Turretune*

***FACTS** from one of America's leading, independent research laboratories proved the WALSCO **Imperial** will out-perform **all** other UHF converters . . . anywhere!

	Average Power Gain DB			Average Noise Factor DB		
	500 mc	650 mc	800 mc	500 mc	650 mc	800 mc
WALSCO Imperial	10.0	9.5	9.5	15.0	15.5	16.0
Converter A	6.0	5.4	3.5	18.5	20.0	21.0
Converter B	7.0	6.5	5.0	18.0	18.5	20.0

WRITE FOR COMPLETE INFORMATION

WALSCO ELECTRONICS CORPORATION

3602 Crenshaw Blvd. • Los Angeles 16, California

FM Receivers

(*Continued from page 44*)

ment. It should not move from this point appreciably when the center IF is being applied at the limiter grid.

Now alternately raise and lower the signal generator frequency 75KC from the center intermediate frequency. The positive and negative voltage excursions should be the same on either side of this frequency, and have a minimum amplitude of several volts. If these results are not obtained, and limiter tests have absolved the latter of blame, trouble in the discriminator is indicated.

A ratio detector is similarly checked, except that the VTVM is connected between the audio-output and half-load points—points A and B, respectively in Fig. 3. The VTVM's DC probe connects to point B; its "common" lead to point A.

Troubles in limiter and discriminator stages can be further localized by tube substitution, voltage, resistance and component replacement tests.

With regard to defects in other stages characteristic of FM sets:

Oscillator drift is one such trouble. If drift in the oscillator is excessive, the sound will either be severely distorted or else disappear altogether. Some early FM receivers used piston-type capacitors in the oscillator circuit as trimmers. Beside being very microphonic, they have a poor temperature coefficient. Substitution of air trimmers made of Invar, or negative coefficient Ceramicons, or a combination of both, will reduce oscillator drift to an acceptable minimum.

Other causes of oscillator drift include tubes (new tubes whose design is not suited to FM operation, as well as defective old ones, may cause trouble); poor regulation of the B supply; and inferior sockets. Replacement of ordinary bakelite sockets with mica-filled or steatite sockets often effects a marked diminution of oscillator drift. Monitoring the B supply feed to the oscillator with a voltmeter, and noting whether a voltage change has taken place when drift is noted, will determine whether the B supply is the source of trouble. (A filter condenser that has lost capacitance is a likely source of poor regulation.)

Instability of inductances and capacitances in the discriminator or ratio detector transformer will cause distortion or loss of volume. If frequent readjustment of the discriminator transformer is required, replacement of same is indicated.

Dynamic signal tracing with a sensitive scope and a demodulator probe is advocated in servicing FM receivers. An *amplitude-modulated* signal should be injected when stages preceding the discriminator are serviced, and the demodulator probe is used, since the latter will not respond to changes in frequency. A *frequency-modulated* signal should be injected, on the other hand, when the discriminator or succeeding stages are being checked.

Dynamic signal-tracing was used to locate an obscure trouble the writer ran into the other day. The complaint on this receiver was noise. A random crackling sound, suggestive of an arcing audio transformer, was audible at the speaker, together with the normal sound signal. Further investigation disclosed the fact that the crackling persisted whether or not an FM station was tuned in.

Tests made with a signal generator and scope indicated the presence of the noise at all points between the discriminator and the speaker, but not at the grid of the limiter—the stage directly preceding the discriminator. The trouble was finally isolated to leakage in the coil form between the primary and secondary windings of the discriminator transformer. Replacing the transformer verified as well as cured the trouble.

Servicing Interlace Problems

(*Continued from page 45*)

each field by the different video signals will therefore be unequal, upsetting interlace. As the video information is continually changing, the amount of displacement will vary, and a jiggling effect results.

It should be noted that only video information near the bottom of the picture can upset interlace. When the picture jiggles in and out of interlace only when a large area at the bottom of the picture suddenly becomes dark, it would be wise to scope-check the sync separator output for the presence of video signals. High-amplitude (black) video signals are probably causing incorrect triggering of the vertical oscillator in such cases.

Interlace may be upset by improper adjustment of the vertical hold control. The picture will hold over a small range of this control; obtaining the proper point in this narrow range is important. The adjustment will vary depending on signal areas. In weak signal areas, the vertical hold control should be set as follows: First set the control to make the picture roll slowly *downward* (this indicates that the vertical oscillator frequency is slightly higher than that of the sync pulse). Then advance the control setting just enough to stop the picture. The reason that this adjustment is best for weak signal areas lies in the fact that a small pulse will be sufficient to trigger the vertical oscillator (see fig. 4).

Some Disadvantages

It should be noted, however, that there are some disadvantages to this setting. When switching stations, the picture may roll slowly up to the lock-in position. Noise pulses will be able to upset synchronization of the oscillator easily. Interlace will be difficult to maintain for strong stations in this setting, since the bottom of the pulse causes triggering, and this portion tends to vary in amplitude from pulse to pulse.

In view of these considerations, it is preferable in strong or noise signal areas to advance the hold control further. The best adjustment probably is the point where it will just hold (before rolling rapidly *upward*) on the weakest station in the area.

Component defects in the vertical section that can also cause jiggling in and out of interlace include: leaky coupling condensers, a defective discharge condenser, overheated resistors, variations in B voltages, and so on. Any of these defects might produce slight variations in the amplitude of the vertical sweep signal, producing the jiggling of interlace referred to. One often-overlooked cause of steady loss of interlace is excessive sync pulse amplitude. When the vertical sync pulse amplitude is excessive, the equalizing pulses are unable to equalize the residual charges present in the integrator during each field, causing a displacement of the starting points of the two fields.

Excessive sync pulse amplitude is often the result of improper servicing. It should be remembered that the sync section contains mostly limiters, which require low B voltages. When servicing the set, these voltages should be maintained, otherwise excessively large sync signals may be produced.

It should be remembered that the purpose of servicing is *repair*, not re-design.

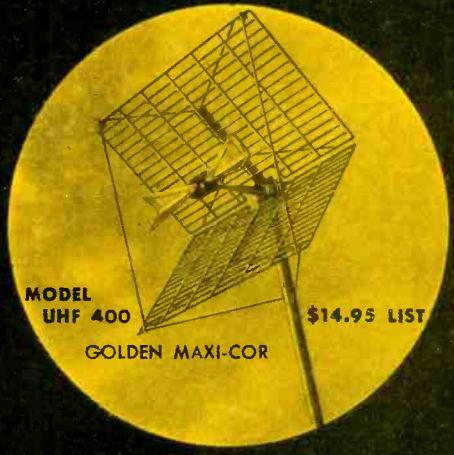
GOLD-COLORED ANTENNA...
FULL-YEAR GUARANTEE AGAINST RUST AND CORROSION...
ADVANCED HIGH-GAIN ANTI-VIBRATION DESIGN...

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

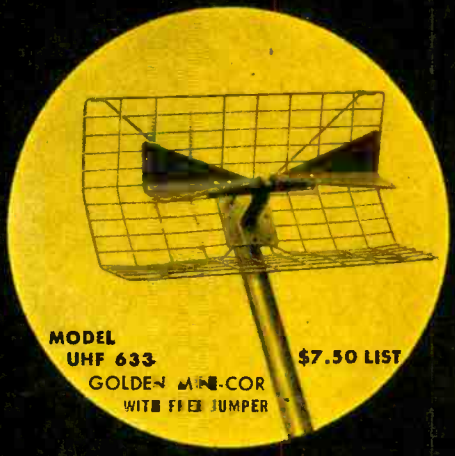
This JFD Gold-Shield Antenna is Guaranteed Against Rusting for 1 Year (normal use)

MODEL UHF 902 — $18.95 LIST
PARA-STAK



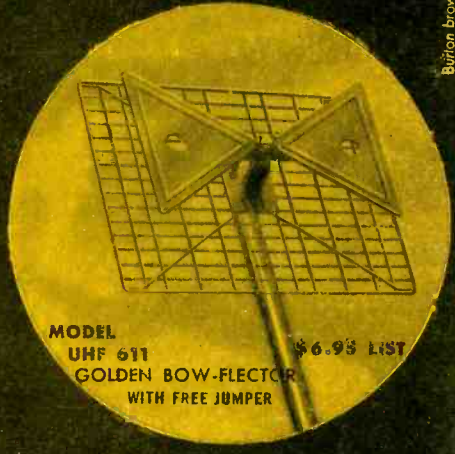
MODEL UHF 400 — $14.95 LIST
GOLDEN MAXI-COR

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 30C 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.
World's largest manufacturer of TV antennas and accessories

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MFRS' Catalogs & Bulletins

Waldom Catalog

Waldom Electronics, Inc., has published a new catalog of electronic components and Croname products. The catalog, No. 5C3, lists more than two thousand items in stock. Included are tuner assemblies; mask, glass and escutcheon kits; title plates, dial and switch plates; knobs; instrument drives and dials; terminal lugs, cases and dial locks; terminal strips; push-button and control knobs; TV replacement items and accessories, sockets and shield bases and other components. Copies are available from Waldom Electronics, Inc., 911 No. Larrabee St., Chicago 10, Ill.

Astron Stocking Guide

A new distributor stocking guide for twist-prong electrolytic capacitor inventory lists the number of models of each television make employing a given twist-prong capacitor. Copies of *Astron's Distributor Stocking Guide* may be obtained by writing the Astron Corporation, 255 Grant Avenue, E. Newark, N.J.

Transformer Catalog

The new Stancor transformer catalog carries complete electrical and physical specifications on almost 500 transformers for radio, television, high-fidelity, amateur, military, and other electronic applications. The TV section has been increased to 4 pages, listing 129 TV components. The high-fidelity section has been expanded to include the new miniature audio transformers. A cross-index chart between obsolete power transformers and the current "8400" series power transformers has been included. The catalog may be obtained from any Stancor distributor, or by writing the Chicago Standard Transformer Corp., Standard Division, Elston and Addison, Chicago 18, Ill.

Turner Technical Bulletin

A complete technical bulletin on the Turner UHF Converter Model TV-3 is now available. Copies may be obtained from parts jobbers or by writing to The Turner Co., 903 —17 St. N.E., Cedar Rapids, Iowa.

Channel Master Booklet

This 16-page booklet, titled *Antennas and Boosters,* is designed to help technicians understand the factors which determine the performance of TV antennas and boosters. Channel Master Corp. Ellenville, N.Y.

Perma-Power Catalog

A four-page catalog of the electronic equipment made by Perma-Power is now being distributed. Items listed include TV tube-brighteners and battery eliminators. Perma-Power Co., 4727 N. Damen Ave. Chicago 25, Ill.

Sprague Price List In New Form

A new condensed price list on all Sprague "bread and butter" service capacitors and resistors has just been announced by Sprague Products Company.

Mounted on a wall, under glass on a desk or counter, the sheet makes an ideal, ready reference of the most widely used Sprague ratings. Since catalog numbers are followed by both net and list prices, jobbers will find it a quick check on prices. Dealers will find it a convenient way to determine what the customer should pay, as well as an easy means of checking inventory of "must" components.

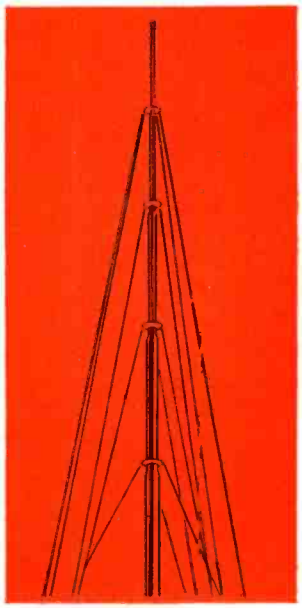
Available from any Sprague distributor, the new list P-143 may also be obtained by writing Sprague Products Company, 65 Marshall St., North Adams, Mass.

After-WARD You'll Install no Others.

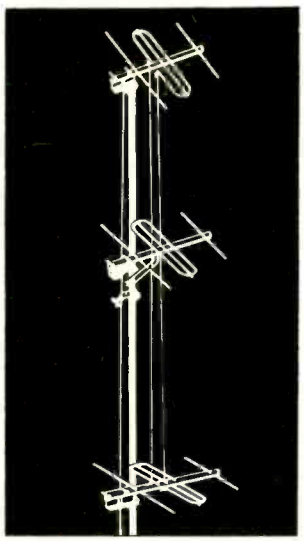
WARD will give you the "HI" in sales — the "HI" in profits you seek . . . WARD Antennas always create greater customer satisfaction. Remember, WARD will keep your inventory lower and cut your "call backs" . . .

Ask Your Distributor for the new Ward Ultra Hi-Line and Signaline Catalog.

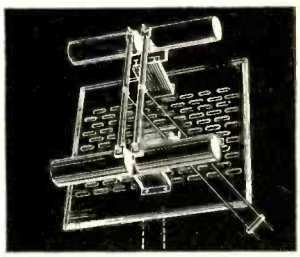
BOW TIE — Peak-A-Bow design with the only adjustoble screen on the market . . . Available in single and stacked models.



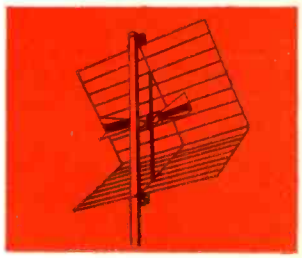
ZIP-HI MAST — Corrosion-proof 16 gauge permatube . . . easily assembled . . . in 2, 3, 4, 5 section models.



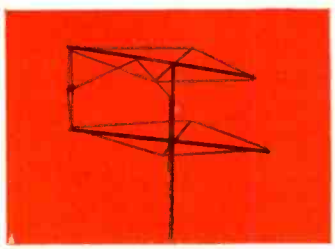
3 X 3 — Original development for UHF band composed of 3 stacked 3 element beams. Full wave spacing between bays . . . clean cut pattern with sharp forward lobe and no side lobes . . . cut to frequency . . . unsurpassed for near fringe and fringe areas.



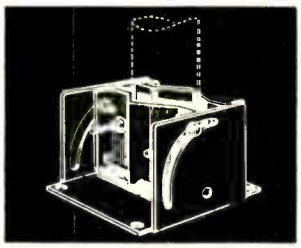
CAN-CAN — New lazy H design for entire UHF band . . . uni-directional pattern . . . sturdy compact unit . . . field tested and thoroughly proven.



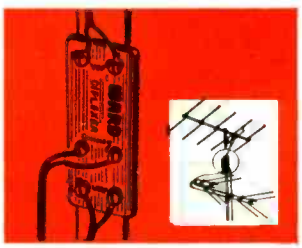
CORNER REFLECTOR — For semi-fringe areas . . . ruggedly designed to eliminate ghosts and vibration.



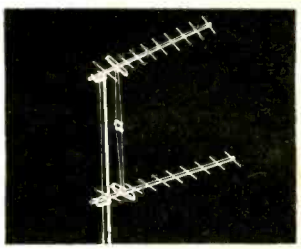
RHOMBIC — Highest gain of all UHF antennas . . . for fringe and super fringe areas.



HEAVY DUTY BASE — Ruggedly constructed to fit all masts from 1¼" to 2¼" O.D.



DIPLEXER — For separate UHF-VHF antennas . . . or for set and converters with separate UHF-VHF terminals . . . Foolproof . . . easily installed.



10 ELEMENT YAGI — Multi-channel series of 10 element UHF Yagis . . . Excellent for fringe areas . . . very directional . . . completely pre-assembled — single and stacked models.

A GABRIEL PRODUCT

THE WARD PRODUCTS CORP.

DIVISION OF THE GABRIEL COMPANY

1148 Euclid Avenue • Cleveland 15, Ohio • *in Canada: Atlas Radio Co., Ltd.*

NEWS of the REPS

Granco Appoints Reps

Granco Products, Inc. of Long Island City, N.Y., makers of UHF converters and components, has appointed ABM Sales Co. of Highland Park, Mich., Cartwright & Bean of Memphis, Tenn., Earl S. Dietrich Co. of Cleveland, O., Electronic Sales Co. of New York City, Gerber Sales Co. of Boston, Mass., Jack F. McKinney Sales Co. of Dallas, Texas, and L. L. Minthorne Co. of Portland, Ore., as manufacturers' representatives. Also named are Wm. J. Purdy Co. of San Francisco, Calif., Al J. Rissi of Los Angeles, Calif., John G. Twist Co. of Chicago, Ill., Allen I. Williams Co. of Denver, Colo., Wolfe-Marsey Sales Co. of Rochester, N.Y., and Wright Engineering Co. of Indianapolis, Ind.

Brach Names Reps

The Brach Manufacturing Corporation, Division of General Bronze Corp., Newark, N.J., announces the appointment of two new sales reps: F. J. Perna, mid-Atlantic states; Sam Hooker Co., New England.

Russell Ragon To Rep For UTC

United Transformer Company of 150 Varick St., New York, has just announced the appointment of Russell Ragon as industrial and jobber rep in the states of Wisconsin and Minnesota. Ragon was formerly purchasing agent for Engineering Research Associates in Minneapolis. He is presently located at 1406 West Idaho Avenue, St. Paul, Minn.

Koessler Becomes Rep

Frank B. Koessler has formed a manufacturers' representative organization to specialize in the high-fidelity sound-equipment field in the states of California, Arizona and Nevada. Joe Craig and Mrs. Lorraine Koessler have joined Koessler in the Los Angeles office. Koessler has plans to establish a San Francisco office in the near future.

Midwest Reps for GI Converters

General Instrument and Appliance Corp., a subsidiary of General Instrument Corp., Elizabeth, N. J., has appointed five new reps for its GI UHF TV converters. They are Eugene Loeb, of Milwaukee, for the state of Wisconsin; William Linz, of Chicago, for northern Illinois, and L. F. Waelterman, of St. Louis for southern Illinois, Missouri, Iowa, Kansas and Nebraska. For the state of Michigan, R. C. Nordstrom, of Birmingham, Mich., has been selected. Robert C. Whitesell & Associates, of Indianapolis, have been named for Indiana and Kentucky.

Pioneer Names Distrib and Rep

Pioneer Electronics Corp., Santa Monica, Cal., is providing for increased distribution of its television picture tubes in the San Francisco-Oakland Bay Area with the appointment of a distributor and a plant representative. The distributor is G. M. Popkey Co., Inc., San Francisco, who will handle Pioneer tubes for the entire Bay Area. The new plant representative, David Silverberg, will contact picture-tube dealers in Northern California. Pioneer has also established a warehousing facility for a full inventory of picture tubes in San Francisco.

Perma-Power Sets N. Y. Reps

The Perma-Power Co., 4727 North Damen Ave., Chicago, makers of C-Brite and Tube-Britener units, announces that Kaelber & Mack of New York City will be Perma-Power representatives in the metropolitan area of New York and the surrounding counties. Preston Mack will handle the Perma-Power products.

Leader Will Manufacture

Les Wildberg, president of Leader Electronics Inc., of Cleveland, Ohio, announced plans for his firm to enter into the manufacture and sale of TV equipment intended primarily for consumer use. The firm now produces special industrial switches.

Mallory Capacitor Sales Mgr.

Thomas M. Fitzgerald, Jr. has joined P. R. Mallory & Co., Inc. as sales manager of the capacitor division. He comes to Mallory from the Stewart-Warner Corporation, where he was chief administrative engineer for their South Wind Division for a period of two years. Prior to that, Fitzgerald was in business for himself, after having been associated with the General Motors Corporation as sales manager of the Fabricast Division for approximately three years.

Ulrich Joins Bogen

Vinton K. Ulrich has joined the sales staff of the David Bogen Co. Inc., 29 Ninth Ave., New York, as distributor sales manager. Ulrich was formerly renewal sales manager of the National Union Radio Corp. An M.I.T. graduate, he has also served as chief commercial engineer for CBS-Hytron. The Bogen Co. manufactures PA and intercom equipment, audio amplifiers, TV boosters, radio tuners, and UHF converters.

New Vee-D-X Sales Rep

Vee-D-X television antennas and accessories will be represented in Ohio, West Virginia and western Pennsylvania by Henry G. Maerlender. Mr. Maerlender was with the Burgess Battery Co.

NEW BOOKS

TV MANUFACTURERS' RECEIVER TROUBLE CURES, Volume 4. John F. Rider Publisher, Inc., 480 Canal Street, New York 13, N. Y. 115 pages, paper binding. $1.80

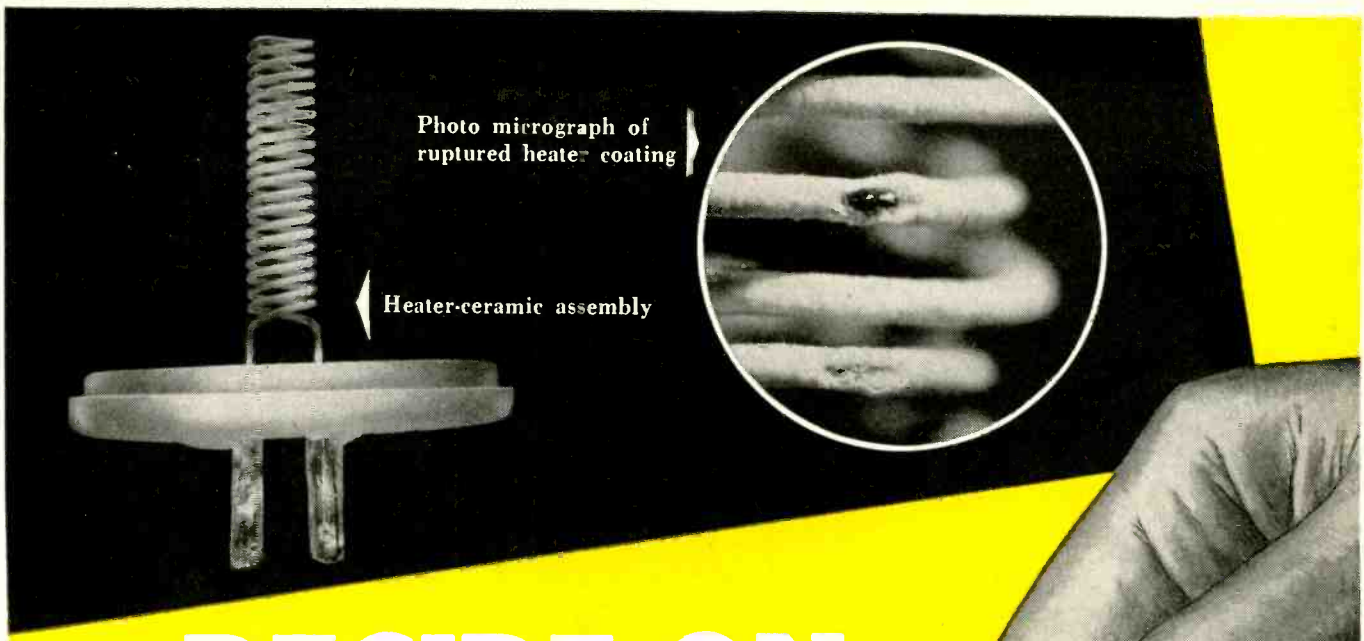
The fourth volume in this series, which lists the receiver manufacturers' remedies for TV receiver performance "bugs," contains data from the following set manufacturers: Philharmonic, Pilot, Radio & Television (Brunswick), RCA Victor, Remington (Rembrandt), Scott, Sears Roebuck, Sentinel, Setchell-Carlson, and Shaw TV. Each remedy listed comes directly from the receiver's own manufacturer. Listings are by manufacturer's name and model or chassis number. Volume 5 in the series is now in preparation.

ELECTRONIC CIRCUITRY FOR INSTRUMENTS AND EQUIPMENT, by Milton H. Aronson. Instruments Publishing Co., Pittsburgh 12, Pa. 310 pages. $4.

This book is intended to be used as a home-study course on fundamental electronic circuitry for instruments, communications, TV, laboratory apparatus, and military equipment. 458 multiple-choice home-study questions are provided, to enable the reader to check on what he has learned.

BASIC ELECTRONIC TEST INSTRUMENTS, by Rufus P. Turner. Rinehart Books, Inc., 232 Madison Ave., New York 16, N. Y. 254 pages. $4.

This book was written to fill the need for an accurate up-to-date work on test instruments used in the television, radio and general electronic field. Instruments covered include volt-ohmmeters, vacuum-tube voltmeters, power meters, impedance meters, capacitor checkers, inductance testers, oscilloscopes, signal generators, signal tracers, and other pieces of test equipment. Mr. Turner's style is clear and non-mathematical. Unnecessary theory has been eliminated.



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.

G.I. Stockholders Meet

At the recent annual stockholders meeting of General Instrument Corp. at its home plant in Elizabeth, N. J., Abraham Blumenkrantz, chairman of the board, told the stockholders that net profit was the greatest for any initial quarter in the 30-year history of the company. The company has broadened its activities in such fields as components for transistor application, printed circuits, color TV equipment and electronic materials for the defense program. Malcolm C. Hutchison, a retired vice-president of Irving Trust Co., was elected a director. Following the meetings of shareholders, directors declared the regular quarterly dividend of 25 cents a share. Shown in photo, left to right, are Alois Konecny, Jr., treasurer; Chairman Blumenkrantz, Monte Cohen, president; Edwin Freed, sales manager.

Erie Names Veeps

Erie Resistor Corporation of Erie, Pa., manufacturer of electronic components and custom-molded plastics, has named Allen K. Shenk and Jerome D. Heibel as vice-presidents. Shenk was named vice-president in charge of sales. He came to Erie in 1942 from W. S. Hill Company, Pittsburgh, and became assistant sales manager of the electronics division. Heibel has been appointed vice-president in charge of research and engineering. He joined Erie in 1936. Heibel was formerly in the engineering department of Talon, Inc., Meadville, Pa., as manager of the condenser division.

TRIPLETT 630 Volt-Ohm-Mil-Ammeter "speaks" for itself in any company

TRIPLETT 630 Volt - Ohm - Mil - Ammeter has many significant advantages and features that make it stand distinctly apart from similar instruments in its price class. Actually in components, in engineering, in minutely accurate performance, Triplett 630 closely approaches laboratory standards.

Since the scales of any VOM comprise the means by which it makes its multiple services most valuable, the legibility and easy-read-ability are of prime importance. Triplett engineers have created in Triplett 630 the longest scales available in this size tester. (The upper arc by actual measurement is four and three-eighth inches.)

This long-scale factor accounts for the ease with which precise readings are easily made. Further legibility is gained by use of black and red scale markings. D.C. and D.B. are black and white. A.C. and Ohm markings are red on white. Ohms from one hundred million to one-tenth ohm mark the range of this amazing scale. On low ohms, center scale reading is 4.5 ohms.

The Single Switch

Futher indication of the practical skill and engineering "know-how" behind Triplett 630 is the Single Switch. Its simplicity of operation assures no burn-outs thru momentary memory lapses. There is instant switching to desired circuit thru a single 2½" knob flush with the face panel. The molded switch itself embodies the most advanced engineering practices. Fully enclosed, the silvered contacts are kept permanently clean. Its rugged construction means stronger performance and longer life.

These two factors are but samples of the many ways in which on-the-job needs have been anticipated and provided for in a beautiful streamlined tester. It provides A.D-D.C. Volts, D.C. Micro-amperes, Milliamperes, Amperes, Ohms, Megohms, Decibel and Out Put readings in a no-short design embodying interior construction with all direct connections; no harness cabling. Its fool-proof unit switch construction houses precision resistors in insulated recesses in direct connection with switch contacts.

Study the following Ranges and descriptions and compare them point by point with *any* similar instrument for conclusive proof that Triplett 630 "speaks" for itself in *any* company.

Ranges

D.C. Volts: 0-3-12-60-300-1200—at 20,000 Ohms/Volt (For Greater Accuracy on TV and other High Resistance Circuits.)
A.C. Volts: 0-3-12-60-300-1200-6000—at 5,000 Ohms/Volt (For Greater Accuracy in Audio and other High Impedance A.C. Circuits.)
Decibels: —30, +4, +16, +30, +44, +56, +70. (For Direct Reading of Output Levels.)
D.C. Microamperes: 0-60—at 250 Millivolts.
D.C. Milliamperes: 0-1.2-12-120—at 250 Millivolts.
D.C. Amperes: 0-12—at 250 Millivolts.
***Ohms:** 0-1,000-10,000—(4,4-44 at center scale).
***Megohms:** 0-1-100—(4,400-440,000 center scale).
Output: Condenser in series with A.C. Volt ranges.

**Resistance ranges are compensated for greatest accuracy over wide battery voltage variations. Series Ohmmeter circuits for all ranges to eliminate possibility of battery drain when leaving switch in Ohms position.*

Get a Triplett 630 into your own hands at your distributor.
U.S.A. Dealer Net $39.50

TRIPLETT ELECTRICAL INSTRUMENT COMPANY
BLUFFTON, OHIO

TRIPLETT

Stacked Conical

(*Continued from page* 56)

reflector. Rods are mounted in the center of the reflector sections, just as in fig. 1A.

The spider web reflector must have the adequate protection of heavily-insulated wire to combat precipitation static. Under certain conditions in some fringe areas, excessive snow and poor picture quality are caused by precipitation static. This condition develops when wind-blown dust, sand, snow or fog is present. Electrical noise from these sources is mostly due to their charged particles hitting against, and imparting their charges to, the bare metal portions of the receiving antenna system. This kind of interference can be substantially reduced by applying a heavy insulating coating of varnish or plastic spray, or a covering of a waterproof compound, to the antenna and its wiring; also, by not having any exposed surfaces in the antenna system.

To obtain the full benefits of the spider web reflector, the efficiency of the lead-in wires must be taken into serious consideration. The best grade of transmission line is none too good. A 300-ohm transmission line that is coated with simonizing wax or silicone compound will not produce an annoying increase in the snow content of the picture during wet weather.

"Tough Dogs"

(*Continued from page* 58)

looking at the schematic for the umteenth time, we finally doped it out. If C-1 was leaky, the effect as far as AC (audio signal) was concerned, would be negligible, but the small DC current flowing through the recording head would cause it to act as an erase unit at the same time, wiping out the recording signal before the tape left the head. On the playback position, no symptoms would be present, since the record-playback switch disconnected the coil from the circuit containing the leaky condenser. Acting on this hypothesis, we changed C-1, replacing it with a .03 MFD 600 V type (instead of the 400 V type originally present). This procedure completely eliminated the trouble. *M. G. Goldberg, St. Paul, Minn.*

PRODUCTS ADVERTISED IN THIS ISSUE

501 Admiral Corp./Antenna masts
502 Aerovox Corp./HV ceramic capacitors
503 All Channel Antenna Corp./UHF-VHF antenna
504 Allied Radio Corp./Equipment catalog
505 American Phenolic Corp./UHF antennas
506 American Television & Radio Co./DC power supplies
507 Arco Electronics Inc./Paper tubular capacitors
508 Blonder-Tongue Laboratories/UHF converter
509 Bogen Co., Inc., David/Wireless intercom system
510 Bogen Co., Inc., David/AM-FM tuners, amplifiers
511 Channel Master Corp./Masts, UHF antenna
512 Cisin, H. G./Television service books
513 Cornell-Dubilier Electric Corp./Molded tubulars
514 DuMont Laboratories Inc., Allen B./Picture tubes
515 Electronic Measurements Corp./Signal generator
516 Federal Telephone and Radio Co./Selenium rectifiers
517 Finney Co./UHF-VHF antenna
518 Finney Co./UHF antennas
519 Fretco Inc./UHF-VHF antenna
520 Hickok Electrical Instrument Co./Oscilloscope
521 Hi-Lo TV Antenna Corp./UHF-VHF antenna
522 IE Manufacturing/Lead-in standoffs
523 International Resistance Co./Replacement controls
524 JFD Manufacturing Co., Inc./UHF antennas
525 Jensen Industries, Inc./Phonograph needles
526 K-G Electronics Corp./UHF-VHF indoor antenna
527 Kay-Townes Antenna Co./Primary area antenna
528 Kay-Townes Antenna Co./Fringe area antenna
529 Kay-Townes Antenna Co./VHF antenna
530 Kenwood Engineering Co., Inc./Chimney mount
531 Krylon Inc./Plastic spray
532 LaPointe Electronics Inc./VHF, UHF antennas; rotators
533 Littelfuse Inc./Fuses
534 Macmillan Co./Service books
535 Mallory & Co., Inc., P. R./UHF converter, vibrators, capacitors, controls
536 National Electric Products/Masts, brackets, mounts
537 National Union Radio Corp./Diodes, transistors
538 Oelrich Publications/Business forms
539 Philco Corp./Test equipment
540 Precision Apparatus Co., Inc./Test equipment
541 Presto Recording Corp./Phonograph turntable
542 Radiart Corp./Lightning arrester
543 Radiart Corp./Antenna rotor
544 Radio Corp. of America/Store identification plan
545 Rauland Corp./Picture tubes
546 Raytheon Manufacturing Co./Radio and TV tubes
547 Regency Division, IDEA, Inc./Boosters, converters
548 Rohn Manufacturing Co./Towers, masts
549 Shure Brothers Inc./Microphone
550 Sola Electric Co./Constant voltage transformers
551 South River Metal Prods. Co., Inc./Chimney mounts
552 Sprague Products Co./Capacitor replacements
553 Sylvania Electric Products Inc./Picture tubes
554 Tech-Master Products Co./TV chassis
555 Terminal Radio Corp./Audio catalog
556 Tricraft Products Co./Yagi antenna
557 Trio Manufacturing Co./VHF antenna, antenna rotator
558 Triplett Electrical Instrument Co./Multimeter
559 Tung-Sol Electric Inc./Picture tubes
560 Turner Co./UHF converter
561 United Technical Labs./TV pattern generator
562 Walsco Electronics Corp./UHF converter
563 Ward Products Corp./UHF antennas
564 Weller Electric Corp./Soldering gun
565 Wells & Winegard/VHF, UHF antennas
566 Westinghouse Electric Corp./Tube guide book
567 Wincharger Corp./Antenna support

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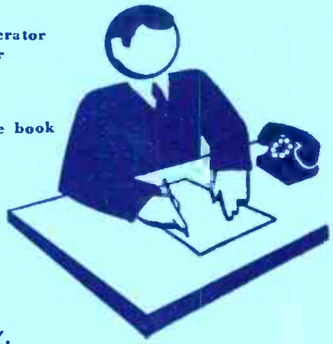

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Do you know the newest products and the latest developments in

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Make TECHNICIAN *Your* Information Center

Right now, 44,000 technicians and service managers receive their most urgent technical information from TECHNICIAN'S now-famous Circuit Digests. By January 1954, 50,000 will receive it.

In every issue, numerous other editorial features go right to the root of the technician's problems. In addition, TECHNICIAN advertisers put on a constant parade of new products and new ideas.

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Are you fully informed and equipped to cope with the spread of service to MORE CUSTOMERS, NEW COMMUNITIES, LARGER AREAS? And, of course, MORE COMPLEX CIRCUITS?

With the fantastic growth of service facilities and personnel to take care of 25 million television sets and 120 million radios, the service profession is faced with many opportunities and problems.

Right now, any one of them might send you scurrying for information—with a profitable service job at stake.

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Trade surveys have shown that TECHNICIAN is now the preferred TV-electronic service monthly. It has the largest readership among men who are professionally engaged in servicing. From the editorial and advertising pages, you will get important information on such subjects as:

1 — Improvements in newest picture tubes.
2 — Areas ready for TV installation and service.
3 — Latest developments in UHF conversion.
4 — Suggestions on the use of printed circuits.
5 — Products having heavy consumer advertising.
6 — A schematic isolating and explaining color circuitry.
7 — Test equipment for UHF and VHF ranges.

Don't miss TECHNICIAN'S many service articles—all written for practical help to the active members of the profession. Use TECHNICIAN to get more information on any product or service advertised in this issue. See list of manufacturers on previous page.

Fill out these postage-free cards and drop in the mail. You will receive the desired information direct from the manufacturers.

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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).
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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.

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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-1209, 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.

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Company_____

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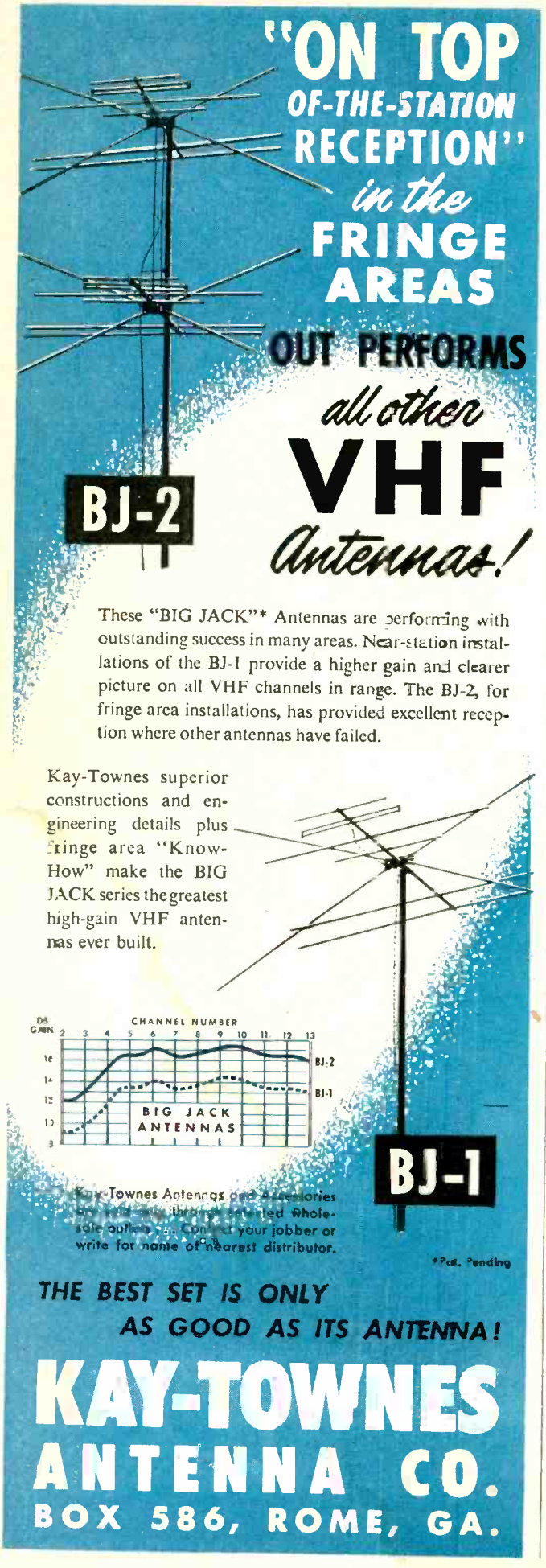

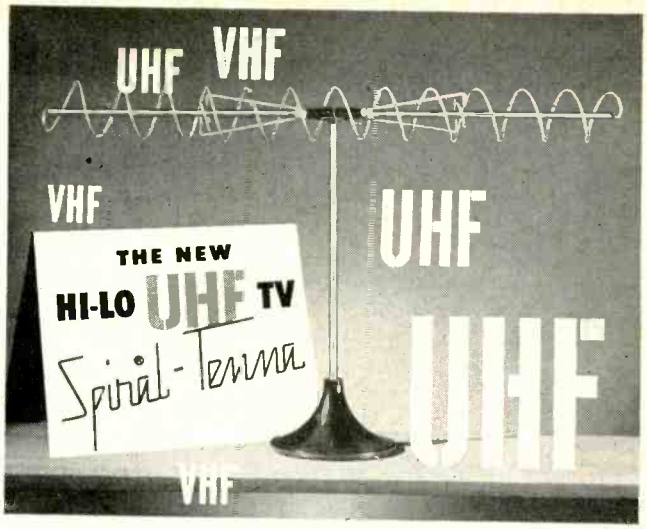

Model 202 U-V

Peak Performance for Indoor UHF and VHF Television Reception

Now — the nationally advertised, consumer accepted HI-LO TV Indoor Spiral-Tenna is applicable for both VHF and UHF with our exclusive UHF antenna adapter from channels 2-83. But, you still get the volume by selling at the same low, low price.

The Hi-Lo UHF antenna adapter is available separately for all previous HI-LO antennas. List Price $2.00.

Sold by recognized jobbers

at the same low list price!

U. S. Patent No. 2,495,579 Canadian patents 1951 — other patents pending

ORDER HI-LO UHF-VHF TV Spiral-Tenna TODAY!

Hi-Lo TV ANTENNA CORP.
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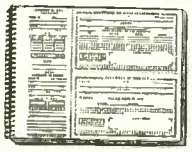
$9.95 LIST PRICE



A Good Guarantee Can Mean Dollars

(*Continued from page* 43)

If the call is *not* of the "nuisance" type, and there is something wrong in a section of the receiver not covered by the guarantee, this fact should be explained to the customer. A non-technical explanation that a receiver is made of many stages, each differing in function, is not difficult to make clear. It should then be pointed out that the new trouble (as evidenced by the symptoms) is located in a portion of the receiver other than the one that was recently repaired. The repair called for therefore represents a new job and must be charged for accordingly. If the explanation has been made properly, the result is generally satisfactory to both customer and technician; the customer feels that he has received some education in the workings of his television receiver, and the technician has painlessly brought in a new repair job.

Successful Application

One serviceman who adopted this procedure described its operation as "terrific" and related the following incident. About two months after having repaired a sync circuit defect (which he guaranteed) he received a call from the lady customer complaining of complete loss of picture. He responded to the call and found that the video amplifier tube was defective. After an explanation, he replaced the tube, charging only for the latter. The lady was so pleased by the explanation and the low cost of the service call that she sat down and wrote a letter to the service shop owner. The letter praised his guarantee and his method of fulfilling it; it also described her satisfaction with the performance of the repaired TV set. The dealer used this letter (after getting permission to do so) in an advertisement in the local weekly paper. The response, in the form of new business, was excellent, particularly from people who lived in the same section as the letter writer. Needless to say, this service dealer is now a firm believer in the policy of giving and backing up service guarantees.

While there is not now in existence any standard form of guarantee, with respect to the period of coverage and other phases, groups of service technicians throughout the country are taking steps to develop

one. There is no doubt that a guarantee helps to raise service standards in the industry, promotes better customer relations, and puts dollars into the serviceshop owner's pocket.

Is *your* guarantee policy "paying off?"

UHF Converters

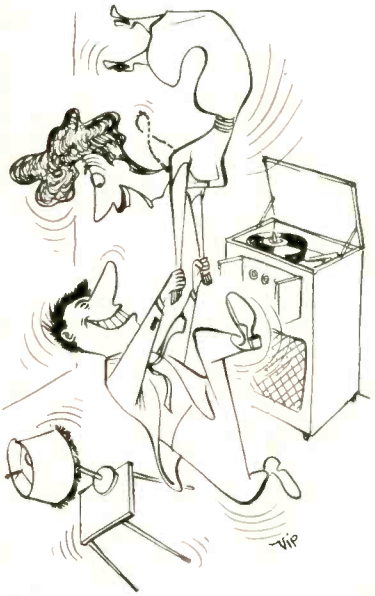
(*Continued from page* 35)

To determine if the oscillator is working, check its grid bias. A bias reading of at least —1 V should be obtained, if the oscillator is functioning properly. In some converters, a bias reading of less than —3 V is a sign of trouble. The bias reading will normally vary as the tuning shaft is rotated to different frequency settings.

This bias check should be made with a VTVM. A 1-meg resistor with very short leads should be connected in series with the DC probe of the meter.

If zero or insufficient bias is measured, check the oscillator plate voltage. Excessive plate voltage indicates that little or no plate current is flowing, in spite of the absence of

(*Continued on page* 88)



"Dancing's a lot more exciting when we use a JENSEN NEEDLE!"

adequate bias. One or several new tubes may be tried; if the trouble persists, other voltage measurements and resistance tests should readily localize the fault to the component responsible.

If these tests do not reveal the trouble, check for: poor soldered connections on oscillator plate and grid capacitors; loose plates on the oscillator trimmer capacitor; cold solder joints, particularly in tuned circuits. Sweat any suspicious connections.

Make sure that the lead dress of components or wiring is not disturbed during the course of trouble-shooting, to prevent the introduction of misalignment into the converter.

When a VTVM is not available, the oscillator may be roughly checked for operation as follows: Measure the "B" current flowing in the converter with a milliammeter; leaving the meter in the circuit, bring a screwdriver near the oscillator tuned circuit. A rise in current indicates that the oscillator was functioning, and that the screwdriver decreased or eliminated the oscillator output by detuning the tank circuit.

Normal Converter Drift

In some converters 15 to 30 minutes may elapse before the converter reaches a satisfactory degree of stability. This is especially apt to be true when the converter is used with a split-carrier TV set. Recently-built units are much less apt to manifest symptoms of this kind than those constructed last year.

Vertical Retrace

(*Continued from page* 31)

CRT cathode circuits. These changes apply only to RF chassis units 33, 35, 37 and 38, and power chassis C2, CPI and F2; variations for other chassis types are described in the publication previously mentioned.

Note in fig. 11 that the vertical spike is *positive* at the tap-off point, and is therefore applied to the *cathode* of the picture tube, the video signal being fed to the grid. Because the peak-to-peak voltage at the plate of the output tube is about 250 V—much more than is needed for blanking—it is dropped down to the proper amount by means of R1, R2, C1 and C2.

A series of RCA models that came out between 1949 and 1951 may be readily modified for retrace blanking. Some of these sets use an auto-

(*Continued on page* 92)

FIRST

before the race begins!

Yes, even before the first issue of TECHNICIAN was published (September, 1953), we knew that the nation's TV-electronic technicians would prefer it to all other publications in the field.

Here's why: In April, John Falkner Arndt & Company, advertising agency for International Resistance Co. and Weller Electric Corp., conducted a survey, asking Philadelphia servicemen: "What radio-TV publication do you read regularly?" Their overwhelming choice for first place was: *Television Retailing* TECHNICIAN.

Remember — at that time, TECHNICIAN was just a part of *Television Retailing*. So, *before* it had become a full fledged magazine, TECHNICIAN was already first in the service-magazine preference race.

And... if TECHNICIAN was out front as just a section of a magazine—*what a lead it's going to take now that it's a complete magazine!*

CALDWELL-CLEMENTS, INC., 480 Lexington Ave., New York 17, N. Y.

The nation's servicemen say— "TECHNICIAN's Circuit Digests are the greatest service ever offered by any publication."

"... what every TV technician must have on every set to be serviced, and fills the bill to the letter."
H. Jessen, Sr., Radio-Tel. Service
Mountain View, California

"TECHNICIAN . . . so far received are far ahead of other sources of data in up to date information."
K. A. Richardson
Lyndonville, New York

"I believe that it would be a great help to me in trouble shooting . . . putting this vital information in a concise and inexpensive form."
J. Nanes, Nanes Television Service & Repair
Toledo, Ohio

"... beneficial to our business."
J. D. Root, Service Mgr., Root Radio & Television
Newport, Kentucky

"I think this idea is excellent. It seems to help fill in a bad gap in servicing new models."
C. Mathewson, Mathewson Radio & Television
Largo, Florida

"... everything nicely condensed, on easy to handle paper, in an easy style, covering every set made and serviced."
J. Churgo, John Churgo Radio & TV Service
Coldwater, Michigan

"I think it is a wonderful service."
R. V. Witt
Riviera Beach, Florida

"... it will certainly help out in the shop."
R. L. Hutchison, Dick's Radio Service
Denver, Colorado

"... it is a terrific help to us."
R. S. Fallgatter, R. S. Fallgatter Radio
Denver, Colorado

"I believe you are giving us servicemen the greatest information that is available."
J. O'Shea, O'Shea Radio, TV & Electric Service
Jersey City, New Jersey

"... give a very clear picture of the latest models and I believe they will help me greatly to service these latest sets."
I. E. Liscum, Liscum's Radio & TV Service
Schenectady, New York

"Something we've been waiting for without hope."
M. Tworck, Tworck's Electric
Detroit, Michigan

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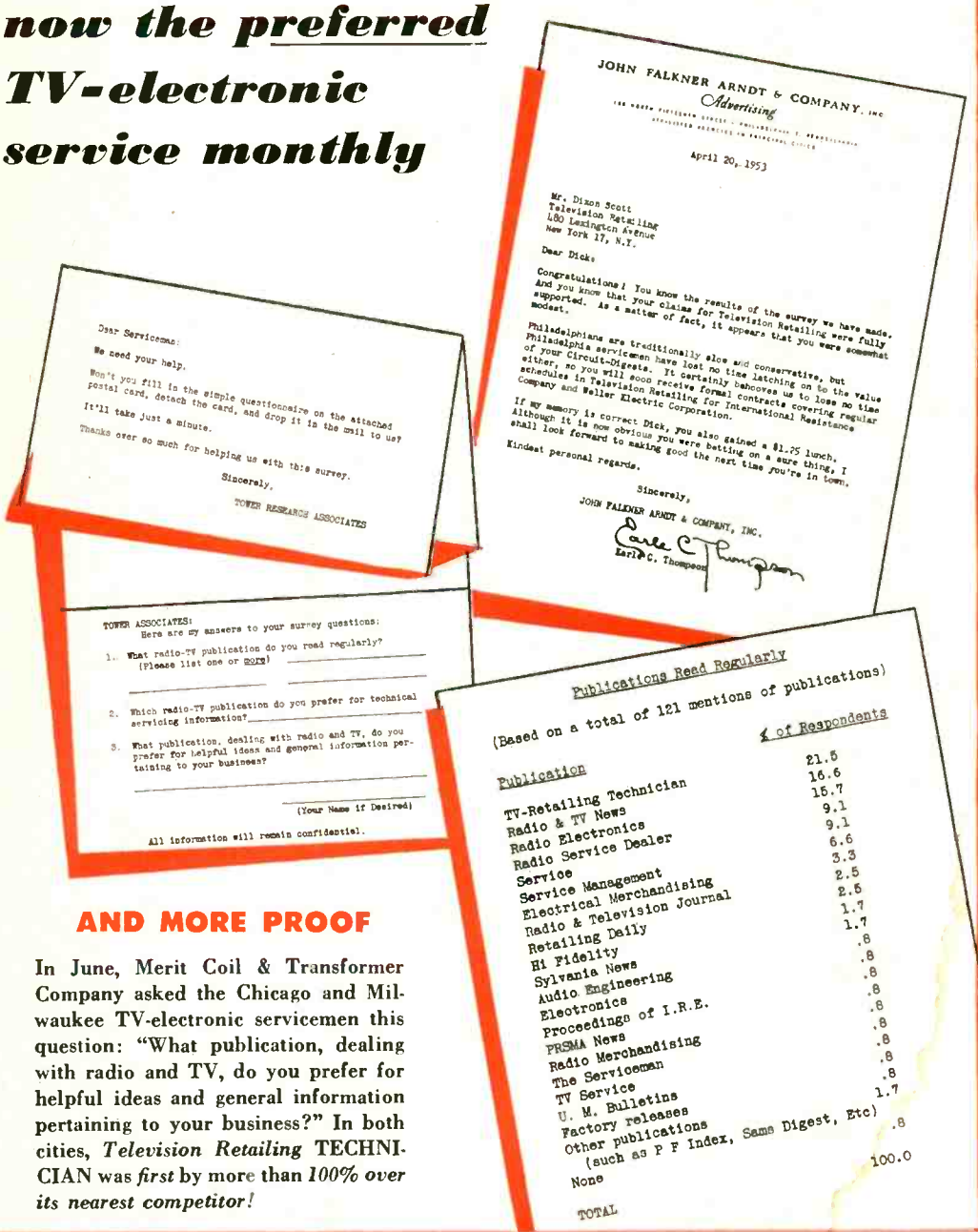
now the preferred TV-electronic service monthly



JOHN FALKNER ARNDT & COMPANY, inc
Advertising

April 20, 1953

Mr. Dixon Scott
Television Retailing
480 Lexington Avenue
New York 17, N.Y.

Dear Dick:

Congratulations! You know the results of the survey we have made. And you know that your claims for Television Retailing were fully supported. As a matter of fact, it appears that you were somewhat modest.

Philadelphians are traditionally slow and conservative, but Philadelphia servicemen have lost no time latching on to the value of your Circuit-Digests. It certainly behooves us to lose no time either, so you will soon receive formal contracts covering regular schedules in Television Retailing for International Resistance Company and Weller Electric Corporation.

If my memory is correct Dick, you also gained a $1.75 lunch. Although it is now obvious you were betting on a sure thing, I shall look forward to making good the next time you're in town.

Kindest personal regards.

Sincerely,
JOHN FALKNER ARNDT & COMPANY, INC.
Earle C. Thompson

Dear Serviceman:

We need your help.

Won't you fill in the simple questionnaire on the attached postal card, detach the card, and drop it in the mail to us?

It'll take just a minute.

Thanks ever so much for helping us with this survey.

Sincerely,
TOWER RESEARCH ASSOCIATES

TOWER ASSOCIATES:
Here are my answers to your survey questions:

1. What radio-TV publication do you read regularly? (Please list one or more)
2. Which radio-TV publication do you prefer for technical servicing information?
3. What publication, dealing with radio and TV, do you prefer for helpful ideas and general information pertaining to your business?

(Your Name if Desired)

All information will remain confidential.

Publications Read Regularly

(Based on a total of 121 mentions of publications)

Publication	% of Respondents
TV-Retailing Technician	21.5
Radio & TV News	16.6
Radio Electronics	15.7
Radio Service Dealer	9.1
Service	9.1
Service Management	6.6
Electrical Merchandising	3.3
Radio & Television Journal	2.5
Retailing Daily	2.5
Hi Fidelity	1.7
Sylvania News	1.7
Audio Engineering	.8
Electronics	.8
Proceedings of I.R.E.	.8
PRSMA News	.8
Radio Merchandising	.8
The Serviceman	.8
TV Service	.8
U. M. Bulletins	1.7
Factory releases	
Other publications (such as P F Index, Same Digest, Etc)	.8
None	
TOTAL	100.0

AND MORE PROOF

In June, Merit Coil & Transformer Company asked the Chicago and Milwaukee TV-electronic servicemen this question: "What publication, dealing with radio and TV, do you prefer for helpful ideas and general information pertaining to your business?" In both cities, *Television Retailing* TECHNICIAN was *first* by more than *100% over its nearest competitor!*

TECHNICIAN 1 CIRCUIT DIGESTS
TECHNICIAN 2 CIRCUIT DIGESTS
TECHNICIAN 3 CIRCUIT DIGESTS
TECHNICIAN 4 CIRCUIT DIGESTS
TECHNICIAN 5 CIRCUIT DIGESTS
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TECHNICIAN 10 CIRCUIT DIGESTS
TECHNICIAN 11 CIRCUIT DIGESTS
TECHNICIAN 12 CIRCUIT DIGESTS
TECHNICIAN 13 CIRCUIT DIGESTS

". . . something that has been needed for a long time and you surely deserve credit for being the first to bring it to the service field. It contains a wealth of information for the serviceman."
G. H. Doty, Doty Radio Sales & Service
Dayton, Ohio

"It's good, it's great—I like it."
T. Love, Ted Love Radio
Trenton, Missouri

". . . the answer to the TV technician's prayer."
F. P. Lea, Lea Radio Service
Portland, Maine

"This is something that servicemen have been dreaming of for years . . . In addition, one is able to anticipate tube requirements of new models."
R. C. Hull, East Brady Electric Shop
East Brady, Pennsylvania

"I find it timely and a great help for anyone who services all makes of TV."
G. Barrere, Radio & TV Service Eng.
New York, New York

". . . greatest thing ever done to help service dealers."
R. O. Hoch, Radio & Sound Service
Philadelphia, Pennsylvania

". . . loaded with first class information, a boon to servicemen who take pride in their work."
F. Droesch, Droesch Radio Service
Flushing, New York

"Finally someone has come out with what every serviceman needs; advance schematics of popular sets."
C. Rocco, Hammond Radio & Electronics
White Plains, New York

"The special technical section really completes everything for the TV man and makes the digest invaluable."
B. Notte
Philadelphia, Pennsylvania

"It definitely helps us a great deal when we get these circuits, because it is some time before they appear in the manuals."
F. E. Berdy, Manfred's Radio & Television
Paterson, New Jersey

"Your company has undertaken a very much needed service. Circuit Digests which no doubt will improve relations between manufacturer, customer and the service man."
F. McClelland, C. H. Davis, Inc.
Ardmore, Pennsylvania

transformer type vertical output transformer; others employ the two-winding type of transformer. The same general treatment may be given to both types, with the vertical blanking spike applied to the CRT cathode, as in the case of the Philco receivers previously referred to. Inasmuch as two million of these receivers, approximately, were manufactured, plenty of jobs are waiting to be done on these models alone.

Fig. 12a shows the simplified schematic for the following 1949 RCA 10 and 12-inch models: 9T246, 9T256, 9TC247, 9TC245, 9TC249. The same circuit was used in these 1950 models: T100, T120, T121, TC125, TC124, TC127. Note particularly the points marked A and B. These are the two points between which only two components need be added to do the entire job satisfactorily. Further-

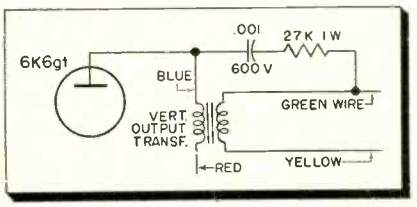

Fig. 14—Additional components (.001 MFD condenser, 27K 1 W resistor) to add to RCA '51 models when retrace blanking at very high brightness settings is desired.

more, an examination of the bottom of the chassis will show that these two points are *adjacent* tie points in almost the exact center of the chassis works, (A) being a green lead and (B) a yellow lead. Could anything be simpler?

Figure 12b shows how the divider network operates to cut the approximately 100-volt pulse available down to half this amount. The 1000-ohm resistor is not essential, but is desirable for two reasons: one, it cleans up the pulse, and two, it gives a certain amount of protection in case of the breakdown of C1. This condenser should be rated at 600 volts, to minimize the likelihood of such a breakdown.

The circuit shown in fig. 12a will remove retrace lines except at very high settings of the brightness control. If further reduction is desired, change C-2 to a .05 or even a .03 MFD unit.

On 1949 RCA models 9T240, 9T272, 9TC240, 9TC272, and on 1950 models T164, TC165, TC166, TC167 and TC168, a two-winding vertical output transformer is used, as shown in fig. 13a. The same circuit revision may be used as in fig. 12a. Point A is again the green lead to which the 1000-ohm resistor is connected; point B is only two inches away on the chassis, making the job very simple. C2 can be changed as in the

previous case, if required.

On RCA 1951 models, A and B are five inches apart on the chassis (see fig. 13b). The same general change is made as in the earlier models. The '51 models referred to are 6T53, 6T54, 6T64, 6T65, 6T71, 6T75 and 6T76. To see how easy these jobs are to change over, look at fig. 13b. This sketch, which shows a fraction of the parts layout on the bottom of the last-mentioned models, pictorially indicates the tie points to which the two added parts are connected. With this sketch in view, turn the RCA chassis over, locate the two tie points, add the resistor and C-1 and the job is done! If more blanking pulse voltage is required, change C-2 to .02 MFD, 600 V.

When the owner of one of these RCA models wants retrace lines eliminated at far-advanced brightness control settings, the circuit shown in fig. 14 may be added to the one previously described. This circuit provides an increased blanking pulse voltage of the proper polarity. The circuit change can be made very easily, since the points of connection are only three inches apart, with just enough separation between them for the parts to be connected in without additional wiring.

NEDA Convention Sponsors

The following firms will have booths at the National Electronic Distributors Assn., annual convention in St. Louis, Sept. 14-16:

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New Transistors by Sylvania

Sylvania Electric Products Inc. announces that it has developed two new types of transistors, tiny crystal devices that promise to greatly expand the field of electronics. A "tetrode transistor" is now available commercially. Final tests on a "pentode transistor" that is expected to become commercially available later this year are being made.

INDEX TO ADVERTISERS
SEPTEMBER, 1953

While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.

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"RECTIFIER RED"

the new product-line color for

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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!

Look for *"Rectifier Red"*... get the performance that *clicks* . . . the replacement profit that *sticks*! See your Federal Distributor for Federal miniatures in handy 8-unit kits . . . in quantity lots . . . or in individual packages sold through Federal's self-service rectifier dispenser... on hundreds of counters! See *your* "FTR" Distributor now, or write to Dept. F-754.

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In Canada: Federal Electric Manufacturing Company, Ltd., Montreal, P. Q.
Export Distributors: International Standard Electric Corp., 67 Broad St., N. Y.

Frequency Chart of the

TELEVISION & RADIO CHANNELS

Get Familiar with the FCC Broadcasting and Other Frequencies of Importance to You in Your Service Work

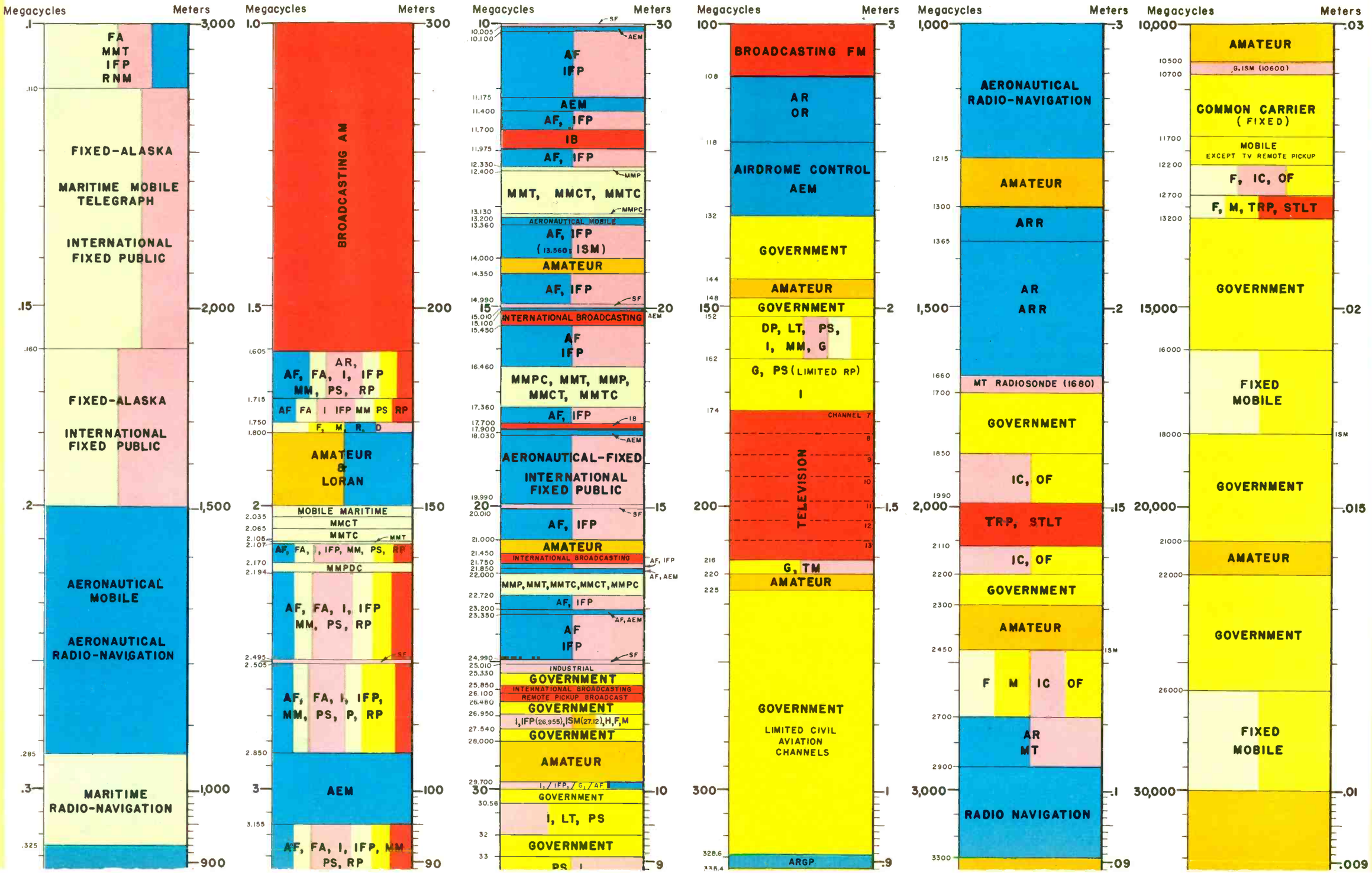
ALL FREQUENCIES ARE SHOWN IN MEGACYCLES – ONE MEGACYCLE = 1000 KILOCYCLES – ALL WAVELENGTHS ARE SHOWN IN METERS

For convenience of Service Technicians, we have marked in RED all channels carrying AM, FM, TV and International Broadcasting—the channels with which you are probably most concerned.

Supplement to September 1953

TECHNICIAN

(Formerly the Technician Section of Television Retailing)
With "Circuit Digests"



Depend on Mallory
for
Approved Precision Quality

This Service Job Will Stay "Sold"!

with Mallory Capacitors

For good reason, too. Mallory FP capacitors were used. They are engineered to duplicate the electrical characteristics of the original part in any TV or radio set that comes into your shop. They will give performance that's equal to . . . and often better than . . . the original equipment. You can count on Mallory FP's for precision quality . . . no call-backs.

Mallory FP's are the only fabricated plate capacitors available to the replacement market. They'll give you long lasting performance at high temperatures and greater ripple currents . . . even at 185° F. (85° C.).

When you use Mallory FP capacitors for all your service work, you can be sure that every job is right the first time. It just doesn't pay to take chances on capacitor performance. Always specify *brand* as well as rating when you order . . . ask for Mallory and watch your call-backs fall away to nothing. It costs no more to be sure with Mallory.

For plastic tubular replacements, ask your distributor for Mallory Plascaps®. They will put an end to premature shorts . . . leakage . . . off center cartridges . . . and unsoldered leads.

RIGHT The First Time!

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THE Mallory Midgetrol in his hand is the answer . . . the answer to long, dependable service for the set he is working on. Mallory Midgetrols® are engineered to match the electrical characteristics of the original equipment in any TV or radio set. From the standpoint of performance and long life, they are equal to . . . and often better than . . . the original control. Midgetrols are designed to save you precious time.

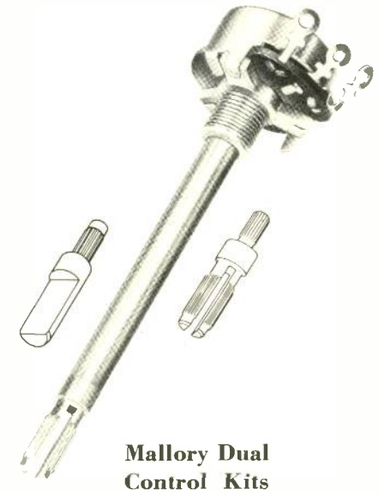
Round tubular shafts are built for fast, accurate cutting . . . fit split-knurl and flatted-type knobs.

AC switches may be attached instantly without disassembling the control.

Their unique design simplifies inventory problems . . . always available from your Mallory distributor.

Be sure *every* job is right the first time . . . use Mallory Midgetrols for *all* your service work.

Here is another time saver. The Mallory Control Guide is a complete cross reference between set manufacturers' part numbers and the equivalent Mallory control. Ask your distributor for your copy.



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Each of three popular kits of controls and switches will service over 50 different models of radio and TV sets. Housed in an attractive 3-drawer metal cabinet. You pay only for the controls and switches; the cabinet is yours at no additional charge. Details available from your Mallory distributor.

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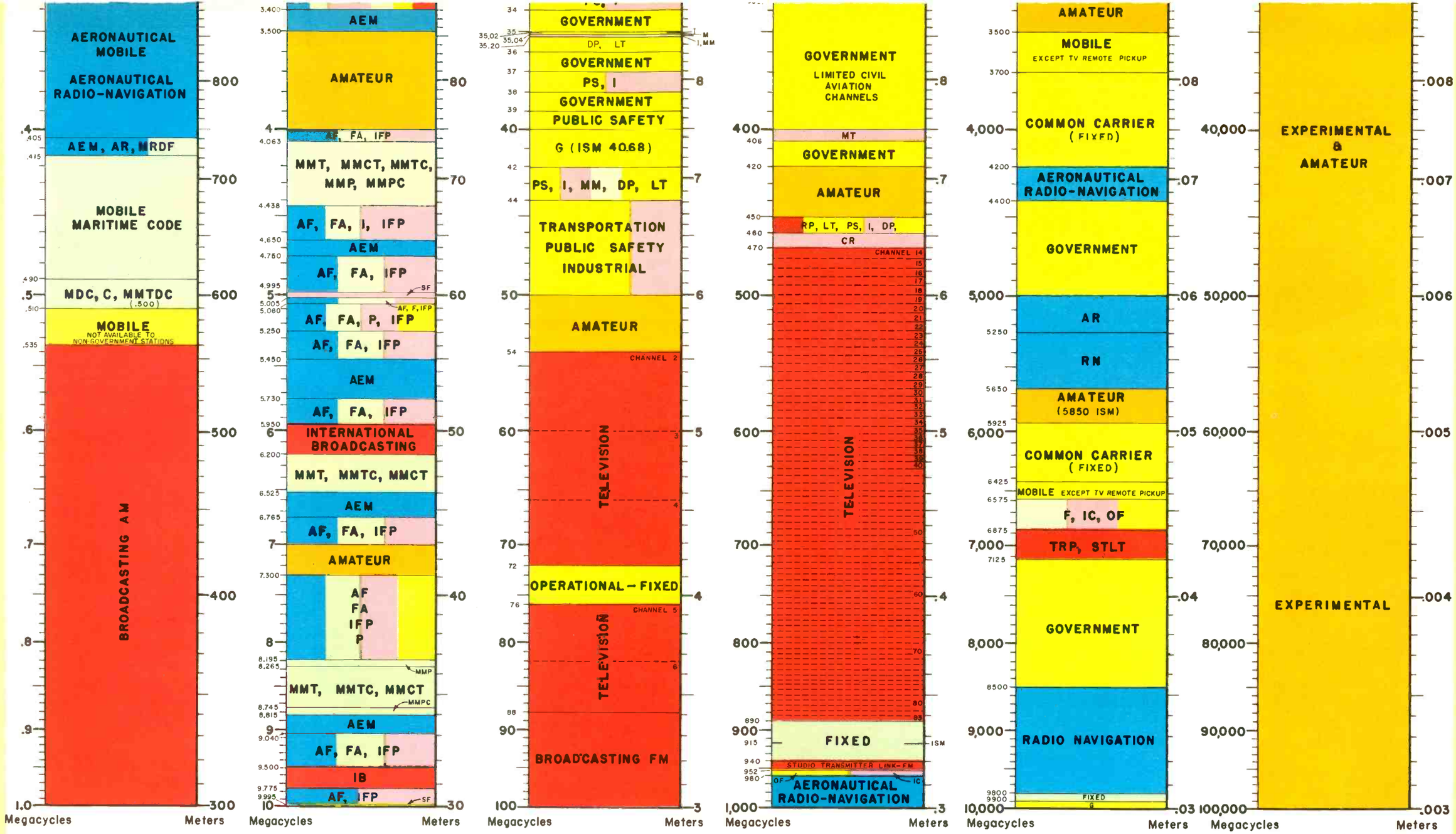

Note: All allocations shown are final. The section from 2 to 20 megacycles is expected to become effective sometime during 1954.

Index to Abbreviations and Key to Chart Color Groupings

MARINE | BROADCASTING | AERONAUTICAL | PUBLIC SERVICE | MISCELLANEOUS | EXPERIMENTAL

AC	Airdrome Control	C	Coast	FA	Fixed-Alaska	ISM	Industrial Scientific Medical	MMP	Maritime Mobile Phone	OF	Operational Fixed	RNM	Radionavigation Mobile
AF	Aeronautical Fixed	CC	Common Carrier	FM	Frequency Modulation Broadcasting	L	Loran	MMT	Maritime Mobile Telegraphy	OR	Omni-Directional Radio Range	SF	Standard Frequency Transmission
AEM	Aeronautical Mobile	CR	Citizens Radio	G	Government	LT	Transportation	MMCT	Maritime Mobile Coastal Telegraphy	P	Police	STL	Studio Transmitter Link-FM
AR	Aeronautical Radio-Navigation	D	Disaster	H	Amateur	M	Mobile	MMPC	Maritime Mobile Phone Coastal	PS	Public Safety	STLT	Studio Transmitter Link-TV
ARR	Aeronautical Radio-Navigation Radar	DP	Domestic Public	I	Industrial	MM	Maritime Mobile	MMTC	Maritime Mobile Telegraphy Calling	R	Radiolocation	TM	Telemetering
ARGP	Aeronautical Radio-Navigation Glide Path	EX	Experimental	IB	International Broadcasting	MT	Meteorological Aids	MRDF	Maritime Radio Direction Finding	RN	Radio Navigation	TRP	TV Remote Pickup
BAM	Broadcasting AM	F	Fixed	IC	International Control	MDC	Mobile Distress Calling	MMPDC	Maritime Mobile Phone Distress and Calling	RP	Remote pickup broadcast	TV	Television Broadcasting
				IFP	International Fixed Public			MMTDC	Maritime Mobile Telegraphy Distress and Calling				

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"...and BE SURE the VIBRATORS are MALLORY!"

That's the best way to be sure your service jobs stay "sold". You can depend on Mallory Vibrators to give more years of service. Their precision quality is the answer to time-wasting call backs. These are just two of the reasons why 5 out of 6 service men prefer Mallory for all their service work.

And the preference doesn't end there. They are more widely used as original equipment than all other makes combined. The patented, tuned mechanism in Mallory Vibrators gives better performance because:

Slow contact make . . .
means less wear

High contact pressure . . .
means low resistance

Fast clean break . . .
means reduced arcing

The next time you order vibrators . . . be sure to ask for Mallory. You'll get better vibrators, available in a complete line, meeting original equipment specifications . . . yet they cost no more. You can be sure that every service job is done right the first time.

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In 2 Sections • Section 2

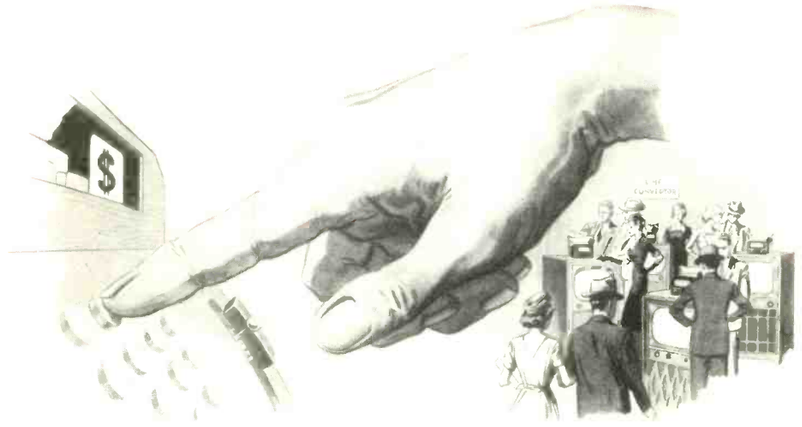
September • 1953

With Complete Spectrum Chart

TECHNICIAN

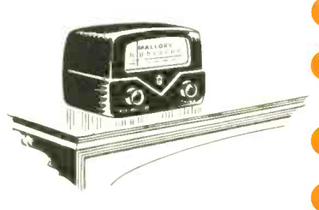
Showing All FCC Frequency Allocations

(Formerly the TECHNICIAN SECTION of "TELEVISION RETAILING")



The MALLORY CONVERTER Can Be Your Best Profit Maker in the New UHF Market

When UHF goes on the air in your area, thousands of sets will need converting. The Mallory UHF Converter can become your fastest moving item almost overnight. Be sure you are ready to take advantage of the opportunity . . . get your full share of the market.



- The Mallory Converter adds *all* UHF channels to any TV set without sacrificing reception of a single VHF channel.
- The Mallory Converter has outsold all other makes in every area where UHF is already on the air.
- A preselector in the Mallory Converter protects against image interference, interference at the IF frequency and oscillator radiation. It insures better selectivity.
- The attractive deep maroon plastic cabinet is smaller than most portable radios.
- The customer has nothing more to buy, no adjustments to make . . . even if he moves to another broadcast area.

YOUR MALLORY DISTRIBUTOR has complete details on the Converter. It has been an outstanding profit maker in other areas. It can be for you.

Installation is easy too. Simply connect the antenna leads and power lines from the Converter to the set . . . right in the customer's home.

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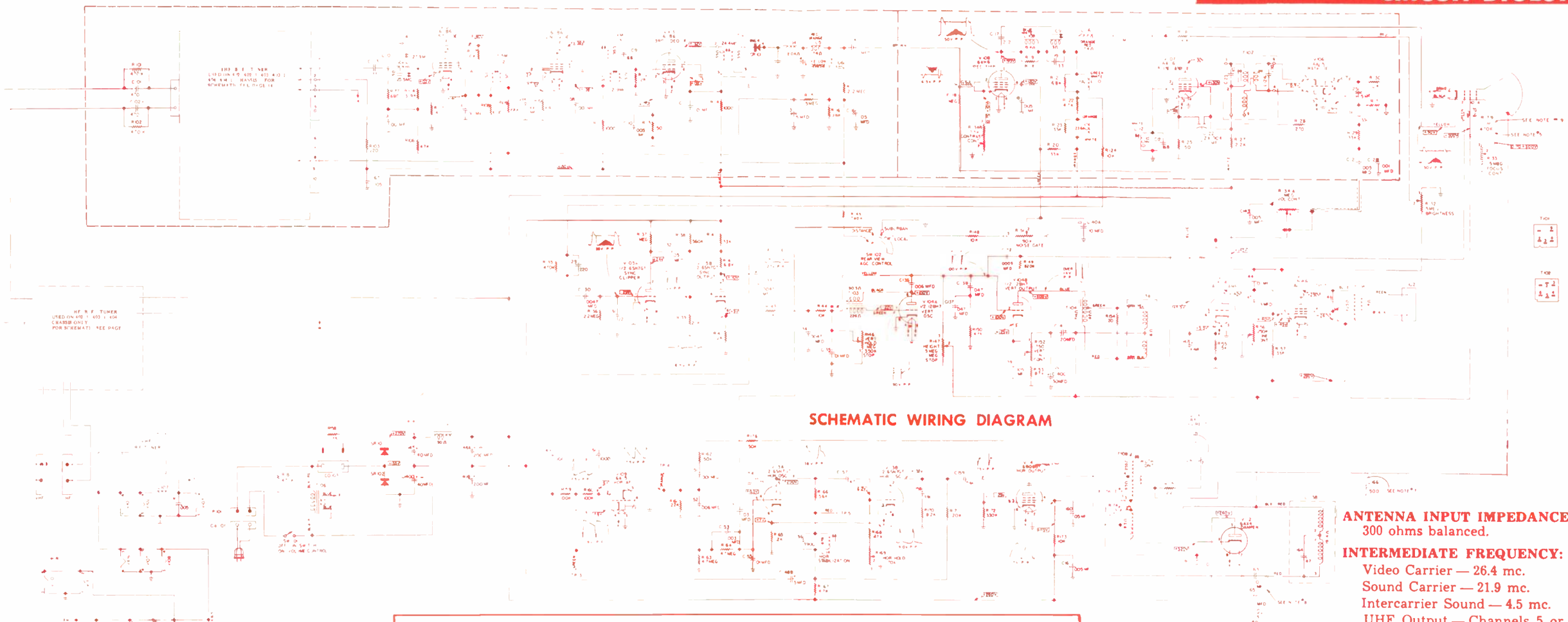
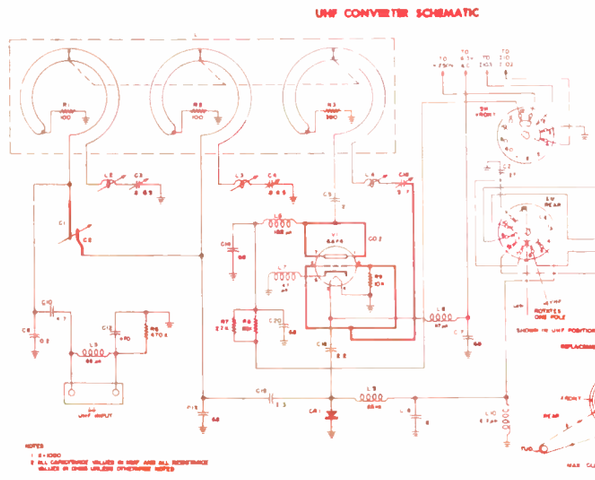
September • 1953

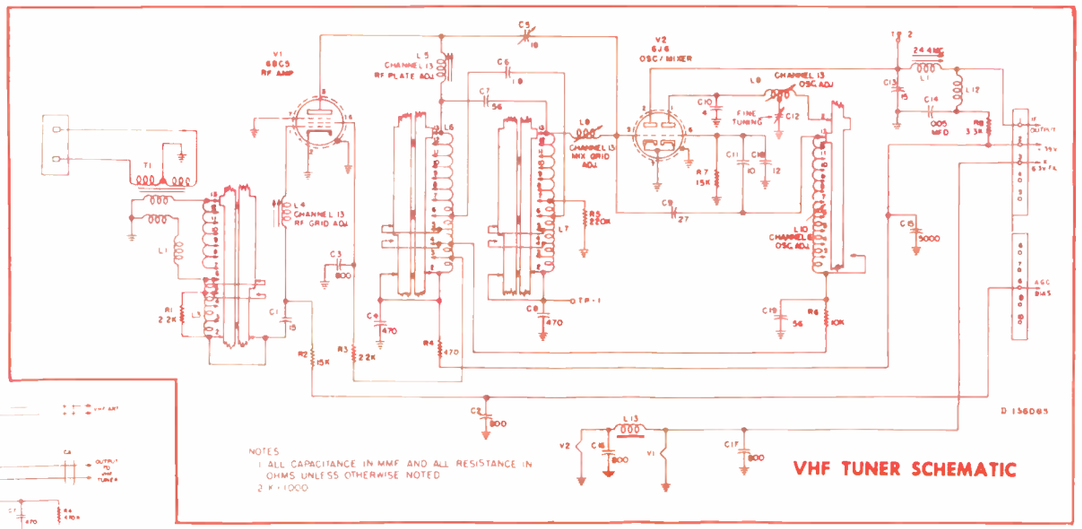
TECHNICIAN
CIRCUIT DIGESTS



SCHEMATIC WIRING DIAGRAM



UHF CONVERTER SCHEMATIC



VHF TUNER SCHEMATIC

REPLACEMENT PARTS LIST

CHASSIS 402, 403 & 404 (Schematic Parts)
402-1, 403-1 & 404-1

Symbol No.	Part No.	Description
C101	156201-*	Capacitor 470 mmf 2 Kv disc ceramic
C102	156201-1	Capacitor 470 mmf 2 Kv disc ceramic
C103	137727-129	Capacitor 330 mmf 500 v ceramic
C104	Part of L101	Capacitor, 110 mmf, 10% 500 v, ceramic
C105	144675-28	Capacitor 001 mfd, 500 v, disc ceramic
C106	144675-28	Capacitor, 001 mfd, 500 v disc ceramic
C107	144675-28	Capacitor 001 mfd 500 v disc ceramic
C108	144675-28	Capacitor, 001 mfd, 500 v, disc ceramic
C109	Part of L103	Capacitor, 68 mmf 10% 500 v mica
C110	144675-2	Capacitor, 005 mfd 500 v, disc ceramic
C111	144675-28	Capacitor 001 mfd 500 v disc ceramic
C112	137727-135	Capacitor 10 mmf 500 v ceramic
C113	154157	Capacitor 5 mfd 25 v paper
C114	137727-103	Capacitor 5 mmf 500 v ceramic
C115	39001-19	Capacitor 1 mfd 600 v, paper
C116	39001-17	Capacitor 05 mfd 600 v paper
C117	154100-4	Capacitor 2.2 mmf 500 v ceramic
C118	144675-2	Capacitor 005 mfd 500 v, disc ceramic
C119	137727-126	Capacitor 33 mmf 500 v ceramic
C120	39001-19	Capacitor 1 mfd 600 v paper
C121	137727-133	Capacitor 68 mmf 10% 500 v ceramic
C122	144675-6	Capacitor 004 mfd 400 v } Assembly
C123		Capacitor 004 mfd 400 v }
C123	Part of T102	Capacitor 10 mmf
C124	Part of T102	Capacitor 100 mmf
C125	154103	Capacitor, 5 mfd., 50 v Electrolytic
C126	137727-129	Capacitor 330 mmf 500 v ceramic
C127	144675-2	Capacitor 005 mfd 500 v disc ceramic
C128	144675-28	Capacitor 001 mfd 500 v disc ceramic
C129	137727-131	Capacitor 220 mmf 500 v ceramic
C130	39477-39	Capacitor 0047 mfd 600 v molded paper
C131	137727-26	Capacitor 22 mmf 500 v ceramic
C132	39001-17	Capacitor 05 mfd 600 v paper
C133	39477-39	Capacitor 0047 mfd 600 v molded paper
C134	39477-39	Capacitor 0047 mfd 600 v molded paper
C135	39478-41	Capacitor 01 mfd 600 v 10% molded paper
C136	39001-78	Capacitor 006 mfd 600 v paper
C137	39477-45	Capacitor 047 mfd 600 v molded paper
C138	39477-45	Capacitor 047 mfd 600 v molded paper
C139	144675-2	Capacitor 005 mfd 500 v disc ceramic
C140A	155438*	Capacitor 10 mfd 300 v } Electrolytic
C140B		Capacitor 200 mfd 150 v }
C140C		Capacitor 30 mfd 150 v }
C140D		Capacitor 140 mfd 150 v }
C141	154097	Capacitor 20 mfd 450 v Electrolytic

(Continued on reverse side)

ANTENNA INPUT IMPEDANCE:
300 ohms balanced.

INTERMEDIATE FREQUENCY:
Video Carrier — 26.4 mc.
Sound Carrier — 21.9 mc.
Intercarrier Sound — 4.5 mc.
UHF Output — Channels 5 or 6.

Chassis 402:
models F-17TOLH, F-17TOLBH
Chassis 403:
models F-21TOLH, F-21TOLBH
Chassis 404:
models F-21COLH, F-21COLBH, F-21CDLH, F-21CDLBH
Chassis 402-1:
models F-17TOLU, F-21TOLBU
Chassis 403-1:
models F-21TOLU, F-21TOLBU
Chassis 404-1:
models F-21COLU, F-21COLBU, F-21CDLU, F-21CDLBU

CROSLEY
Chassis 402, 403, 404, 402-1, 403-1, 404-1

Technician
CIRCUIT DIGEST 82

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CROSLEY
Chassis 402, 403, 404, 402-1, 403-1, 404-1

Technician
CIRCUIT DIGEST
82

REPLACEMENT PARTS LIST (Continued)

Symbol No.	Part No.	Description
C142	154104	Capacitor, 10 mfd 50 v. Electrolytic
C143	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C144	39001-13	Capacitor, .01 mfd., 600 v. paper
C145	39001-82	Capacitor, .03 mfd., 600 v. paper
C146	39001-80	Capacitor, .02 mfd., 600 v., paper
C147	155684	Capacitor, 140 mfd., 150 v., Electrolytic
C148A	155428	Capacitor, 200 mfd 150 v. } Electro-
C148B		Capacitor 5 mfd., 150 v. } lytic
C149	137727-132	Capacitor, 1000 mmf 500 v. ceramic
C150	137727-132	Capacitor, 1000 mmf 500 v. ceramic
C151	39478-108	Capacitor, .001 mfd 10% 1000 v., molded paper
C152	146434-16	Capacitor, .006 mfd., 10% 600 v., paper
C153	39001-76	Capacitor, .003 mfd. 600 v. paper
C154	137727-134	Capacitor, 75 mmf., 500 v., ceramic
C155	39001-13	Capacitor, .01 mfd., 600 v., paper
C156	137499-30	Capacitor, 3900 mmf., 500 v., mica
C157	137499-36	Capacitor, 470 mmf., 500 v., mica
C158	137499-31	Capacitor, 390 mmf., 500 v., mica
C159	137499-34	Capacitor, 560 mmf., 500 v., mica
C160	39001-17	Capacitor, .05 mfd., 600 v., paper (used on 402 chassis)
C161	144675-2	Capacitor, .005 mfd 500 v., disc ceramic
C162	154988	Capacitor 120 mmf., 10% 3 KV disc ceramic
C163	39001-19	Capacitor, .1 mfd. 600 v. paper (used on 402 only)
C164	154211	Capacitor, 47 mmf., 2 KV., mica (Part of L113)
C165	Part of L115	Capacitor, .1 mfd., 200 v., paper
C166	151109	Capacitor, 500 mmf., 20 KV. ceramic (used on 403 chassis only)
C167	144675-2	Capacitor, .005 mfd 500 v. disc ceramic
C170	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C171	39001-82	Capacitor, .03 mfd., 600 v., paper
C172	39001-5	Capacitor, .0005 mfd., 600 v. paper
R101	39374-57	Resistor, 470,000 ohm, 10% 1 2 w
R102	39374-57	Resistor, 470,000 ohm, 10% 1 2 w
R103	39374-17	Resistor, 220 ohm, 10% 1 2 w
R104	39375-63	Resistor 3900 ohm, 5% 1 2 w
R105	39374-9	Resistor 47 ohm 10% 1 2 w
R106	39374-33	Resistor 4700 ohm 10% 1 2 w
R107	39375-73	Resistor 10 000 ohm, 5% 1 2 w
R108	39374-25	Resistor 1000 ohm, 10% 1 2 w
R109	39374-25	Resistor 1000 ohm, 10% 1 2 w
R110	39374-11	Resistor 68 ohm, 10% 1 2 w.
R111	39374-25	Resistor 1000 ohm 10% 1 2 w
R112	39375-75	Resistor 12,000 ohm, 5% 1 2 w
R113	39374-15	Resistor 150 ohm 10% 1 2 w
R114	39374-25	Resistor 1000 ohm, 10% 1 2 w
R115	39374-65	Resistor, 1.5 megohm 10% 1 2 w
R116	39375-67	Resistor 5600 ohm 5% 1 2 w
R117	39374-69	Resistor 2.2 megohm, 10% 1 2 w
R118	39374-61	Resistor 1 megohm 10% 1 2 w
R119	Part of L108	Resistor, 8200 ohm 10% 1 2 w
R120	39374-219	Resistor 33,000 ohm, 10% 2 w
R121	Part of L110	Resistor 6800 ohm, 10% 1 2 w
R122	39375-361	Resistor, 4700 ohm, 5% 2 w.
R123	Part of L111	Resistor, 3300 ohm, 10% 1 2 w
R124	39374-37	Resistor, 10,000 ohm, 10% 1 2 w
R125	39374-15	Resistor, 150 ohm, 10% 1 2 w
R126	39374-49	Resistor, 100,000 ohm, 10% 1 2 w
R127	39374-29	Resistor, 2200 ohm, 10% 1 2 w
R128	39374-18	Resistor, 270 ohm, 10% 1 2 w
R129	39374-43	Resistor, 33,000 ohm, 10% 1 2 w
R130	39375-73	Resistor, 10,000 ohm, 5% 1 2 w
R131	39375-73	Resistor, 10,000 ohm, 5% 1 2 w
R132	155352	Control, Brightness (5 megohm)
R133	154094	Control, Focus (1.5 megohm used on 402 chassis only)
R134A	154085	Control, Volume (1 megohm) } Assembly
R134B		Control, Contrast (2500 ohm) }
R135	39374-57	Resistor, 470,000 ohm 10% 1 2 w
R136	39374-69	Resistor, 2.2 megohm, 10% 1 2 w
R137	39374-61	Resistor, 1 megohm, 10% 1 2 w
R138	39374-146	Resistor, 560,000 ohm, 10% 1 w
R139	39374-41	Resistor, 22,000 ohm, 10% 1 2 w.
R140	39374-31	Resistor 3300 ohm, 10% 1 2 w
R141	39374-35	Resistor, 4800 ohm, 10% 1 2 w
R142	39374-29	Resistor, 2200 ohm, 10% 1 2 w
R143	39374-41	Resistor, 22,000 ohm, 10% 1 2 w
R144	39374-37	Resistor, 10,000 ohm, 10% 1 2 w
R145	39374-58	Resistor, 390,000 ohm 10% 1 2 w
R146	155810	Conirol, Vertical Hold
R147	154086	Control, Height
R148	39374-125	Resistor, 10,000 ohm, 10% 1 w
R149	39374-60	Resistor, 820,000 ohm, 10% 1 2 w
R150	39374-33	Resistor, 4700 ohm, 10% 1 2 w.
R151	155576	Control, Noise Gate (80,000 ohm)
R152	154088	Control, Vertical Linearity
R153	154084	Resistor, 8700 ohm, 5% 5 w wire wound
R154	39374-14	Resistor, 120 ohm, 10% 1 2 w.
R155	39374-27	Resistor, 1500 ohm, 10% 1 2 w.
R156	155389	Control, Tone (250,000 ohm)
R157	39374-43	Resistor, 33,000 ohm, 10% 1 2 w
R158	154089	Resistor, 7.5 ohm, 10% 5 w wire wound
R159	39374-49	Resistor, 100,000 ohm, 10% 1 2 w.
R160	39374-49	Resistor, 100,000 ohm, 10% 1 2 w
R161	39374-41	Resistor, 22,000 ohm, 10% 1 2 w.
R162	39374-139	Resistor, 150,000 ohm, 10% 1 w
R163	39374-77	Resistor, 4.7 megohm, 10% 1 2 w
R164	39374-77	Resistor, 4.7 megohm, 10% 1 2 w
R165	39374-26	Resistor, 1200 ohm, 10% 1 2 w.
R166	39374-34	Resistor, 5600 ohm, 10% 1 2 w
R167	39374-33	Resistor 4700 ohm, 10% 1 2 w
R168	39374-45	Resistor, 47,000 ohm, 10% 1 2 w
R169	155511	Control, Horizontal Hold
R170	39374-36	Resistor, 8200 ohm 10% 1 2 w
R171	39374-50	Resistor, 120 ohm, 10% 1 2 w
R172	39374-55	Resistor, 330,000 ohm, 10% 1 2 w.
R173	39374-213	Resistor, 10,000 ohm, 10% 2 w
R174	39374-6	Resistor, 27 ohm, 10% 1 2 w (used on 403, 404 chassis only)
R175	39303-12	Resistor, 2.2 ohm (Part of T108)
R176	39374-139	Resistor, 150,000 ohm, 10% 1 w
R177	39374-23	Resistor, 680 ohm, 10% 1 2 w.
R179	39374-57	Resistor, 470,000 ohm, 10% 1 2 w. (used on 402 only)
R180	39374-57	Resistor, 470 000 ohm 10% 1 2 w
L101	155304	Coil, Converter IF (1 98 to 4 5 microhenries)
L102	155319	Coil, 1st IF (1 95 to 4 5 microhenries)
L103	155348	Coil 2nd IF (2 4 to 4 5 microhenries)
L104	154376	Coil, Diode Choke (15 5 microhenries)
L105	156035	Coil, Video Peaking (117 microhenries)
L106	156036	Coil, Video Peaking (494 microhenries)
L107	155956	Choke, Filter (HF) (576 microhenries)
L108	154194	Coil, Video Peaking (414 microhenries)
L109	155446	Coil, 4 5 MC. Trap (27 to 57 microhenries)
L110	154206	Coil, Video Peaking (106 microhenries)
L111	154176	Coil, Video Peaking (840 microhenries)
L112	155442	Coil, Sound Take-Off (12 to 23 microhenries)
L113A	154221-6	Yoke, Deflection A ssembly (used on 403 4 M chassis only)
L113B		Yoke, Deflection (402 only)
L113A	154221 9	Yoke, Deflection A ssembly (used on
L113B		Yoke, Deflection (403 404 chassis)
L114	154220	Coil, Horizontal Oscillator (18 to 37 microhenries)
L115	154156	Network, Yoke Coupling (3 microhenries used on 403 4 M chassis only)
L116	156035	Coil, Video Peaking (117 microhenries)
T101	155594	Transformer, Diode (I
T102	154108	Transformer, Ratio Detector
T103	155255-1	Transformer, Vertical Oscillator
T104	155572	Transformer, Vertical Output
T105	154109 2	Transformer, Audio Output
T106	155390	Transformer, Filament
T107	155529-1	Choke, Filter
T108	155514-1	Transformer, Horizontal Deflection
CO102	138352	Socket, Speaker
CO103	154114	Socket, Terminal Strip
SW101	Part of R134A&B	Switch, ON OFF Power
SW102	155554	Switch, Rotary (AGC Control)
CR101	154211	Crystal, 1N64
SR101	155575 2	Rectifier, Selenium
SR102	155575 2	Rectifier, Selenium
SP101	138762-7	Speaker, PM (5 1 4)
SP102	138762 7	Speaker, PM (5 1 4)
SP103	138762 5	Speaker, PM (10)
CA101	132300 6	Cable & Plug A ssmbly, AC Power
P101	154125	Receptacle, AC Power
P102	131983	Plug (Male), 2 Prong

I. F. ALIGNMENT

All lead connections from the signal generator and wobbulator must be shielded. Keep the exposed ends and ground leads as short as possible (about one inch). Always locate the ground lead connections as close as possible to their respective "hot" leads in the television receiver chassis. The wobbulator, signal generator output, and contrast control must be kept low enough to prevent overloading the television receiver circuits.

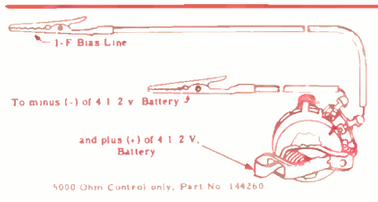
CAUTION: One side of the chassis is connected to the power line. Therefore, test equipment should not be connected to the receiver unless an isolation transformer is used between the power line and the receiver. DO NOT GROUND THE RECEIVER CHASSIS UNLESS AN ISOLATION TRANSFORMER IS USED.

1. To Check I. F. Alignment on Oscilloscope:

(a) Lift the shield of the Oscillator-Mixer tube V2 sufficiently to clear the socket ground clips. Connect sweep signal generator "hot" lead to the ungrounded tube shield and generator ground lead to the tuner chassis.

(b) Connect high side of oscilloscope to high side of contrast control (pin 2 and 7 of V108), and the low side to chassis.

(c) Apply -3.0 volts D.C. bias to I-F Bias line (See sketch "Variable Bias Control"). Contrast control should be set in the maximum counter-clockwise position.



5000 Ohm Control only, Part No. 144260

VARIABLE BIAS CONTROL ASSEMBLY

2. Alignment, I. F. & Tuner Assembly (with electronic voltmeter):

(a) Connect -3.0 Volts D.C. bias supply to I-F Bias line.

(b) Connect signal generator "hot" lead through a 1000 mmf. capacitor to TP-1 (wire protruding from tuner directly adjacent to the oscillator mixer tube V2) and ground lead to the R. F. tuner case.

(c) Connect high side of Electronic Voltmeter to top of detector load resistor, R116, and low side to chassis; zero meter.

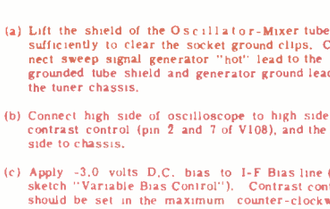
(d) Set signal generator to 24.4 mc. and adjust top of T101 for maximum D.C. meter indication on voltmeter. Adjust the signal generator amplitude to make this peak indication 2 volts D.C., approximately.

(e) Set signal generator to 22.9 mc. and adjust top of L103 for maximum D.C. meter indication, limiting meter deflection to 2 volts D.C. by adjusting input of attenuator.

(f) Set the signal generator to 21.9 mc. and adjust bottom of L103 for minimum D.C. meter deflection. Input should be high enough to permit a definite null to be observed on the meter.

(g) Repeat steps e and f.

(h) Set signal generator to 25.5 mc. and adjust top of L102 for maximum meter deflection, limiting meter deflection to 2 volts D.C. by adjusting input attenuator.



NOMINAL OVERALL I. F. RESPONSE CURVE

Note: Response as Seen by Means of Sweep Generator

(i) Reset signal generator to 24.4 mc. Connect a 100 ohm resistor in series with a 1000 mmf. capacitor across L101. Adjust converter output, L11, of R.F. Tuner for maximum meter deflection, but limit output of generator so this reading does not exceed 2 volts D.C. Remove the 100 ohm resistor and the 1000 mmf. capacitor.

(j) Reset signal generator to 27.9 mc. and adjust the bottom of L101 for minimum D.C. meter deflection. Signal generator amplitude must be sufficiently high to produce a definite null.

(k) Set signal generator to 25.5 mc. Connect the 100 ohm resistor and the 1000 mmf. series capacitor from TP-2 (wire protruding from the tuner through the insulated eyelet between the brass adjusting screws) on the R-F Tuner to the tuner case and adjust L101 for maximum D.C. meter indication. Adjusting amplitude of signal generator to make this maximum indication approximately 2 volts D.C. Remove the 100 ohm resistor and the 1000 mmf. capacitor

(l) Repeat steps j and k.

(m) Check sensitivity. The input for 2 volts D.C. output and zero bias should not exceed 650 microvolts at 24.4 mc. with generator properly terminated, and generator fed into grid of first I-F amplifier.

(n) Remove the signal generator and electronic voltmeter.

(o) Note: When aligning bottom of L103 and bottom of L101 the first null obtained when running the core into the trap winding from the Tinnermann Clip end of the trap winding is the proper alignment null.

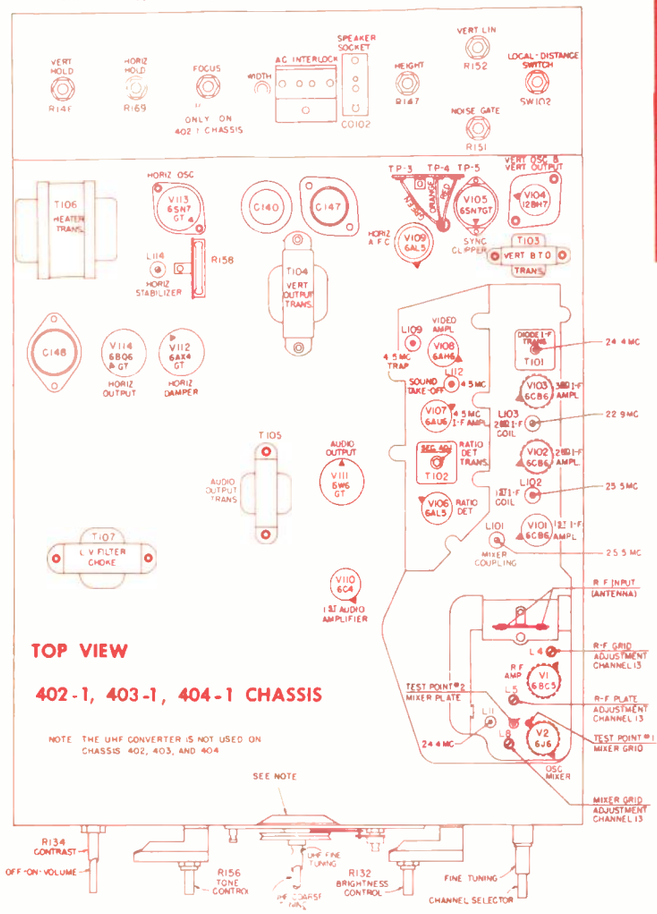
SOUND ALIGNMENT

1. Connect crystal controlled 4.5 mc. 400 cycle amplitude modulated signal, modulated 30% or greater, between grid of video amplifier and chassis.
2. Connect high side of scope through detector probe to the picture tube cathode (pin 11). Connect low side of scope to chassis. Adjust 4.5 mc. trap, L109, for minimum 400 cycle deflection on scope.
3. Connect electronic voltmeter to lug 2 of ratio detector, V106, and adjust 4.5 mc. sound take-off (L112) and bottom of ratio transformer (T102) for peak reading on voltmeter. Adjust input to make this peak reading 4 volts.
4. Adjust input to obtain 12 volts output. Transfer electronic voltmeter to junction of R129 and C128 (refer to Schematic Wiring Diagram). Adjust top of T102 for zero balance on electronic voltmeter.
5. Recheck steps 2, 3 and 4.
6. Remove input signal, scope and electronic voltmeter.

HORIZONTAL HOLD ADJUSTMENT

1. Tune in a local television signal and adjust contrast control for normal picture.
2. Connect electronic voltmeter between TP-3 (green lead) and chassis.
3. Short TP-4 (orange lead) to chassis and adjust electronic voltmeter to zero.
4. Remove short from TP-4. Do not change zero on electronic voltmeter.
5. Connect a 0.1 mfd., 600 volt capacitor between TP-5 (red lead) and chassis.
6. Adjust Horizontal Hold control for zero reading on the meter.
7. Remove the 0.1 mfd. capacitor from TP-5 and chassis. Do not disturb setting of horizontal hold control.
8. Adjust Horizontal Stabilizer coil (L114) for zero reading on the meter.
9. Remove electronic voltmeter from TP-3.

10. Check horizontal pull-in range. The pull-in range should be approximately 50° of the control's rotation.



TOP VIEW

402-1, 403-1, 404-1 CHASSIS

NOTE THE UHF CONVERTER IS NOT USED ON CHASSIS 402, 403, AND 404

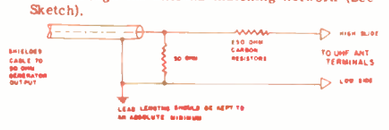
UHF ALIGNMENT

CAUTION: This UHF converter unit is used with a VHF receiver that has one side of the chassis connected to the power line. DO NOT CONNECT TEST EQUIPMENT TO ANY PART OF THE RECEIVER OR GROUND THE CHASSIS UNLESS AN ISOLATION TRANSFORMER IS USED BETWEEN THE POWER LINE AND RECEIVER.

1. Remove the UHF Converter from the VHF receiver chassis.
2. Disengage the toggle coupling from the switch throw arm on the front of the UHF chassis. To accomplish this: -
   a. Turn the UHF tuning control clockwise until the pin located on the rear of the drive pulley is free from the toggle coupling.
   b. Loosen the two set screws in switch throw arm collar and remove from switch shaft.
   c. Turn the switch clockwise to the UHF position; contact blade on switch rotor must contact and center on the two switch fingers with the red wires attached. Leave switch in this position while aligning.
3. Connect the output leads of the UHF converter to the R-F input terminals of the VHF Tuner.
4. Connect the B+ and filament leads of the tuner to their respective points from which they were removed on the VHF receiver. Connect UHF Converter chassis to B- (VHF receiver chassis).
5. Keep all leads as short as possible, one way to accomplish this is to mount the UHF converter at right angles to the TV chassis with one mounting screw. Most of the leads on the converter will then require no additional length.
6. Set VHF Tuner to Channel 6.
7. Alignment should be followed in the order shown.

OSCILLATOR ALIGNMENT

1. Connect an electronic voltmeter or scope across the second detector load resistor.
2. Turn on the power
3. Apply a 460 mc. (amplitude modulated, when scope is used) signal to the UHF antenna terminals through the antenna matching network (See Sketch).



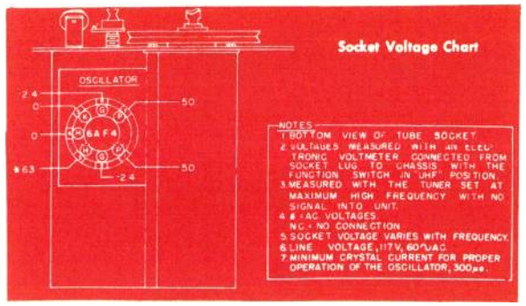
Antenna Matching Network

4. Turn out the adjusting screw of the mixer circuit trimmer C4 so that the flat side of the head is 5/8" above the chassis before aligning oscillator.
5. With the tuner shaft at maximum CCW position, adjust the oscillator trimmer C18 for peak reading on the electronic voltmeter or maximum indication on the scope (oscillator frequency is set to 84 mc below the carrier frequency).
6. Set the signal generator to 904 mc.
7. Rotate the tuner shaft to maximum CW position and adjust the oscillator coil inductor, L4 up or down for maximum reading on the voltmeter.
8. Repeat steps 3 through 6 until maximum reading is obtained.

R-F CIRCUIT ALIGNMENT

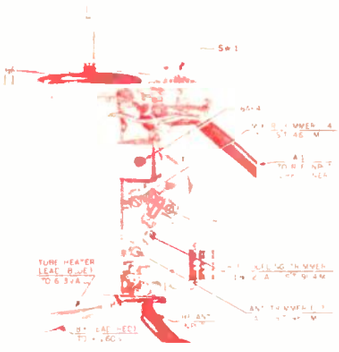
1. With the signal generator and electronic voltmeter or scope connected as for the Oscillator Alignment above, set the R-F coupling trimmer, C1 and C2 to minimum capacity by turning the screw CCW.
2. Set the signal generator to 460 mc. (Amplitude modulated when scope is used).
3. With the tuner shaft at maximum CCW position, adjust the antenna and mixer trimmers, C3 and C4 for maximum meter reading. (or scope indication)
4. Reset signal generator to 904 mc.
5. Rotate the tuner shaft to maximum CW position and adjust the antenna and mixer end inductors, L2 and L3, for maximum reading on meter or scope, by forming larger or smaller loop
6. Repeat steps 2 through 5 until maximum reading is obtained.
7. Turn the tuner shaft to maximum CW position and adjust the coupling trimmer, C1 and C2 for peak reading at 904 MC.
8. Turn the power switch to the "OFF" position.
9. Disconnect the generator and electronic voltmeter, or scope.
10. Re-engage the toggle coupling in the pin on the switch throw arm and the pin on the drive pulley as follows:
    a. Rotate the tuning control shaft clockwise until the pin on the rear of the drive pulley is toward the base of the chassis.
    b. Turn the tuning shaft CCW and guide the pin on the rear of drive pulley into the fork of the toggle coupling, then continue to turn tuning shaft CCW to stop. The coupling is now in the proper operating position.
    c. With the switch set to the VHF position (CCW) replace the switch throw arm so that the pin on the arm engages the fork of the toggle coupling. In this position it is approximately 30° CW from horizontal. Tighten the two set screws in the switch throw arm collar.
    d. Function switch should be checked for proper operation under conditions of customer use. At full CCW rotation of tuner shaft, all VHF position contacts must be fully and firmly made and all UHF position contacts must be fully broken. All UHF position contacts must be fully and firmly made and all VHF position contacts must be fully broken, when tuner shaft is 7-1 2° or more from full CCW, as tuner shaft is rotated toward stop from UHF position.
11. Replace the UHF Converter on the VHF receiver chassis.

Socket Voltage Chart

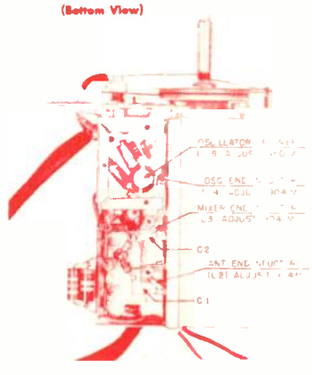


NOTES
1. BOTTOM VIEW OF TUBE SOCKET.
2. VOLTAGES MEASURED WITH 20K ELECTRONIC VOLTMETER CONNECTED FROM SOCKET LUG TO CHASSIS WITH THE FUNCTION SWITCH IN UHF POSITION.
3. MEASURED WITH THE TUNER SET AT MAXIMUM HIGH FREQUENCY WITH NO SIGNAL INTO UNIT.
4. A-C VOLTAGES.
5. NC = NO CONNECTION
6. SOCKET VOLTAGE VARIES WITH FREQUENCY.
7. LINE VOLTAGE 117V, 60 CYCLE AC
8. MINIMUM CRYSTAL CURRENT FOR PROPER OPERATION OF THE OSCILLATOR, 500μa.

UHF CONVERTER CHASSIS, (Top View)

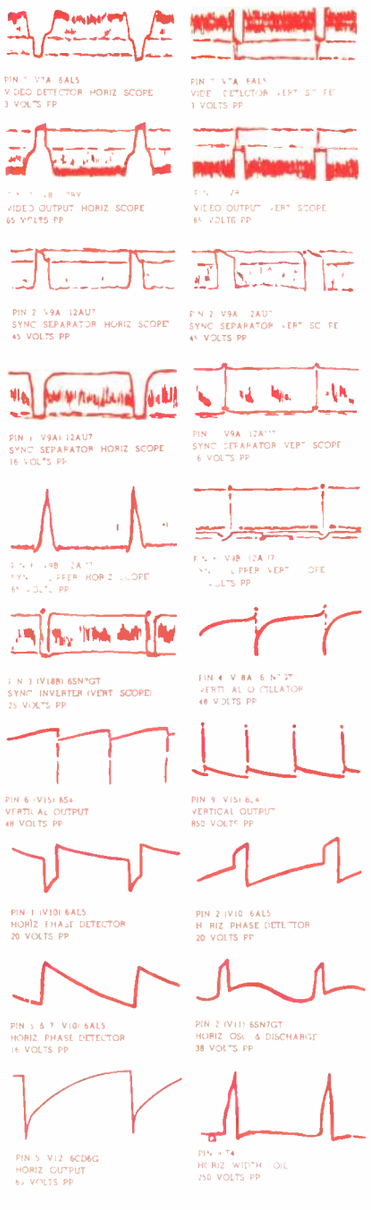


UHF CONVERTER CHASSIS, (Bottom View)



TECHNICIAN
CIRCUIT DIGESTS

WAVE FORMS



ALL VOLTAGES MEASURED WITH RESPECT TO CHASSIS WITH A VACUUM TUBE VOLTMETER ADJUST PICTURE TO NORMAL HEIGHT AND WIDTH TUNE IN AN UNUSED CHANNEL AND DISCONNECT ANTENNA SET CONTRAST AND BRIGHTNESS CONTROLS AT MAXIMUM COUNTER-CLOCKWISE POSITION WITH 117 V A C INPUT, VOLTAGES SHOULD HOLD WITHIN 20%

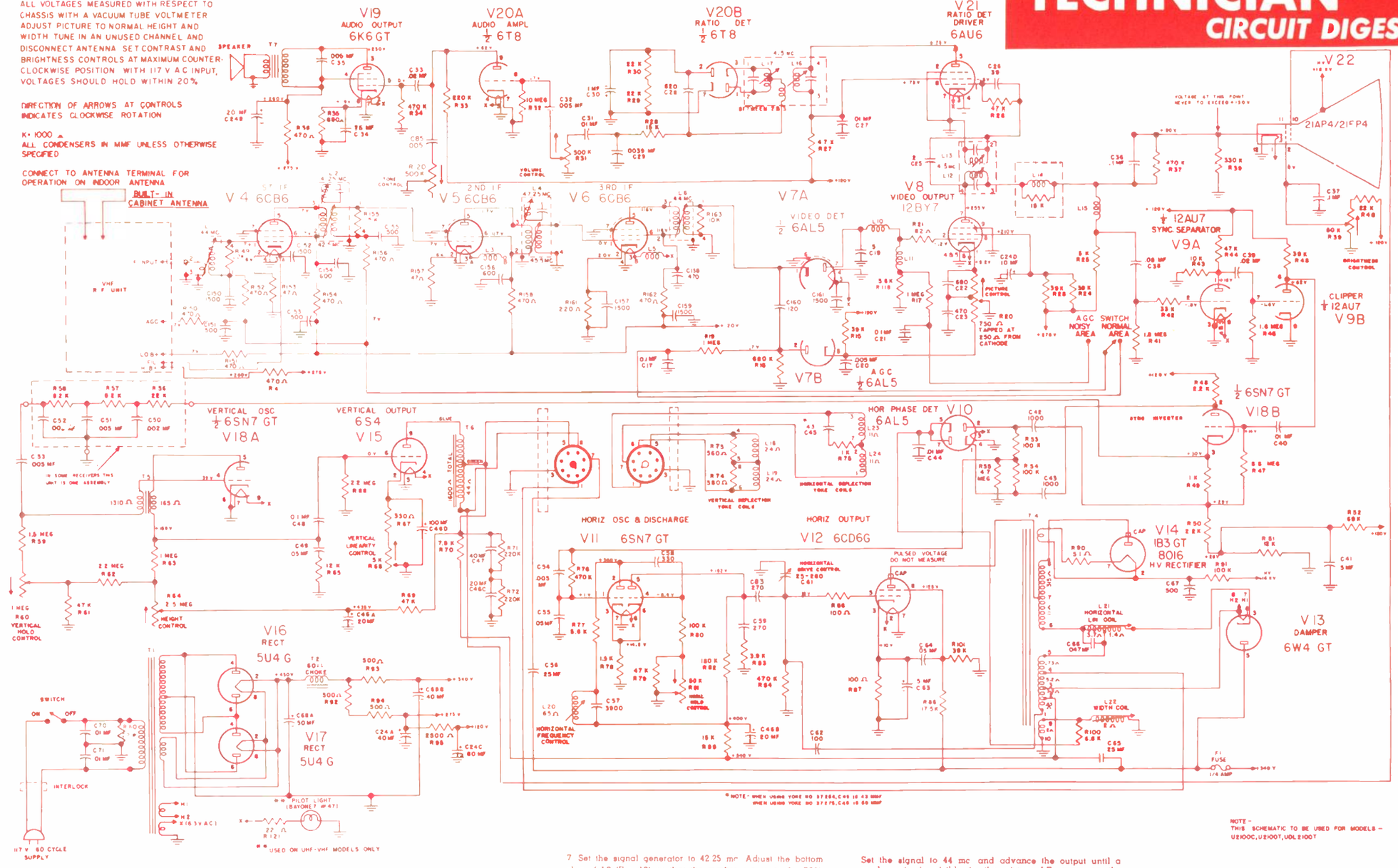
DIRECTION OF ARROWS AT CONTROLS INDICATES CLOCKWISE ROTATION

K= 1000

ALL CONDENSERS IN MMF UNLESS OTHERWISE SPECIFIED

CONNECT TO ANTENNA TERMINAL FOR OPERATION ON INDOOR ANTENNA

BUILT-IN CABINET ANTENNA



* NOTE - WHEN USING YOKE NO 37284, C45 IS 43 MMF
WHEN USING YOKE NO 37475, C45 IS 60 MMF

NOTE -
THIS SCHEMATIC TO BE USED FOR MODELS - U2100C, U2100T, UDL2100T

PICTURE I.F. (ROUGH ALIGNMENT)

1. Connect the 4½ volt bias battery as shown in Fig. 12. The positive side of the bias battery is connected to chassis and the negative side is connected to the junction of R152 R156 and C151.

Connect the output of the signal generator through a 1000 mmf. ceramic condenser to pin 1 of V4. Use short leads.

2. Connect the probe of the VTVM to the junction of R118 R17 and L11 in the grid circuit of V8 (Fig. 12). The common lead of the VTVM should be grounded close to the probe. For the following steps 3, 4, and 5 adjust the signal generator to maintain a 2 volt output.

3. Set the signal generator to 42.5 mc. and adjust bottom slug of L2 (Fig. 12) for maximum output on VTVM.

4. Reset the signal generator to 45.5 mc. and adjust bottom slug of L4 (Fig. 12) for maximum.

5. Reset signal generator to 44 mc. and adjust top slug of L6 (Fig. 13) for maximum.

6. With signal generator at 41.25 mc. adjust top slug of L2 (Fig. 13) for minimum.

7. With signal generator at 47.25 mc. adjust top slug of L4 (Fig. 13) for minimum.

8. Repeat steps 3 to 7 inclusive.

9. If the repetition of steps 3 to 7 shows more than a slight change in output voltage it will be necessary to repeat steps 3 to 7 again.

PICTURE I.F. (FLAT-TOPPING)

1. Remove signal generator and VTVM.

2. Connect the sweep generator to pin 1 of V4 through a 1000 mmf. ceramic condenser. Use short leads.

3. Connect the oscilloscope across R118 as shown in Figure 6. Use shielded cable to oscilloscope.

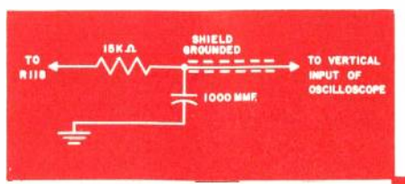


FIG. 6. OSCILLOSCOPE PROBE

4. Connect the hot side of the signal generator to the chassis side apron nearest the first I.F. stage. Leave the ground side disconnected. The signal so obtained is used for marker pips.

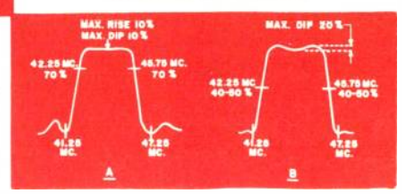
5. Adjust the vertical gain of the oscilloscope so that a signal input of 1 volt peak to peak will produce a trace height of about ¾ of the screen.

In the following steps adjust the output of the sweep generator to indicate a 1 volt peak to peak output on the oscilloscope.

With most sweep generators there is enough output to give an I.F. response curve of sufficient height on the oscilloscope. If there is insufficient output use 3 volts bias instead of 4.5 volts.

6. Set the signal generator to 45.75 mc. and advance the output until a marker pip is visible in the picture I.F. curve on the oscilloscope. Be careful not to distort the I.F. curve by advancing the generator output too far. Adjust bottom slug of L4 (Fig. 12) so that the marker pip is at the 70% point. See Fig. 7A Picture I.F. Curves and Markers.

FIG. 7. TYPICAL PICTURE I.F. CURVES AND MARKERS



7. Set the signal generator to 42.25 mc. Adjust the bottom slug of L2 (Fig. 12) so that the marker pip is at the 70% point. See Fig. 7A.

8. If the curve is tilted it may be corrected by adjustment of L6 top slug (Fig. 13).

9. Repeat steps 6, 7 and 8 until an acceptable curve is achieved.

10. Remove tube shield on the 6J6 (V3) in the VHF tuner.

11. Modify a tube shield which will fit snugly over the 6J6 as follows: Take a tube shield and cut off, on the bottom edge, a ring about ½" wide. Then space three ½ watt 470K ohm resistors equally around the shield soldering one end of the resistors to the main portion of the shield and the other end of the resistors to the small ring cut from the original tube shield. The two pieces thus joined by the resistors must not touch each other. See Fig. 8 for a sketch of this modified tube shield.

12. Connect high side of sweep generator output to the ungrounded portion of the 6J6 modified tube shield. Ground side of sweep output to chassis. Adjust output of sweep generator to fill ¾ of the screen.

13. With the VHF tuner set to an unused channel between channels 9 and 13, rotate the fine tuning control to a position where no spurious responses are indicated on oscilloscope trace. Rotate the individual channel oscillator adjustment slug (see Fig. 13) to its maximum counter clockwise position without removing it from coil.

Set the signal to 44 mc. and advance the output until a marker pip is visible in the picture I.F. curve on the oscilloscope.

14. Slugs L1 (Fig. 13) and L9 on VHF tuner (Fig. 13) are adjusted for maximum response at 44 mc. — keeping the 44 mc. marker pip at center of the pass band.

15. Adjust L1 and L9 to properly position the 42.25 mc. and the 45.75 mc. markers as shown in Fig. 7B Picture I.F. Curves and Markers.

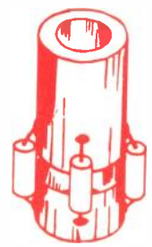


FIG. 8. ALIGNMENT SHIELD

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Models U2100C, U2150C, U2100T, UDL2100T, UH21T

FADA
Models U2100C, U2150C, U2100T, UDL2100T, UH21T,

Technician
CIRCUIT DIGEST
83

FADA
Models U2100C, U2150C, U2100T, UDL2100T, UH21T,
Technician
CIRCUIT DIGEST
83

I.F. ALIGNMENT (44 MC. I.F. COIL ON UHF TUNER)

1. Connect sweep generator to antenna terminals of the UHF tuner. If the sweep generator is not terminated for balanced 300 ohms insert the network shown in Fig. 10.

2. Connect the hot side of the signal generator to the chassis side apron nearest the first I.F. stage. Leave the ground side disconnected. This is for obtaining marker pips.

3. Connect the oscilloscope across R118 as in Fig. 12.

4. Refer to step 5 of Picture I.F. (Flat-Topping).

5. Set the sweep generator to a center frequency of 680 mc. Set the UHF tuner to channel 48 to pick up the signal from the sweep generator. Set signal generator to obtain picture carrier and then sound carrier markers.

6. Adjust L304, see Fig. 13, for a flat top response curve. See Fig. 7b for a typical curve keeping in mind that the 41.25 mc point is the sound carrier and the 45.75 mc point is the picture carrier.

7. Check at a frequency of 470 mc and then at 830 mc for an acceptable passband. Readjust L304 slightly if necessary to obtain an acceptable response at the three R.F. check points.

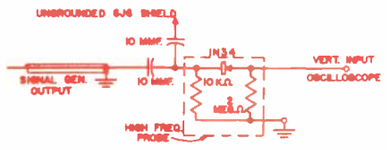


FIG. 9. OSCILLATOR ALIGNMENT

OSCILLATOR AND R.F. ALIGNMENT

The receiver employs two separate tuners — one for VHF and the other for UHF. The tuners are connected mechanically so that the fine tuning control for VHF also selects channels for UHF. This arrangement is illustrated in Fig. 13. For re-stringing of dial drive cord refer to Fig. 14.

The VHF tuner is a 13 position turret type with one position for 44 mc. (at UHF setting) and 12 positions for the VHF channels.

Normal channel sequence is progressive in a clockwise direction covering 44 mc. and channels 2 to 13.

The R.F. amplifier is of the cascode type utilizing a 6BQ7 or 6BK7. The oscillator-mixer stage uses a 6J6.

A switch is mounted at the rear of the VHF tuner. When this tuner is set to the UHF position the switch serves to (a) Transfer the output of the UHF tuner to the input of the VHF tuner which now functions as a 44 mc. amplifier.

(b) Disconnect the VHF antenna from the VHF tuner.

(c) Supply B+ to the UHF tuner.

When the tuner is set at any of the VHF channels the switch will

(a) Disconnect the output of the UHF tuner from the input of the VHF tuner.

(b) Connect the VHF antenna to the VHF tuner.

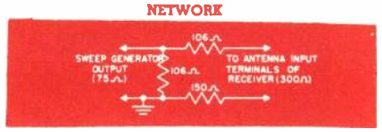
(c) Remove the B+ from the UHF tuner.

The UHF tuner is of the continuous type and covers from channels 14 to 83, inclusive. Channel numbers are indicated on the prism located in the channel Selector Knob.

The output of the UHF tuner is at a frequency of 44 mc. This output is fed through a 72 ohm shielded coaxial line to the switch on the VHF tuner.

The mixer stage utilizes a type 1N82 crystal and the oscillator uses a 6J6 operating at ½ frequency with a type G7B crystal harmonic generator.

FIG. 10. ANTENNA MATCHING NETWORK



OSCILLATOR ALIGNMENT—VHF

The fine tuner knob is first set to the center of its range by setting of its shaft close to and parallel to the bottom shield of the tuner.

From this starting position it should be possible to tune all VHF channels with the fine tuning control C18 (See Fig. 13) adjusted within 1/3 turn in either direction. When the oscillator V3 ages, the oscillator frequency may change and require readjustment. If V3 is defective and must be replaced it may be necessary to try several tubes to find one that requires the least oscillator adjustment. If an accurately calibrated signal generator that covers all the R.F. frequencies is available then start with step 1, if not start at step 9.

1. Remove tube shield on the 6J6 (V3).

2. Place the modified tube shield in place of the one removed.

3. Turn channel selector to channel 12.

4. Set generator to channel 12 oscillator frequency of 231.35 mc.

5. With circuit as shown in Fig. 9 connect the generator to one of the 10 mmf capacitors and connect the other 10 mmf capacitor to the ungrounded tube shield over the 6J6. Connect remaining terminal on probe to vertical input on oscilloscope.

6. Set fine tuning control C18 (fig. 13) to center of its range. Adjust C17 for zero beat pattern on the oscilloscope screen. (The oscillator coil slug which is accessible from the chassis front apron should be in its mechanical mid-position. If the slug should fall in during adjustment, the oscillator coil segment will have to be removed from the turret housing, the little wire spring which normally fits into the slug threads lifted up, and the slug brought forward to its mean position.)

7. Reset the generator for the oscillator frequency of channel 11. Adjust the oscillator coil slug for zero beat on the oscilloscope screen. Use a non-metallic screw-driver in adjusting the oscillator coil slug.

8. Repeat step 7 for the remaining channels, making sure the signal generator is set for the proper frequency on each channel.

When an accurately calibrated generator is not available, then oscillator alignment can only be accomplished when the local T.V. transmitters are on the air.

9. Remove bias battery.

10. Set fine tuning control C18 (fig. 13) to center of its range.

11. Rotate channel selector control to one of the local T.V. stations and adjust the oscillator coil slug, which is accessible from the front chassis apron (fig. 13), for best picture.

12. Check remaining local stations by rotating the channel selector switch to each channel in turn and adjusting the oscillator slug for best picture.

13. If on one or two of the channels you do not have enough oscillator range, readjust C17 and repeat steps 11 and 12. It is possible to adjust the oscillator channel slugs without removing the chassis from the cabinet. The slugs are made accessible by removing the channel selector and fine tuning knobs and by moving the escutcheon plate to one side. Use a long thin fibre or bakelite screwdriver for making adjustments.

R.F. ALIGNMENT

1. Reconnect bias battery as in step 1. Picture I.F. (Rough alignment). Set bias for 3 volts.

2. Connect oscilloscope through 10,000 ohms to test point on R.F. Unit. Connect sweep generator to antenna terminals. If the sweep generator is not terminated for balanced 300 ohms, insert the network shown in fig. 10.

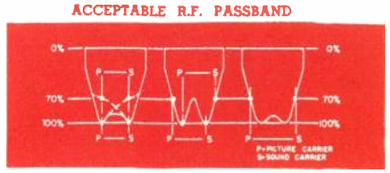
3. Set fine tuning control at approximately the midpoint of its tuning range and rotate channel selector to channel 12.

4. Adjust sweep generator to channel 12 and loosely couple signal generator to sweep generator in order to obtain picture carrier and sound carrier markers.

5. Adjust C3, C5, and C10 for flat top response curve. See figure 11 for acceptable R.F. passbands.

6. Check remaining channels. If the response curves obtained on any channel is not acceptable, it might be necessary to return to channel 12 and make a compromise of its response. If one channel is extremely out, that coil section should be repaired or replaced. It is not necessary to remove the tuner from the chassis in order to repair or replace a coil section.

FIG. 11
ACCEPTABLE R.F. PASSBAND



OSCILLATOR ALIGNMENT—UHF

When V1 ages, the oscillator may shift slightly in frequency requiring adjustment. If V1 is defective and must be replaced, several tubes should be tried to find one that requires the least oscillator adjustment.

If an accurately calibrated signal generator that covers all the R.F. frequencies is available then continue with step 1. If not go on to step 4.

1. Feed signal generator into antenna terminals of the UHF tuner at a frequency of 870 mc.

2. Connect probe of VTVM to the junction of R118, R17, and L11 in the grid circuit of V8 (Fig. 12). Common to ground.

3. Set UHF tuner to channel 80 and adjust C304 (Fig. 13) on UHF tuner to give maximum output on VTVM.

4. When an accurately calibrated generator is not available then oscillator alignment can be accomplished when the local T.V. transmitters are on the air. Tune to a known operating channel and adjust C304 until this channel is received. It is preferable to select a channel in the higher frequencies of the UHF band.

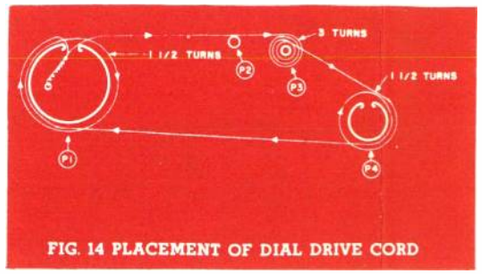


FIG. 14 PLACEMENT OF DIAL DRIVE CORD

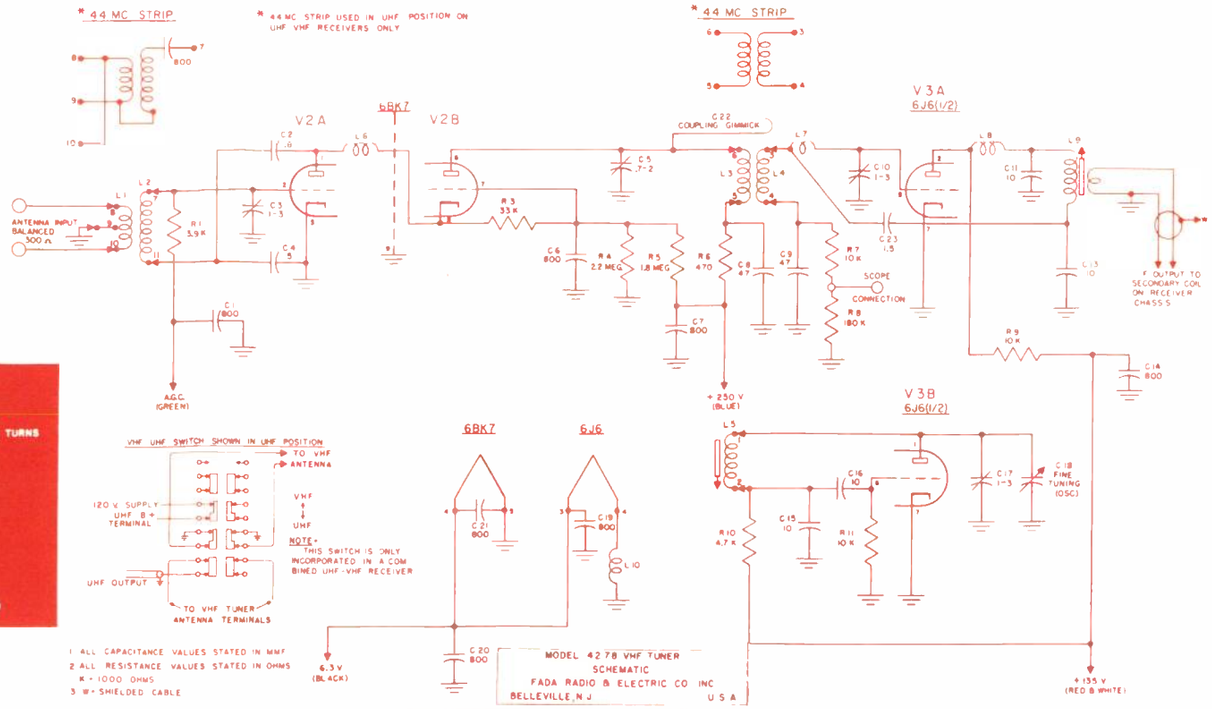


FIG. 12. BOTTOM VIEW OF CHASSIS

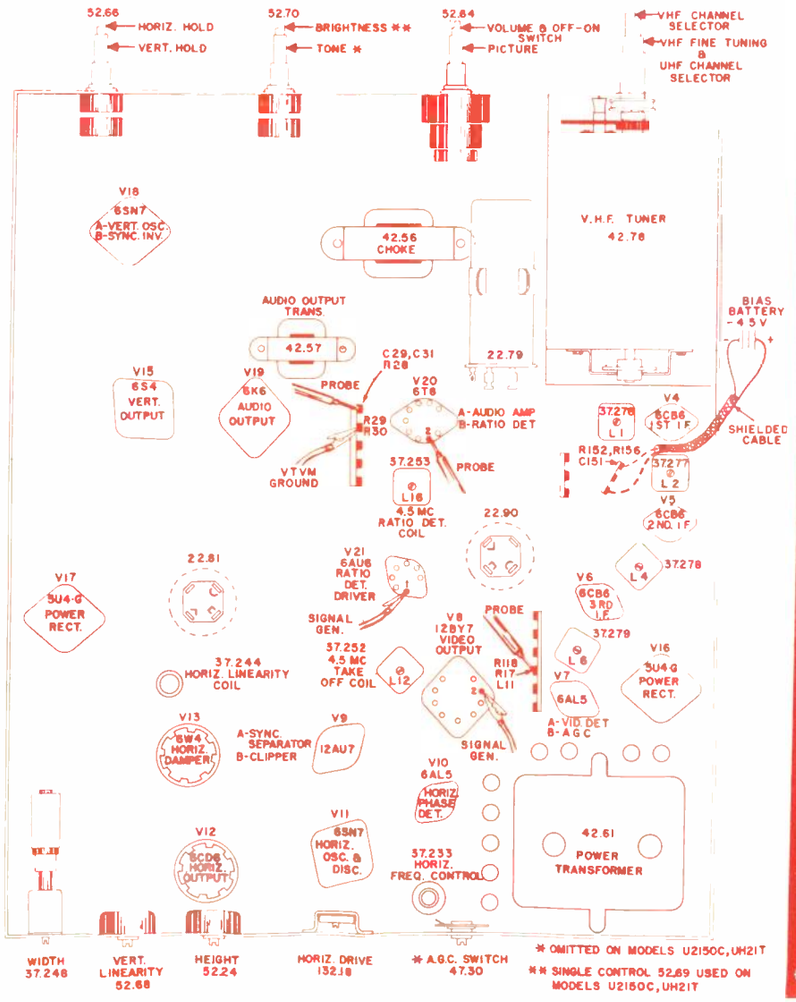
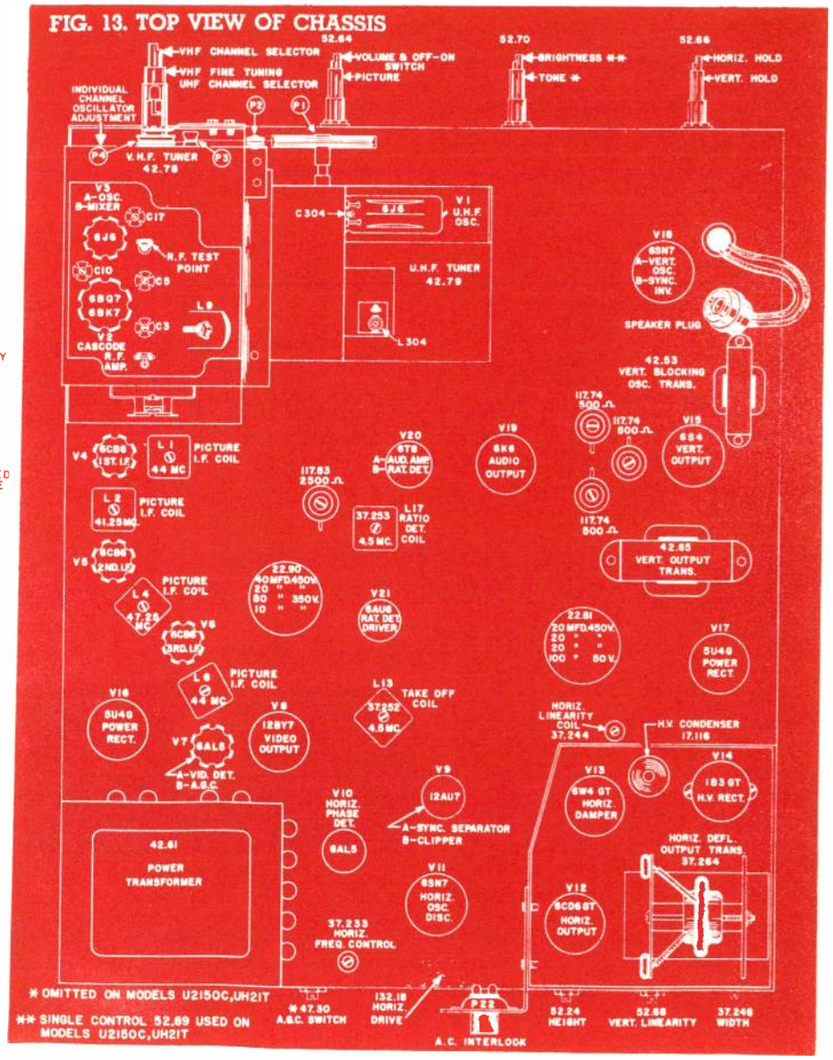


FIG. 13. TOP VIEW OF CHASSIS



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CAUTION NOTICE

THE REGULAR B+ VOLTAGES ARE DANGEROUS AND PRECAUTION SHOULD BE TAKEN WHEN THE CHASSIS IS REMOVED FROM THE CABINET FOR SERVICE. THE HIGH VOLTAGE SUPPLY (16,000 VOLTS) AT THE PICTURE TUBE ANODE WILL GIVE AN UNPLEASANT SHOCK BUT DOES NOT SUPPLY ENOUGH CURRENT TO GIVE A FATAL BURN OR SHOCK. HOWEVER, SECONDARY HUMAN REACTIONS TO OTHERWISE HARMLESS SHOCKS HAVE BEEN KNOWN TO CAUSE INJURY. ALWAYS DISCHARGE THE PICTURE TUBE ANODE TO THE RECKIVER CHASSIS BEFORE HANDLING THE TUBE.

Either a 21JP4 or a 21EP4-A type picture tube may be found in this model receiver.

PRELIMINARY REPLACEMENT PARTS LIST FOR MODEL 21T14

MAIN CHASSIS

CAT. NO.	SYMBOL	DESCRIPTION	UNIT PRICE
		CAPACITORS (Paper)	
*RCC-035	C310	.001 mf, 600 V.	$0.25
RCN-025	C265	.01 mf, 600 V.	.35
*RCN-030	C267	.01 mf, ±20%, 1000 V.	.60
*RCN-034	C259	.0039 mf, 600 V., molded	.35
*RCN-041	C266	.047 mf, 600 V.	.55
*RCN-050	C205,207	.022 mf, 600 V., molded	
*RCN-051	C208,252	.0047 mf, ±20%, 600 V., molded	.40
*RCN-062	C201	.001 mf, 600 V., molded	.40
*RCN-063	C261	.01 mf, ±20%, 600V., molded	.35
*RCN-071	C206	.001 mf, ±20%, 600 V., molded	
*UCC-035	C256,257	.001 mf, +60%-20%, 600 V.	.25
*UCC-038	C311	.004 mf, +40%-20%, 600 V.	.25
*UCC-040	C163,315, 317	.01 mf, +40%-10%, 600 V.	.25
*UCC-045	C153,168 258	.05 mf, +40%-10%, 600 V.	.30
*UCC-048	C170,204 263	.1 mf, +40%-10%, 600 V.	.10
UCC-051	C166,171	.2 mf, +40%-10%, 600 V.	
*UCC-061	C316	.008 mf, +40%-10%, 1000 V.	.30
		(Electrolytics)	
*RCE-090	C167,309	1 mf, +150%-0%, 50 V.	1.20
RCE-161	C402A,B, C,D	40 mf @350 V., 40 mf @350 V., 30 mf @350 V., 10 mf @25 V.	
RCE-163	C401A,B, C,D	90 mf @350 V., 30 mf @350 V., 5 mf @350 V., 100 mf @25 V.	
RCE-164	C309	10 mf, +100%-10%, 25 V.	
		(Micas & Ceramics)	
RCM-028	C318	3.3 mmf	.35
RCM-040	C156	6 mmf, ±.5 mmf, 500 V.	.25
*RCU-307	C254	180 mmf, 800 V.	.40
*RCW-3014	C301,303, 305,307, 308,313	5000 mmf, +150%-0%, 450 V.	.25
*RCW-3037	C151,155, 157,159, 160,162, 169,268, 403,405	800 mmf, 500 V.	.25
*RCW-3052	C154,158	820 mmf, 350 V.	.30
*RCW-3053	C302	1300 mmf, 500 V.	.25
*RCW-3054	C312	.01 mf, 450 V.	.35
RCW-3057	C164,172	5 mmf, ±5%, 500 V.	.25
RCW-3097	C161	470 mmf, 500 V.	
RCW-3101	C269	240 mmf, ±20%, 3000 V., disk type	
*UCO-1019	C314	43 mmf, 500 V.	
UCO-2024	C165	68 mmf, ±5%, 500 V.	.30
*UCU-520	C304	47 mmf, 500 V.	.30
*UCU-544	C203,253	470 mmf, ±20%, 500 V.	.30
*UCU-1046	C202,255, 260,262	560 mmf, 500 V.	.30

RESISTORS (Carbon, 1/2 watt)

*URD-001	R151	10 ohms	$0.13
*URD-019	R153,156	56 ohms	.13
URD-027	R310	120 ohms	.13
*URD-031	R158,301	180 ohms	.13
*URD-037	R210,269	330 ohms	.13
*URD-049	R155,157 315	1000 ohms	.13
*URD-051	R266	1200 ohms	.13
*URD-057	R252	2200 ohms	.13
*URD-061	R162	3300 ohms	.13
*URD-069	R267	6800 ohms	.13
*URD-071	R262	8200 ohms	.13
URD-073	R257	10,000 ohms	.13
*URD-077	R167	15,000 ohms	.13
*URD-079	R159,302	18,000 ohms	.13
URD-081	R308,311	22,000 ohms	.13
*URD-083	R307	27,000 ohms	.13
*URD-085	R166	33,000 ohms	.13
*URD-089	R165,218, 263,304	47,000 ohms	.13
*URD-095	R173,201, 259,261, 265	82,000 ohms	.13
*URD-097	R152,154, 176,203, 208,255, 256,258, 304,305, 321	100,000 ohms	.13
URD-101	R202	150,000 ohms	.13
*URD-105	R168,274, 275	220,000 ohms	.13
*URD-107	R174	270,000 ohms	.13
*URD-113	R177,253, 254,268, 306,313, 314	470,000 ohms	.13
*URD-121	R179,181, 260	1 megohm	.13
URD-125	R215	1.5 megohms	.13
*URD-129	R163,169, 180,209	2.2 megohms	.13
URD-131	R214	2.7 megohms	.13
URD-137	R206	4.7 megohms	.13
*URD-141	R312	6.8 megohms	.13
		(Carbon, 1 watt)	
*URE-041	R212	470 ohms	.17
*URE-065	R160,303	4700 ohms	.17
URE-097	R401	100,000 ohms	.17
		(Carbon, 2 watt)	
*URF-029	R270	150 ohms	.25
*URF-041	R317,403	470 ohms	.25
URF-045	R405	680 ohms	.25
*URF-079	R171	18,000 ohms	.25
URF-1077	R271	15,000, ±5%	.25

RESISTORS (CONT'D) (Wirewound & Special)

*RAW-053	R172	4000 ohms, 10 watts	$0.85
*RAW-079	R404	5600 ohms, 5 watts	.60
*RAW-095	R402	3000 ohms, 7.5 watts	.85
*RAW-105	R273	3.3 ohms, 1/2 watt	
RAW-106	R272	5000 ohms, 6 watts	
		POTENTIOMETERS	
*RRC-191	R175	100,000 ohms, Brightness	
*RRC-193	R205	125,000 ohms, Vertical Hold	1.40
RRC-218	R211	4000 ohms, wirewound, Vertical Linearity	
*RRC-219	R264	200,000 ohms, Horizontal Hold	
RRC-225	R188,207	2 megohm, Height, Area control	
RRC-233	R178,320, 3401	500,000 ohms and 700 ohms Volume-Contrast control and on-off switch	

COILS & TRANSFORMERS

RLD-051	D201, R216,217	YOKE - Deflection yoke with resistors, for use with 21JP4 picture tube	
RLD-052	D201, R216,217	YOKE - Deflection yoke with resistors, for use with 21EP4A picture tube	
RLD-057	L253	COIL - Horiz. lin. coil	
RLD-058	L252	COIL - Width contr. coil	
RLP-024	L154	COIL - Choke coil 31 uh	.65
RLP-062	L401	CHOKE - B+ filter choke	
RLI-138	L157,254	CHOKE - 10 uh choke coil	
RLI-192	L152	COIL - First video I-F grid coil	
RLI-204	L151,C152	TRAP - 47.25mc trap coil	
RLI-206	L153,C156	TRAP - 41.25mc trap coil	
RLI-208	L158,R170	COIL - 300 uh plate choke	
RLI-209	L159	COIL - 270 uh plate choke	
RLI-210	L251	COIL - Horiz. H.V. stabilizer coil	
RLI-214	L155	COIL - 47 uh cathode choke	
RLI-215	L154,156, 157,160 R161,C165	TRAP ASSEMBLY - 4.5 mc trap assembly	
RLI-216	L160,R161	COIL - 1.3 mh choke coil	
RLX-042	T153	TRANSFORMER - Video detector transf.	
*RTD-014	T302,C306 M310	TRANSFORMER - Ratio detector transformer	
*RTL-144	T151,152	TRANSFORMER - 1st and 2nd video i-f transformer	
*RTL-180	T301	TRANSFORMER - 4.5 mc interstage transformer	
RTO-139	T303	TRANSFORMER - Audio output transformer	
RTO-141	T251,C269	TRANSFORMER - Horizontal output transformer	
RTO-142	T201	TRANSFORMER - Vertical output transformer	
RTP-315	T401	TRANSFORMER - Power transformer	

The preliminary parts list for S-21T14 also applies to the Model 21C115 with the exception of the following items:

CAT. NO.	SYMBOL	DESCRIPTION
		ELECTRICAL ITEMS
RJX-053		R-F TUNER - Complete with tubes and aligned
RRC-222	R175	POTENTIOMETER - 100,000 ohms Brightness control
RRC-233	R178, 320, 3401	POTENTIOMETER - 500,000-700 ohms Volume, Contrast, On-Off switch
RRC-235	R188	POTENTIOMETER - 2 megohm area control switch
RRC-237	R205	POTENTIOMETER - 125,000 ohms Vertical Hold control
RTO-140 *3101207	T303	TRANSFORMER - Audio output transf.
		SPEAKER - 10-inch Alnico PM, 3.2 ohms impedance

"F" Chassis:
models 17C127, 21C115, 21C116, 21C117, 21C119, 21C120, 21C121, 17T15, 21T4, 21T10, 21T12, 21T14

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VIDEO I-F SYSTEM

The following alignment data is divided into two separate procedures. Because of the large trap attenuation, the conventional method of sweep observation of these traps becomes difficult. Hence all traps shall be pre-tuned by applying an amplitude-modulated signal and adjusted for minimum signal output.

The second portion of this procedure involves the shaping of the i-f response curve in the conventional manner by the application of a sweep generator signal. During this procedure, observe the usual precautions regarding warm-up time, equipment cable lead dress and generator output cable termination.

TRAP ALIGNMENT

GENERAL:-

As noted above, an AM signal is required for trap alignment. In many cases, the technician will have a suitable AM signal generator available. It should cover the range of 40.0 to 48 megacycles at fundamental frequency, with available internal 400-cycle modulation. When this type of signal is used, the traps should be adjusted for minimum 400-cycle signal as observed on the oscilloscope.

Users of General Electric sweep alignment equipment may obtain the required amplitude-modulated carrier frequencies by a simple manipulation of the equipment controls as noted below.

Those technicians who do not have either of the above equipment available are advised to omit the trap alignment procedure. With the exception of the video amplifier 4.5 mc trap L156, the traps will not become seriously mis-aligned due to tube changes. The above-mentioned 4.5 mc trap may be sweep-aligned, if desired, in which case a 4.5 mc sweep signal should be used in step 2, Fig. 3. The trap may then be tuned to minimum response at 4.5 mc which should be crystal marker calibrated.

OBTAINING AM OUTPUT FROM G-E SWEEP EQUIPMENT.

The General Electric ST-4A Sweep Generator will provide 60-cycle square-wave amplitude-modulated signal. To obtain this signal proceed as follows:

1. Turn the sweep generator sweep width control fully counter-clockwise. This will provide a steady (zero sweep) carrier.

2. Turn the sweep generator blanking switch "on". This will square-wave-modulate the carrier at a 60-cycle rate.

3. The next step is to calibrate the frequency of this AM carrier.

a). Turn the marker generator "on" and set the dial to the desired frequency (4.5 mc, 41.25 mc or 47.25 mc).

b). Slowly tune the sweep generator through the desired frequency. As the desired frequency is approached, a strong beat signal will be observed on the oscilloscope. At exact resonance, a zero beat condition will be noted, on each side of which will appear a beat pattern. Minor sweep generator back-and-forth frequency drift may be noted. However, this drift is insignificant and may be disregarded.

c.) Turn off the marker output.

4. Apply this AM signal according to the instructions in the following chart.

5. The signal observed on the oscilloscope appears as two parallel lines. When the traps are properly tuned the distance between these lines will be at a minimum. NOTE: It may be necessary to use full output of the sweep generator and near maximum oscilloscope gain to observe proper trap tuning.

NOTES:-

1. Allow receiver and alignment equipment to warm up for 20 minutes before proceeding.

2. Set channel selector switch to channel #11 position. Turn the fine tuning control fully clockwise.

3. Turn the volume control and the area control fully counter-clockwise. Turn the picture contrast control fully clockwise.

4. Observe alignment wave forms at test point #5 (picture tube grid).

5. Remove V106 and V113 during alignment. Align as indicated in TRAP ALIGNMENT CHART.

FIG. 3

TRAP ALIGNMENT CHART

STEP	AM - GENERATOR INPUT POINT	AM - GENERATOR FREQUENCY	ADJUST FOR MINIMUM OUTPUT	REMARKS
1	Test Point #1 (R-F Tuner Unit)	47.25 mc	L151	May require maximum oscilloscope vertical gain.
		41.25 mc	L153	
2	Test Point #4 (Diode Load)	4.5 mc	L156	Connect detector network between oscilloscope input and receiver test point #5 as shown in figure 1.

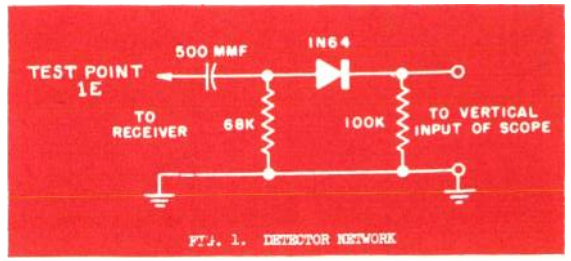


FIG. 1. DETECTOR NETWORK

I-F SYSTEM SWEEP ALIGNMENT

GENERAL:-

Now that the traps have been set at their proper frequencies the i-f curve may be shaped.

The following procedure requires the use of a simple sweep signal coupling jig as depicted in figure 2. This device is made from a tube shield cut in two halves, between which are soldered two 120-ohm resistors. The shield is placed over the 6J6 oscillator converter tube during the i-f alignment and hence provides loose capacitive coupling to the 6J6 i-f plate circuit. The resistors perform the dual function of supporting the upper half-shield and terminating the sweep output cable. Users of General Electric sweep equipment should use two 1-megohm resistors instead of 120 ohms, since proper sweep output cable termination is provided by the cable attenuator. The generator cable shield should be connected to the lower half shield, and the "signal" lead connected to the upper half-shield.

NOTES:-

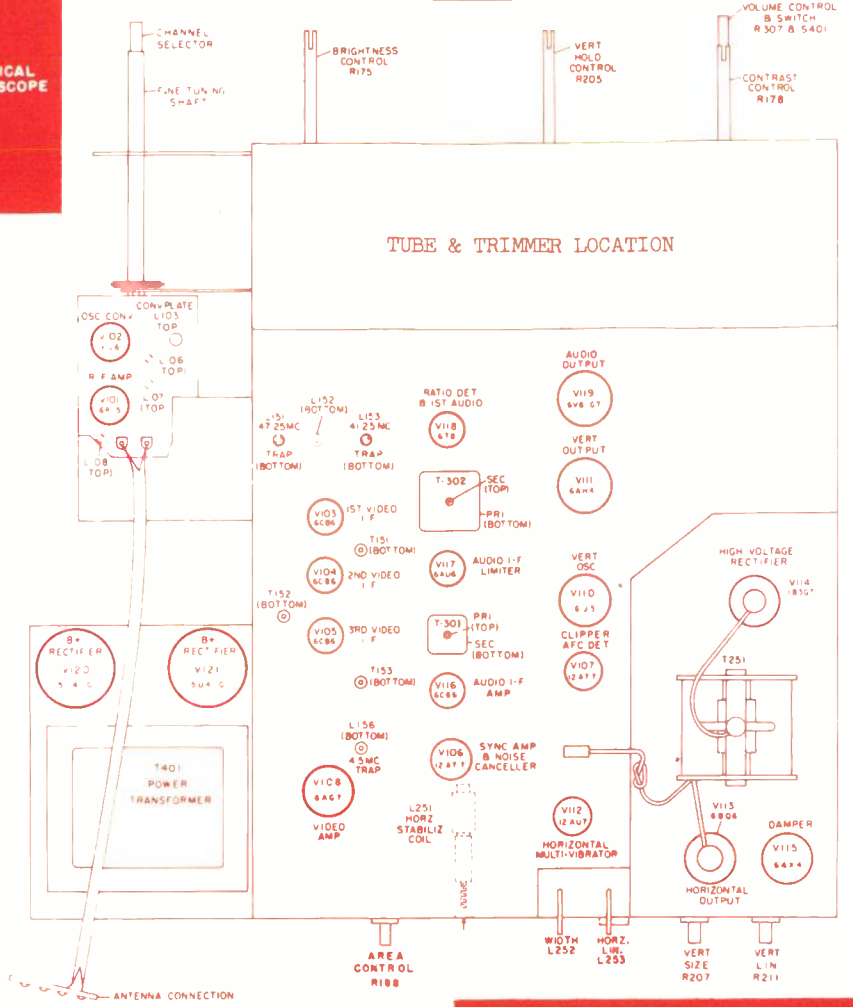
1. Turn picture contrast control to minimum.

2. Observe sweep waveform at test point #3 through a 10,000-ohm resistor. Oscilloscope should be calibrated so that 3/4 volt signal will provide 2-inch vertical deflection.

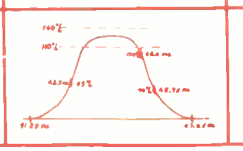
3. Apply a negative 4 1/2 volt battery bias voltage to test point #7. Connect positive lead of battery to chassis.

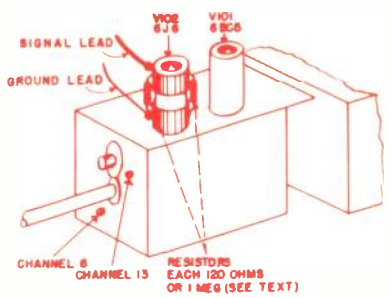
4. Note that the following procedure uses 45.0mc as the 100% reference point. Maintain the sweep generator output level so that the baseline-to-45 mc marker amplitude equals two inches. Align as indicated in VIDEO IF ALIGNMENT CHART.

SPECIFICATIONS	
POWER INPUT RATING:	Frequency ..... 60 cycles Voltage ..... 115 volts Wattage ..... 250 watts
R-F FREQ. RANGE:	Channels ..... No. 2 thru No. 13 Frequencies .... 54-88 mc, 174-216 mc with provision for UHF
OPERATIONAL FREQUENCIES:	Picture I-F carrier ..... 45.75 mc Adjacent channel audio trap ..... 47.25 mc Sound I-F carrier ..... 41.25 mc Intercarrier sound take-off ..... 4.5 mc
AUDIO POWER OUTPUT:	Undistorted ..... 1.5 watts Maximum ..... 2.5 watts



VIDEO I-F ALIGNMENT CHART

CONNECT SWEEP GENERATOR	ADJUST	DESIRED RESPONSE	REMARKS
Into alignment shield jig and r-f tuner chassis.	Peak T153, L103 L152 at 44.15 mc T152 set 42.5 mc @55% T151 set 45.75 mc @40%		T153, L103 and L152 should be readjusted slightly, if necessary, to shape peak region of curve as shown. Peak of curve may fall anywhere between the limits of 110% and 140% of 45 mc 100% reference point.



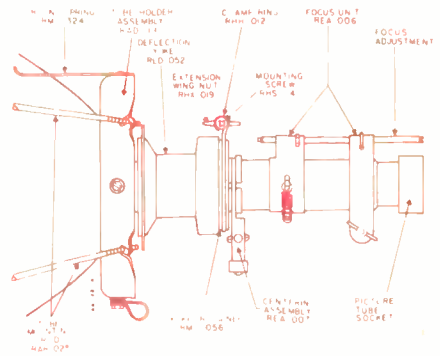


FIG. 2. R-F TUNER & I-F ALIGNMENT JIG

PRE-PEAKING:-

Should difficulty be experienced in obtaining the proper video i-f response, the tuning of the individual coils may be checked.

If the coils are each peaked at the below-specified frequencies, an over-all i-f response curve which closely approximates the proper curve will be achieved. After this is done, the sweep method may be used to thus permit proper final curve shaping. This peaking may be done by using an A-M signal as prescribed for setting the traps or the sweep method may be used by adjusting the coils for maximum amplitude at the desired marker points.

PEAKING FREQUENCIES

L103 - 44.15 mc
L152 - 44.15 mc
T153 - 44.15 mc
T151 - 45.25 mc
T152 - 42.9 mc

AUDIO I-F ALIGNMENT

NOTES:-

1. Tune in a television signal. This will provide a 4.5 mc signal source for audio i-f alignment. Keep the volume control turned down unless the speaker is connected.

2. Step 3 below requires a meter connection to the electrical midpoint of the ratio detector load circuit. To do this, connect two 100 K resistors in series between V118A (6T8) pin 2 and chassis. These two 100 K resistors should be chosen, as accurately as possible, for equal resistance.

Align as follows:

AUDIO I-F ALIGNMENT CHART

STEP	CONNECT VTVM OR 20,000 OHMS/VOLTMETER	ADJUST	METER INDICATION	REMARKS
1	To Test Point #6 and chassis	T301 (top and bottom cores)	Adjust for maximum deflection.	Voltage to be read is negative with respect to chassis.
2	V118A, pin 2 and chassis	T302 primary, (bottom core)		
3	Between Test Point #7 and center of two 100 K resistors.	T302 secondary, (top core).	Adjust for zero volts d-c output	Repeat steps 1, 2 and 3 to assure proper final adjustment.

R-F TUNER ALIGNMENT

For the present time, only the oscillator adjustments shall be considered. Additional r-f tuner alignment information will appear in a subsequent publication.

OSCILLATOR ADJUSTMENT:-

Only two screw-type adjustments are provided to set the oscillator frequency on the various channels, as shown in figure 2. The channel #13 alignment screw should be set to provide adequate fine tuning range for all available channels between #7 and #13. The channel #6 adjustment screw should be adjusted in a like manner for channels #2 through #6. In each case it should be possible, after final adjustments, to tune into audio information at the middle of the fine tuning range.

Minor changes in oscillator tuning due to r-f tuner tube replacement may be compensated for by adjustment of the channel #13 oscillator screw.

ADJUSTMENT OF HORIZONTAL STABILIZER COIL, L251.

1. Short pin 2 of V112 to chassis.

2. Short-circuit terminals of coil, L251.

3. Adjust horizontal hold control potentiometer to bring received picture closely into sync.

4. Remove short circuit from across terminals of L251.

5. Tune L251 to bring picture back into a closely synced condition.

6. Remove short between pin 2 of V112 and chassis. Check lock-in ability of horizontal sync on available channels.

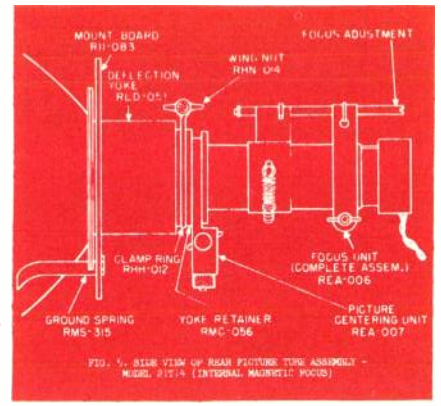
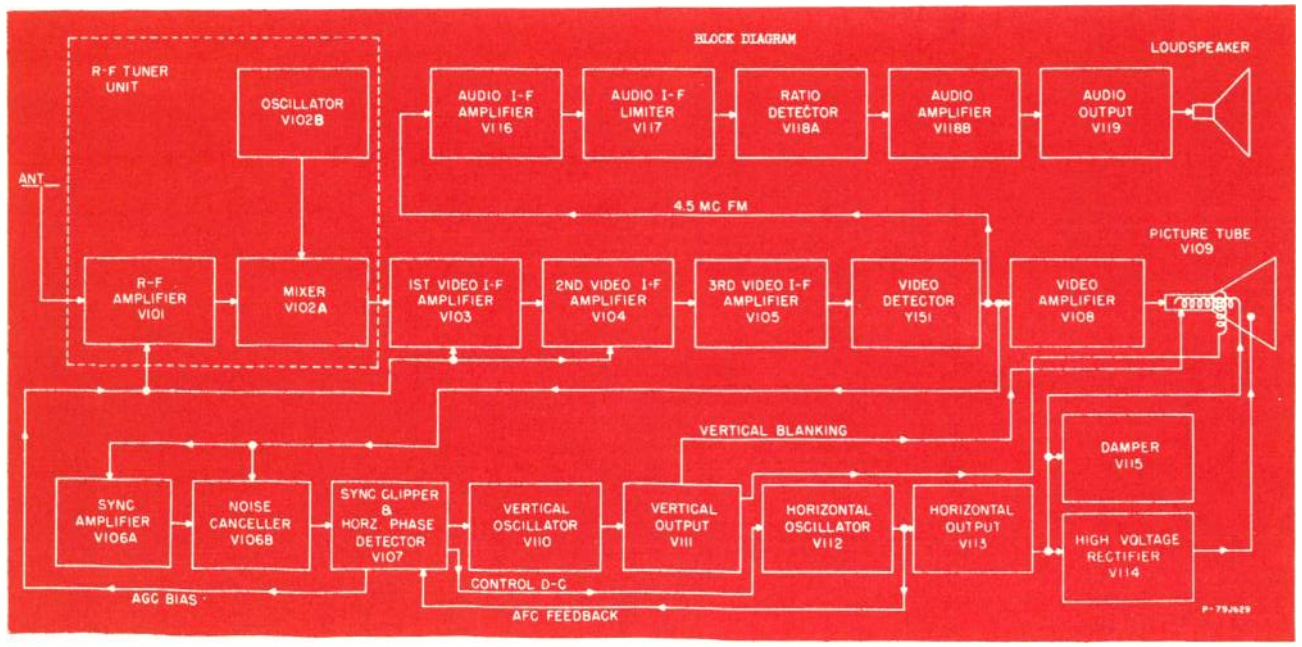


FIG. 4. SIDE VIEW OF REAR PICTURE TUBE ASSEMBLY - MODEL 21T14 (INTERNAL MAGNETIC FOCUS)



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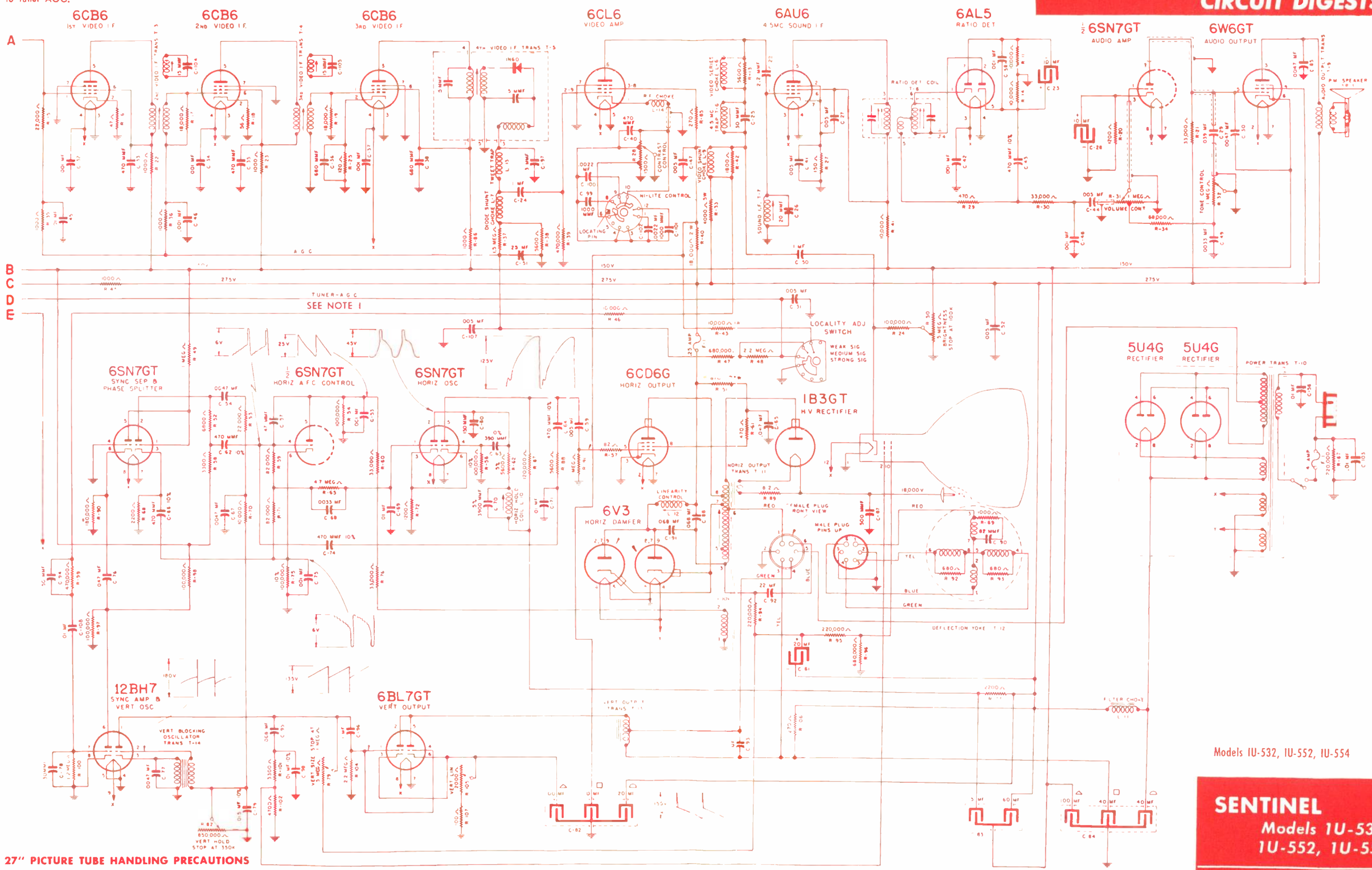
NOTE 1. R-108 (not shown) a 22,000 ohm res. added from junction of C-31 a .005 MFD. cond. and locality adjuster switch lead to tuner AGC.



27" PICTURE TUBE HANDLING PRECAUTIONS

EXTREME CARE MUST BE EXERCISED WHEN HANDLING OR SERVICING THE PICTURE TUBE. ACCIDENTS ARE ONLY CAUSED BY CARELESSNESS.

Listed below are precautions which must be taken when removing the picture tube.

1. To remove the picture tube mounting assembly.
   (a) Disconnect the second anode lead, the picture tube socket assembly, and the deflection yoke plug.
   (b) Remove the main chassis and the four picture tube support braces.
   (c) Remove the wood screws holding the picture tube mounting board assembly to the cabinet.
   (d) Slide picture tube assembly out. Because of its size and weight two persons are required to handle this assembly. The balance or center of weight is at the face of the picture tube.
2. Always wear goggles when handling picture tube.
3. Never hold the picture tube close to the body.
4. Never handle the picture tube by its neck.
5. Never bump or scratch the picture tube.
6. Always clean the neck of the picture tube before adjusting the ion trap.
7. If it becomes necessary to remove the picture tube from its mounting board, always place on a clean soft cloth face down.

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Models 1U-532, 1U-552, 1U-554

SENTINEL
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HIGH VOLTAGE AND CORONA

WARNING: HIGH VOLTAGE DEVELOPED IN THIS RECEIVER IS IN EXCESS OF 18,000 VOLTS.

Increased high voltage not only presents the problem of safety precautions, it also increases the problems of arcing and corona.

When servicing or replacing any part of the high voltage compartment of this receiver the following precautions and suggestions should be followed.

1. All connections to the high voltage transformer, condenser, and socket terminal should be made mechanically tight and all excessive wire clipped off, leaving no sharp points from these terminals.
2. A clean, round and smooth solder connection should be made, covering all sharp points. (Do not use excessive solder.)
3. All lead dresses in the high voltage compartment are critical.
   B+ leads or leads of ground or near ground potential too close to any high voltage leads will cause corona and/or arcing to the extent it may cause the insulation of the wires to burn.
4. All insulating wax when removed around the high voltage socket and condenser must be replaced. Insulating wax may be procured through the Sentinel Service Department.
5. Repairing high voltage transformers is not recommended. Always replace the defective transformer with a new one.
6. Before replacing the high voltage shield cover make a careful inspection of wire dress, soldered connections, and wax insulated parts.

VHF ALIGNMENT TABLE

RATIO DETECTOR AND SOUND ALIGNMENT

Step No.	Connect Signal Generator to	Sig. Gen. Freq.	Connect Voltmeter to	Miscellaneous Instructions	Adjust
1	In series with .001 Mfd Cond. to junction of C-97 and L-13 terminal 3 of 4th I.F. See fig. 5	4.5 MC	In series with 47,000 ohm res. across C-23 a 10 Mfd. cond. See fig. 5	Maintain reading on 10 volt scale contrast at maximum. Remove 3rd video IF tube 6CB6	T-7 (top) and T-8 (bottom) for max reading. See fig. 4 & 5
2	In series with .001 Mfd. Cond. to junction of C-97 and L-13 terminal 3 of 4th I.F. See fig. 5	4.5 MC	In series with 47,000 ohm res. to junction of R-30 and C-44. See fig. 5	Maintain reading on 10 volt scale contrast at maximum. Remove 3rd video IF tube 6CB6	T-8 (top) for zero reading. See fig. 4
3	In series with .001 Mfd. Cond. to cathode of picture tube yellow lead. See fig. 5	4.5 MC	In series with 47,00 ohm res. across C-23 a 10 Mfd. cond. See fig. 5	Maintain reading on low volt scale. Remove 3rd video IF tube 6CB6	T-6 (top) for minimum reading. See fig. 4

NOTE 1: For **minimum buzz** always adjust T-8 (top) with the sound carrier of a TV station.
NOTE 2. Alternate 4.5 MC. trap alignment: Adjust T-6 (top) for minimum 4.5 MC. beat on picture with a strong station signal.

PICTURE I-F ALIGNMENT

Step No.	Connect Signal Generator to	Sig. Gen. Freq.	Connect Voltmeter to	Miscellaneous Instructions	Adjust
4	Ungrounded converter tube (6J6) shield	44.0 MC.	In series with 47,000 ohm res. to junction of R-37 and L-7. See fig. 5	Tuner on channel 3, 3 volts bias across C-51 positive side to ground. Locality switch in strong position. See fig. 5	T-5 (top) for maximum reading. See fig. 4
5	Ungrounded converter tube (6J6) shield	43.0 MC.	In series with 47,000 ohm res. to junction of R-37 and L-7. See fig. 5	Tuner on channel 3, 3 volts bias across C-51 positive side to ground. Locality switch in strong position. See fig. 5	T-4 (top) for maximum reading. See fig. 4
6	Ungrounded converter tube (6J6) shield	41.25 MC.	In series with 47,000 ohm res. to junction of R-37 and L-7. See fig. 5	Tuner on channel 3, 3 volts bias across C-51 positive side to ground. Locality switch in strong position. See fig. 5 Repeat Steps 5 & 6	T-4 (bottom) for maximum reading. See fig. 5
7	Ungrounded converter tube (6J6) shield	45.4 MC.	In series with 47,000 ohm res. to junction of R-37 and L-7. See fig. 5	Tuner on channel 3, 3 volts bias across C-51 positive side to ground. Locality switch in strong position. See fig. 5	T-3 (top) for maximum reading. See fig. 4
8	Ungrounded converter tube (6J6) shield	47.25 MC.	In series with 47,000 ohm res. to junction of R-37 and L-7. See fig. 5	Tuner on channel 3, 3 volts bias across C-51 positive side to ground. Locality switch in strong position. See fig. 5 Repeat Steps 7 & 8	T-3 (bottom) for maximum reading. See fig. 5
9	Ungrounded converter tube (6J6) shield	44.6 MC.	In series with 47,000 ohm res. to junction of R-37 and L-7. See fig. 5	Tuner on channel 3, 3 volts bias across C-51 positive side to ground. Locality switch in strong position. See fig. 5 NOTE: Detune T-2 by turning slug out as far as possible.	T-1 (top) for minimum reading. See fig. 4
10	Ungrounded converter tube (6J6) shield	45.75MC.	In series with 47,000 ohm res. to junction of R-37 and L-7. See fig. 5	Tuner on channel 3, 3 volts bias across C-51 positive side to ground. Locality switch in strong position. See fig. 5	T-2 (top) for minimum reading. See fig. 4

NOTE 3: For visual check of IF response curve (see fig. 2) connect signal and sweep generator to ungrounded converter tube shield (6J6). Connect oscilloscope in series with 47,000 ohm resistor to junction of R-37 and L-7.

TUNER R.F. ALIGNMENT

NOTE 4. NEVER ADJUST C-3, C-7 and C-12 UNLESS ABSOLUTELY NECESSARY. THEY ARE FACTORY PRESET BY SPECIAL EQUIPMENT.

Step No.	Connect Marker Generator to	Marker Gen. Freq.	Connect Sweep Gen. to	Sweep Gen. Chan.	Connect Oscilloscope to	Miscellaneous Connections	Adjust
11	Loosely couple to sweep gen. leads	205.25 MC and 209.75 MC.	300 ohm antenna terminals	12	Lead extending from top of tuner. See fig. 4	Tuner on channel 12, 3 volt bias to junction of C-51 locality switch in strong position	C-3, C-7 and C-12 for max. response having linear peaks with picture and sound markers at 90% maximum response. See fig. 3
12	OBSERVE RESPONSE CURVE FOR ALL CHANNELS USING CORRECT FREQUENCIES AND CHANNELS. A SLIGHT COMPROMISE SHOULD BE MADE WITH C-3, C-7 and C-12 IF MARKERS ARE BELOW 70%.						

NOTE 5. FOR RF OSCILLATOR ALIGNMENT, SET FINE TUNING CONTROL IN CENTER POSITION. ADJUST INDIVIDUAL CHANNEL TRIMMERS FOR BEST PICTURE DETAIL WITH THE PATTERNS OF A TV STATION. NOTE USE A NON-METALLIC SCREW DRIVER.

NOTE 6. C-18 (See fig. 4) part of a 40 MC. tuned trap need only be adjusted when local interferences from 40 thru 45 MC. affect the picture. Adjust C-18 for minimum 40 MC. beat on picture with a station signal. Not used in Models with UHF Tuner.

VHF ALIGNMENT DATA

ALIGNMENT PROCEDURE

All circuits are very stable and will seldom require adjustment. Only when major parts of the tuner or the video I-F strip have been replaced or tampered with will it be necessary to realign the receiver.

Generally under normal conditions only the INDIVIDUAL CHANNEL TRIMMERS in the tuner unit may require adjustment by the service technician.

RATIO DETECTOR AND SOUND I-F ALIGNMENT

In most cases only the secondary of the ratio detector coil will require adjustment. This can be done simply by adjusting the top adjustment screw of the ratio detector for minimum buzz with the sound carrier of a TV station. For complete alignment use steps 1, 2, and 3 in the alignment table.

PICTURE I-F ALIGNMENT

Receiver should be run for at least ½ hour before proceeding with alignment.

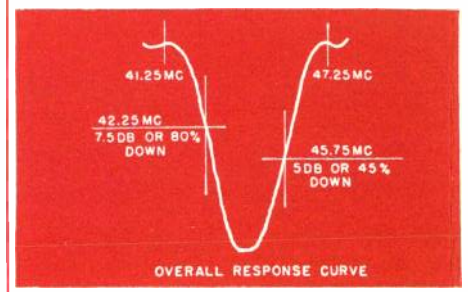


FIG. 2

EQUIPMENT REQUIRED

VACUUM TUBE VOLTMETER
For video IF alignment maintain readings in middle of low volt scale.

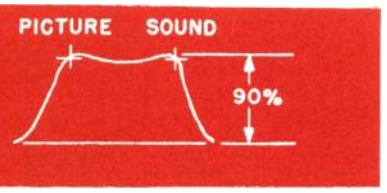
SIGNAL GENERATOR supplying a 4.5 MC (within 25%) 40 to 216 MC (within 1%) signal. With output adjustable to at least .1 volt maximum.

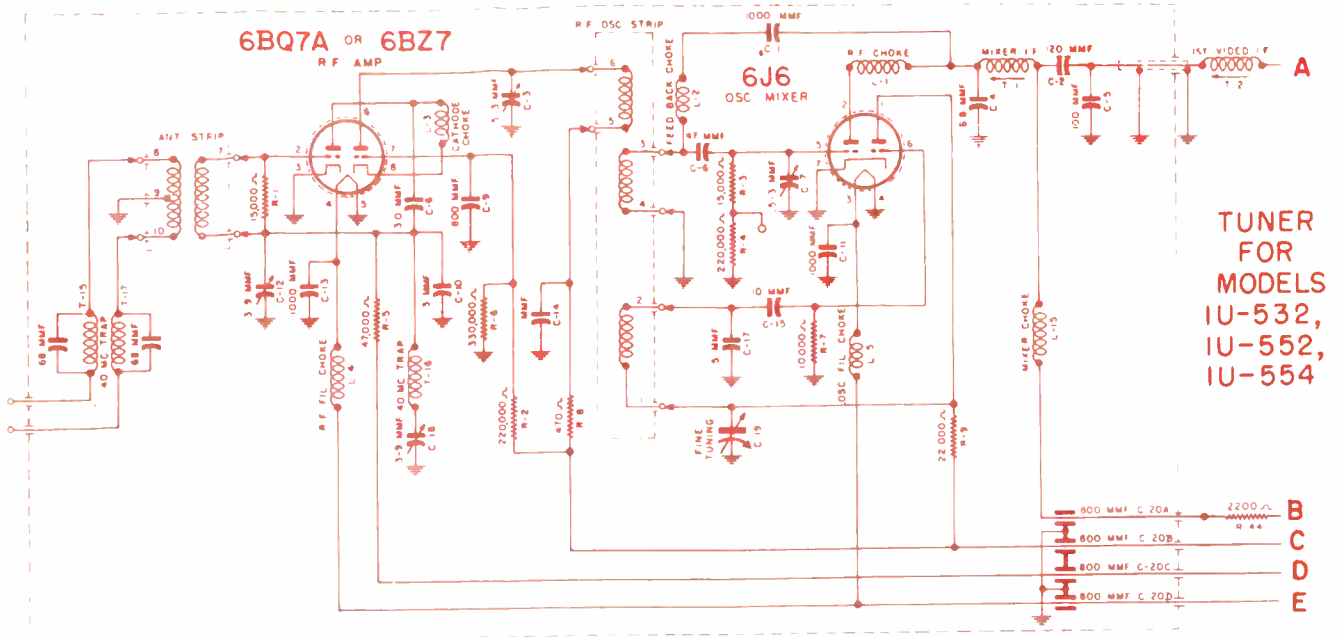
CATHODE-RAY OSCILLOSCOPE. Must have good frequency and phase response from 10 cycles to at least 2 MC.

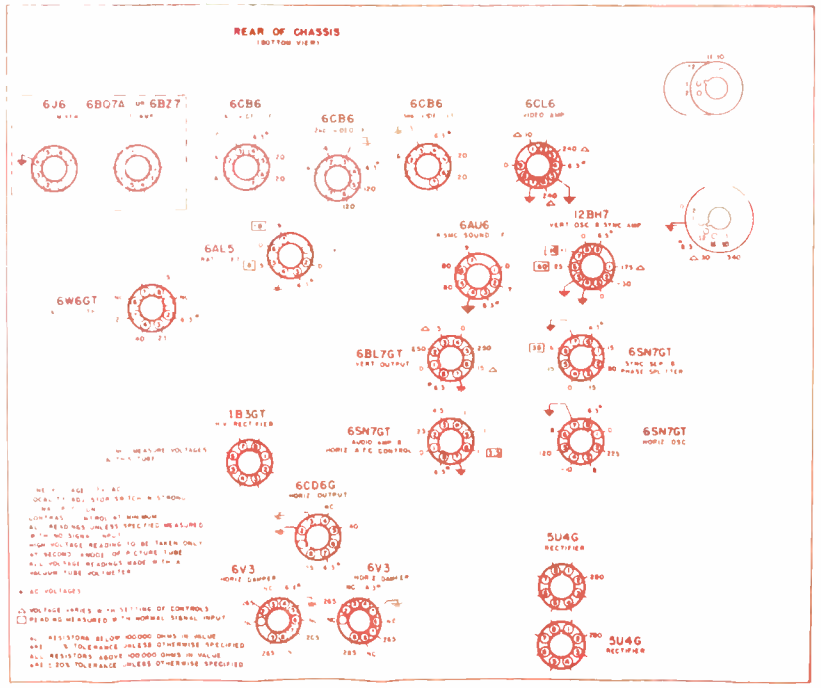
SWEEP GENERATOR. Capable of covering 40 to 270 MC. with a 10 MC. sweep with output adjustable to at least .1 volt maximum.

3 VOLT "A" BATTERY to provide fixed bias during video I-F and R-F alignment.

FIG. 3







TRIMMER LOCATION AND ALIGNMENT CONNECTION POINTS

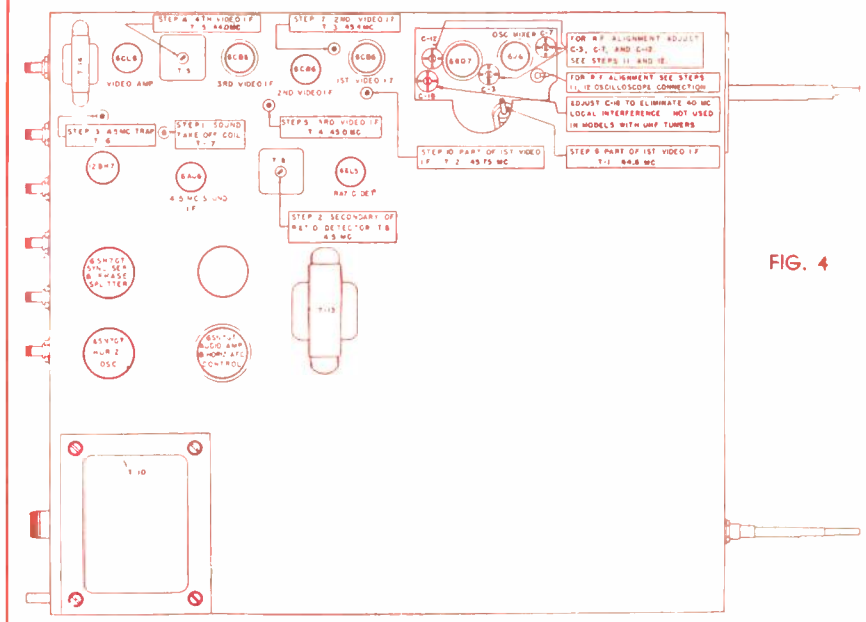


FIG. 4

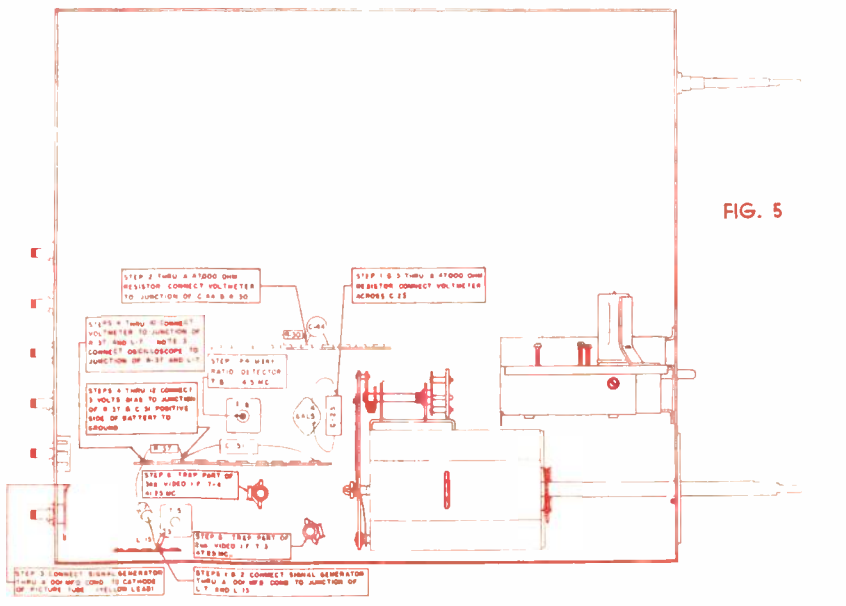


FIG. 5

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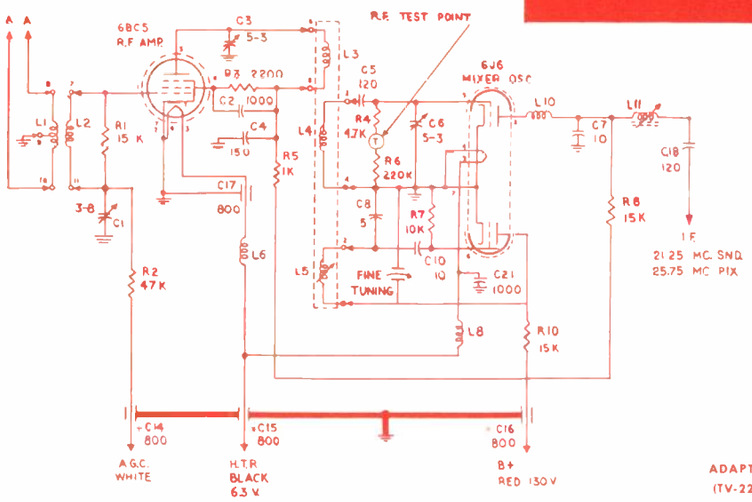
CIRCUIT DIAGRAM—TV-1532

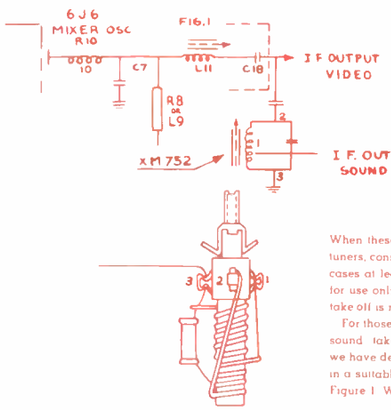


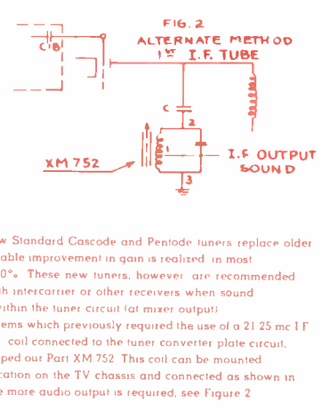
800 mmf minimum feed-thru by pass condensers

All parts listed are engineered and manufactured specifically for THE STANDARD TUNER designated. All other parts not listed, such as resistors, twin lead, etc., are standard items obtainable through your preferred source.

The respective antenna and oscillator coils are not interchangeable in all tuners. Therefore, in ordering these items, be sure to specify correct series of coils: F-G-H-K-M-Q-R.

ADAPTATION OF THE STANDARD "SUPER" CASCODE TUNER (TV-2232) AND THE NEW IMPROVED STANDARD PENTODE TUNER (TV-1532) TO SPLIT SOUND I.F. SYSTEMS





The UHF coil strips are designed to clip into the Standard Coil VHF turret tuner coil drum and replace unused VHF channel strips as required for the reception of individual UHF channels. The coil strips are pretuned at the factory for a specified UHF channel and specified tuner type UHF strips are identified by the channel number followed by a code letter which must be the same as the code letter on the VHF coil strip.

The antenna section, one of the two strips required for each channel, is composed of a specially constructed plastic piece to which a silver plated mounting bracket is attached. Coils with their associated tuning means are mounted on the bracket.

The oscillator-converter coil segment is similar in construction to the VHF coil segment. It differs in that a germanium crystal with its associated biasing resistor R1, and bypass capacitor C6, is included for local oscillator harmonic generation. A pin connector is provided for coupling oscillator energy to the antenna coil segment. Caution—A good contact must be made between the connecting contacts when the strips are installed. Also, be sure that the small grounding tab makes a good contact to ground.

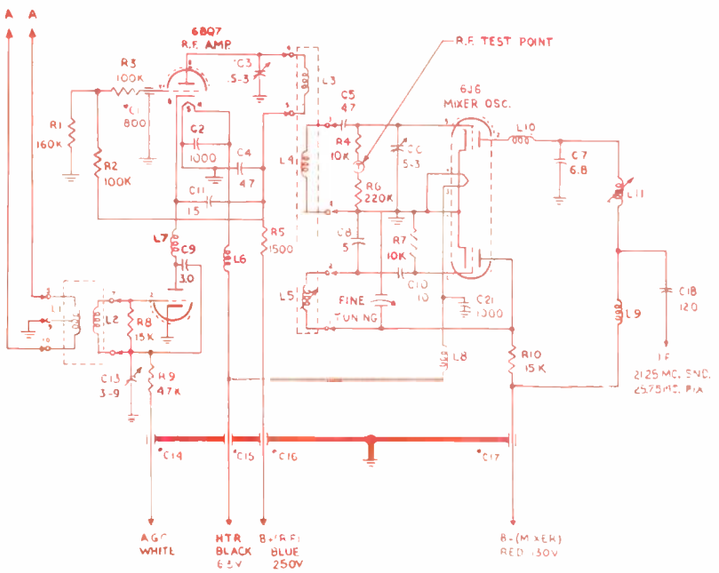
When these new Standard Cascode and Pentode tuners replace older tuners, considerable improvement in gain is realized in most cases at least 50%. These new tuners, however are recommended for use only with intercarrier or other receivers when sound take off is not within the tuner circuit (at mixer output).

For those systems which previously required the use of a 21.25 mc I.F. sound take off coil connected to the tuner converter plate circuit, we have developed our Part XM 752. This coil can be mounted in a suitable location on the TV chassis and connected as shown in Figure 1. Where more audio output is required, see Figure 2.

C — Gimmick or capacitor approx. 2 to 4 mmf depending upon requirements (not supplied as part of XM 752)

NOTE: Some TV sets may not have enough sound rejection built into the I.F. system and will require more trapping than the XM 752 sound take off coil will provide. In these sets it is recommended that an additional trap at sound I.F. frequency be included in the I.F. system.

For optimum performance in fringe areas, maximum B+ (250 V. should be used. Approximately -8 to -11 V. bias AGC White will result in the best sensitivity. A suitable bias control however must be available to avoid overload on strong signals.



800 mmf minimum feed-thru by pass condensers

CIRCUIT DIAGRAM—TV-2232

Models TV-1532, TV-2232

STANDARD COIL Tuner
Models TV-1532, TV-2232

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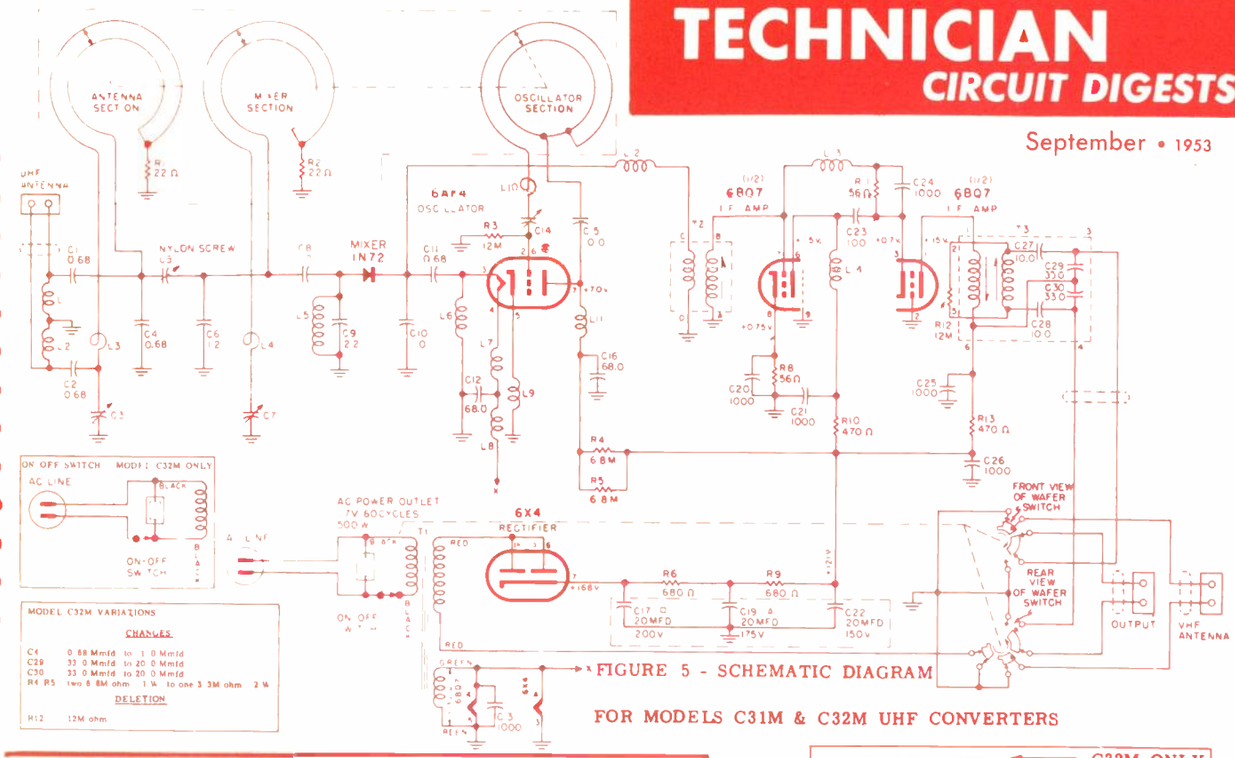

FIGURE 5 - SCHEMATIC DIAGRAM

FOR MODELS C31M & C32M UHF CONVERTERS

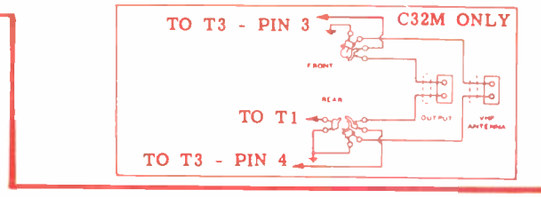

FIGURE 6 - SCHEMATIC DIAGRAM FOR MODEL C33M UHF CONVERTER

VOLTAGES ARE MEASURED TO CHASSIS, D.C. TAKEN AT 20,000 OHMS PER VOLT, A.C. AT 1,000 OHMS PER VOLT MEASUREMENT CONDITIONS: SOURCE 117 VOLT 60 CYCLE, ANTENNAS DISCONNECTED WITH NO SIGNAL INPUT, TUNER IN FULL CCW POSITION, VHF-UHF SELECTOR SWITCH IN "UHF" POSITION

WAFERSWITCH ROTATES IN DIRECTION OF ARROWS TO "VHF" TO "OFF"

CAPACITANCE VALUES ARE IN MICROMICROFARADS, UNLESS OTHERWISE INDICATED

@ MEASURED WITH V.T.V.M. THIS VOLTAGE SHOULD READ 4 TO 6 VOLTS THROUGHOUT RANGE OF TUNER

SPECIFICATIONS

Frequency Range	
Channels 14 to 83	470 Mc. to 890 Mc.
IF Frequency	
Channels 5 & 6 centering at	82 Mc.
Power Supply	
105 to 128 Volts 60 Cycle	25 Watts
Input & Output Impedances	
Antenna Input	300 Ohms
Output	300 Ohms

UHF Converter
models C31M, C32M, C33M

SYLVANIA
UHF Converter
Models C31M, C32M, C33M

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SYLVANIA
UHF Converter
Models C31M, C32M, C33M

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SPECIAL ANTENNA INSTALLATION NOTES

Note 1: Separate VHF and UHF antenna installations will be necessary for a converter-receiver combination using one of these converter models, as the respective converter antenna inputs are grounded when not in use. If use of a single antenna for VHF and UHF is desired, a DPDT switch arrangement in the antenna lead must be used to isolate the unused and grounded converter terminals. When reception conditions permit the use of the built-in UHF antenna, no switching arrangement will be necessary.

Note 2: It is very important to maintain the correct impedance match between all units of any VHF-UHF antenna installation - 300 ohms is the recommended lead-in wire impedance. Flat 300 ohm twin lead may be used between converter and receiver but is not suited for outdoor installation between the UHF antenna and the UHF converter unit. Use tubular 300 ohm lead-in, open line, or one of the special UHF transmission lines recently developed. In all installations of UHF converters, it is recommended that a tin foil strip about 3/8" wide be wrapped around 300 ohm lead-in; then, this "slider" should be adjusted up and down the line for optimum performance.

SPECIAL SERVICE INSTRUCTIONS

The use of the Ultra-High Frequency band for television broadcasting necessitates a high degree of precision in the manufacture of suitable converters. This precision manufacture applies especially to component placement, lead lengths, lead dress, and component size. Thus, the servicing of a converter chassis in the field results in problems not usually encountered in conventional radio and television receivers. To ease many of the servicing problems on major repairs, Sylvania distributors stock a number of converter chassis to replace field failures on an exchange basis.

Many components in the IF and power supply sections may be replaced in the field. However, the length of leads, the lead dress, and the placement of components are extremely critical and must be matched exactly in the course of servicing the chassis.

As for the replacement of tubes, the 6X4 Rectifier tube (selenium rectifier in the C33M) may be replaced without affecting alignment of any critical circuits. Replacement of the IF Amplifier tube will have little or no effect on the alignment. On models C31M and C32M, replace the Mixer crystal with the original type; on model C33M only, Sylvania type 1N82 may be substituted for the 1N72. When replacement of the Oscillator tube becomes necessary, the new 6AF4 may disturb tracking and sensitivity. (Slight variations in tube characteristics are responsible for this possibility.) Substitute several new 6AF4 tubes until one is found that restores normal operation of the converter.

If a satisfactory 6AF4 cannot be found, try a "touch up" adjustment of the oscillator trimmer using an actual station as the signal source.

(On models C31M and C32M, this trimmer is coded C14, and on model C33M this trimmer is coded C13.) This adjustment is accessible on the underside of all chassis thru a hole in the side of the shielded compartment for the oscillator tube socket and adjacent components. Tune the converter to an operating channel and adjust this trimmer to obtain the best possible picture. "Rock" the converter channel selector slightly while adjusting oscillator trimmer to assure optimum tracking of preselector circuits.

If operation of the converter remains unsatisfactory, perform the complete alignment procedure described under "Alignment Procedure". If sensitivity and tracking still cannot be restored after the alignment attempt, return the defective chassis to your Sylvania distributor for exchange.

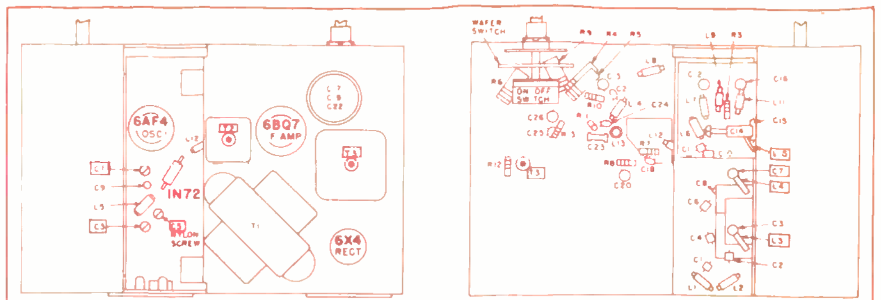
FIGURE 1 - TOP AND BOTTOM LAYOUTS FOR MODELS C31M & C32M

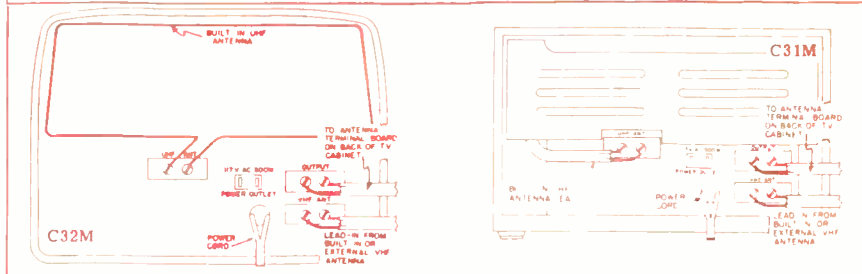

FIGURE 2 - REAR LAYOUTS FOR MODELS C31M & C32M

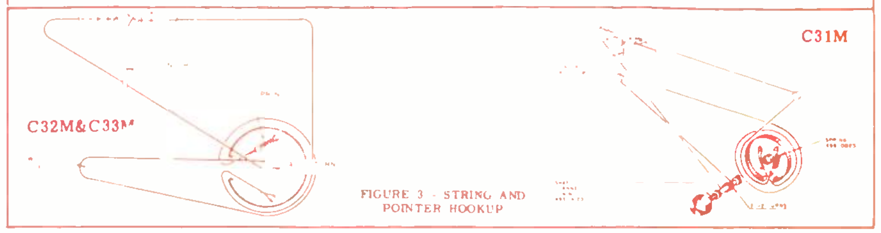

FIGURE 3 - STRING AND POINTER HOOKUP

ALIGNMENT PROCEDURE

I. F. ALIGNMENT

STEP	AM GENERATOR Connection	Freq	SWEEP GENERATOR Connection	Freq	VTVM CONNECTION	OSCILLOSCOPE CONNECTION	ADJUST	OUTPUT READING	COMMENTS
1	Connect UHF converter to VHF receiver [illegible]								
2	Thru resistor network of Fig. A to junction of (C31M C32M) L12 and crystal Mixer 1N72; (C33M) L8 and crystal Mixer 1N72	82 Mc	—	—	Across video detector load resistor of accompanying receiver	—	T2 Top [illegible] T3 Both [illegible]	[illegible]	[illegible]
3	—		Thru resistor network of Fig. A to junction of (C31M C32M) L12 and crystal Mixer 1N72; (C33M) L8 and crystal Mixer 1N72	Chan. 5 76 to 82 Mc; Chan. 6 82 to 88 Mc	—	Across video detector load resistor of accompanying receiver	T2 Top Core; T3 Both Cores	Equal response on Channel 5 and Channel 6 (See Fig. C)	Apply [illegible] AGC [illegible] TV [illegible] information. Set VHF receiver to Channel 5 or 6 (See Note 1). On receivers with detent type tuners, adjust the fine tuning control to a compromise setting between Channels 5 and 6, using an RF marker generator. That is, adjust for a point where picture and sound markers fall in properly for both channels, if possible. ONCE ADJUSTED DO NOT DISTURB FINE TUNING CONTROL. Alternately set both VHF receiver and sweep generator to Channel 5 and Channel 6 and adjust T2 and T3 for equal response on both channels.

Note 1: Check VHF receiver's tuner response on Channels 5 and 6 according to applicable service information. (Response on each channel should be approximately equal in amplitude.)

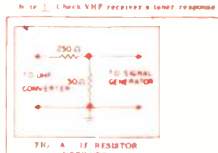

FIG. A IF RESISTOR NETWORK

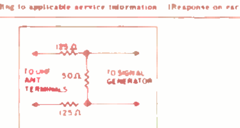

FIG. B RF & OSCILLATOR RESISTOR NETWORK

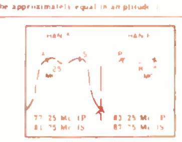
FIG. C IDEAL RESPONSE CURVES

OSCILLATOR ALIGNMENT

STEP	AM GENERATOR Connection	Freq	SWEEP GENERATOR Connection	Freq	VTVM CONNECTION	OSCILLOSCOPE CONNECTION	ADJUST	OUTPUT READING	COMMENTS
1	Thru resistor network of Fig. B to UHF antenna terminals of converter	465 Mc or 93 Mc (5th harmonic)	—		Across video detector load resistor of accompanying VHF TV receiver	—	C31M C32M C14 trimmer; (C33M) C13 trimmer	Max	Set converter tuning control to position pointer at extreme left hand edge of dial. Use long non-metallic screwdriver thru hole in side of oscillator tube [illegible] compartment.
2	Thru resistor network of Fig. B to UHF antenna terminals of converter	900 Mc or 180 Mc 5th harmonic	—	—	Across video detector load resistor of accompanying VHF TV receiver	—	(C31M C32M) L10 end inductor; (C33M) L6 end inductor	Max	Set converter tuning control to position pointer at extreme right hand edge of dial. Spread or pinch together legs of [illegible] L10 or L6 using non-metallic [illegible]. See Note 2.
3	Repeat steps 1 and 2 until no further improvement in signal is apparent. The oscillator alignment figures of 465 Mc and 900 Mc are approximate only and may not fall exactly at the extreme dial settings [illegible]; however, the oscillator must be aligned so that both frequencies can be tuned by normal manipulation of the dial.								

Note 2: The oscillator [illegible] end inductor L10 on C31M and C32M and L6 and on C33M is reached through a hole in the removable cover for the oscillator tube socket compartment. The cover must remain on during adjustment of L10 or L6.

R F ALIGNMENT

STEP	AM GENERATOR Connection	Freq	SWEEP GENERATOR Connection	Freq	VTVM CONNECTION	OSCILLOSCOPE CONNECTION	ADJUST	OUTPUT READING	COMMENTS
1	Thru resistor network of Fig. B to UHF antenna terminals of converter	465 Mc or 93 Mc 5th harmonic		—	Across video detector load resistor of accompanying VHF TV receiver	—	(C31M C32M) C3 and C7 trimmers; C33M C3 and C4 trimmers	Max	Set converter tuning control to position pointer at extreme left hand edge of dial.
2	Thru resistor network of Fig. B to UHF antenna terminals of converter	900 Mc or 180 Mc 5th harmonic	—	—	Across video detector load resistor of accompanying VHF TV receiver	—	(C31M C32M) L3 and L4 end inductors; C33M L1 and L2 end inductors	Max	Set converter tuning control to position pointer at extreme right hand edge of dial. Spread or pinch together the legs of the antenna and mixer [illegible] end inductors L3 and L4 or L1 and L2 [illegible] non-metallic [illegible].
3	Repeat steps 1 and 2 until no further improvement in signal is apparent.								
4	Models C31M and C32M only: Thru resistor network of Fig. B to UHF antenna terminals of converter	465 Mc or 93 M 5th harmonic			Across video detector load resistor of accompanying VHF TV receiver	—	C5 nylon screw	Max	Set converter tuning control to position pointer at extreme left hand edge of dial.
5	Remove all test equipment and resistor networks.								

STANDARD COIL Tuner
Models TV-1532, TV-2232

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THE STANDARD TUNER

	PART NO.
PENTODE CIRCUIT	TV-1532
CASCODE CIRCUIT	TV-2232

PARTS

REFERENCES	DESCRIPTION	TV 200 SERIES PART NO	TV 1500 SERIES PART NO	TV 2000 SERIES PART NO	TV 2200 SERIES PART NO
A	Antenna Coil	31M 012 2F thru 13F	31M 012 2H thru 13H	31M 012 2K thru 13K	31M 012 2Q thru 13Q
B	Oscillator Coil	31M 112 2F thru 13F	31M 112 2H thru 13H	31M 112 2K thru 13K	31M 112 2Q thru 13Q
C	Fine Tuning Assembly	31A 066 22	31A 066 22	31A 066 22	31A 066 22
D	Detent Spring	31B 005	31B 005	31B 005	31B 005
E	Roller	31B 016	31B 016	31B 016	31B 016
F	I. F. Coil Assembly	31A 082	31A 078	31A 078	31A 078
No Reference	Sound Trap Assembly	31A 067			
G	Oscillator Tuning Slug	31B 015	31B 015	31B 015	31B 015
H	Retainer Spring (Drum)	31B 030	31B 030	31B 030	31B 030
I	Contact Plate and Bracket Assembly	31B 278	31B 278	31B 278	31B 278
J	Coil Support Assembly	31B 203 22	31B 203 22	31B 203 22	31B 203 22
K	Fine Tuner Ground Plate	31B 012	31B 012	31B 012	31B 012
L	a Fine Tuner Ceramic Disc	31B 252	31B 252	31B 252	31B 252
	b Mounting Bracket	31B 021	31B 021	31B 021	31B 021
M	Fine Tuner Tension Spring	31B 008	31B 008	31B 008	31B 008
N	Washer Fiber	11D 022	11D 022	11D 022	11D 022
O	Shield Bottom Cover		31B 103	31B 103	31B 103
P	Shield Side Cover		31B 143	31B 143	31B 143
Q	Oscillator Slug Retainer Spring	31A 010	31A 010	31A 010	31A 010
No Reference	Trimmer Kit Antenna	31B 207	31B 207	31B 207	31B 207
R	Trimmer Kit (All others)	31B 206	31B 206	31B 206	31B 206
S	Shield Oscillator Tube	16S 006	16S 006	16S 006	16S 006
T	Shield R. F. Tube	16S 006	16S 006	16S 004	16S 004
No Reference	Sound Take Off Coil		XM 752	XM 752	XM 752
No Reference	Condensers				
	10 mmf ± 5% N750	13LBU 1000		13LBU 1000	
	10 mmf ± 10% NPO		13LBC 100K		13LBC 100K
	120 mmf ± 5% N750	13D-045		13D-045	
	120 mmf ± 10%		13LBD 121K		
	1000 mmf GMV	13LBX 102Z	13LBX 102Z	13LBX 102Z	13LBX 102Z
	47 mmf ± 10% N1400				13LBQ 470K
No Reference	UHF Coil Strips	(For all series of The Standard Tuner Part No. 31G 200)			

IMPORTANT NOTE: UHF Strip Part No. 31G 200 includes one oscillator and one antenna coil.
When ordering please give the channel number and the coil series letter which appears on all Standard coil strips.
Parts for TV 100 series not listed but available. When ordering such parts just describe item and show as TV 100 series.
For location of tuner components, please refer to diagram on page 5.

INSTALLATION

Install the tuner physically on the set chassis after cutting shafts to proper length and connect the several lead wires as follows:

White	to A.G.C. source
Black	to 6.3 V heater source
Red	to 135 V B+ source
Blue	to 250 V B+ source (Cascode only)
Terminal	to I.F. input on main chassis
Antenna	to antenna input terminals

NOTE: (Cascode only)

Prior to aligning the I.F., check the high B+ voltage to be supplied to the Blue lead with the antenna lead disconnected and the two wires shorted. This DC voltage should be 250 V, under this condition for optimum operation.

I. F. ALIGNMENT

Connect a VTVM in series with a 10,000 ohm resistor to the 2nd detector video output on main chassis. Remove the tube shield on the 6J6 on tuner. Capacity couple an A.M. Signal Generator to 6J6 by slipping tight fitting ungrounded shield over the 6J6 and connect generator to ungrounded shield. Set frequency of generator to the recommended I.F. of the set manufacturer and tune L11 (screw set on bias on top of tuner) for maximum voltage on VTVM. Use low output for this adjustment.

NOTE:

This tuner I.F. is nominally set at 22.3 mc at the factory, but can be adjusted to any frequency within the range of 19-26 mc. The above alignment should not be necessary as this unit has been aligned at the factory. However, if other I.F. is required, tubes or other parts replaced, then alignment will be necessary.

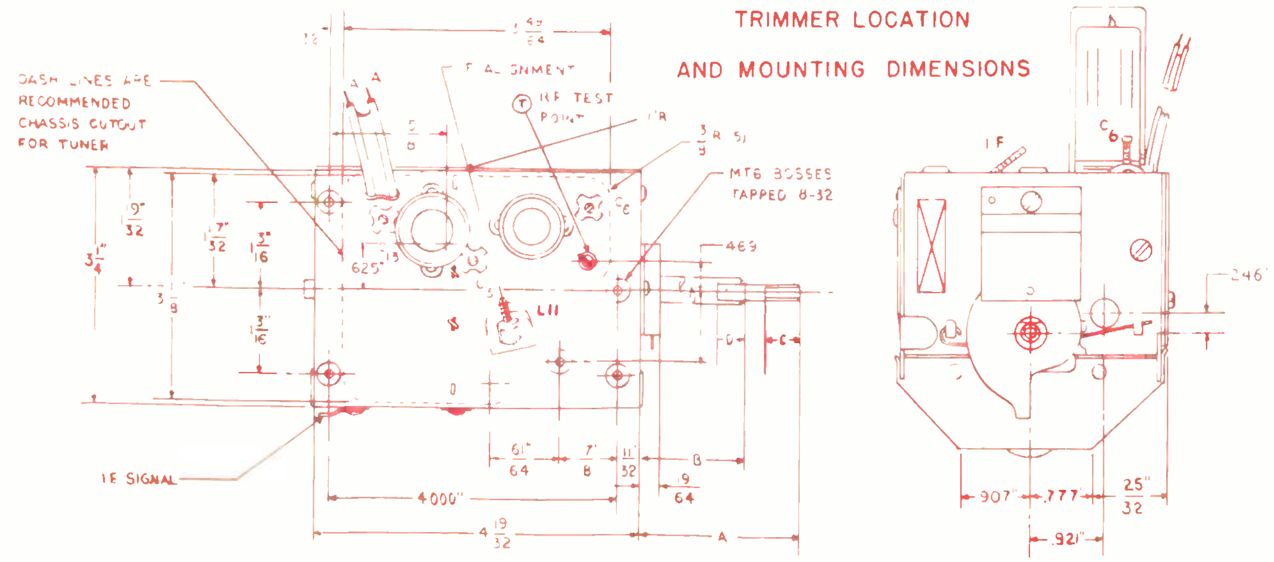
R. F. AND MIXER ALIGNMENT

1. Set station selector to Channel 10.
2. Connect oscilloscope through 10,000 ohms to test point T (Wire loop on top of tuner).
3. For negative bias connect -3 volts DC (1.5 volts DC for Pentode) to A.G.C. lead (white covered wire) from tuner.
4. Feed sweep generator into antenna terminals, sweeping Channel 10.
5. Adjust C13, C3 and C6 on the TV-2232, or C1, C3 and C6 on the TV-1532 (upright screws on top of tuner) for flat top response curve and maximum gain. Check markers on all channels. They should fall in automatically on all channels.

OSCILLATOR ALIGNMENT

1. Turn on set and select channel to be viewed.
2. Center fine tuning control.
3. Place a non inductive screwdriver through opening, and adjust oscillator coil for best picture and sound.
4. Repeat this adjustment for each channel that can be viewed in this area.

TRIMMER LOCATION AND MOUNTING DIMENSIONS



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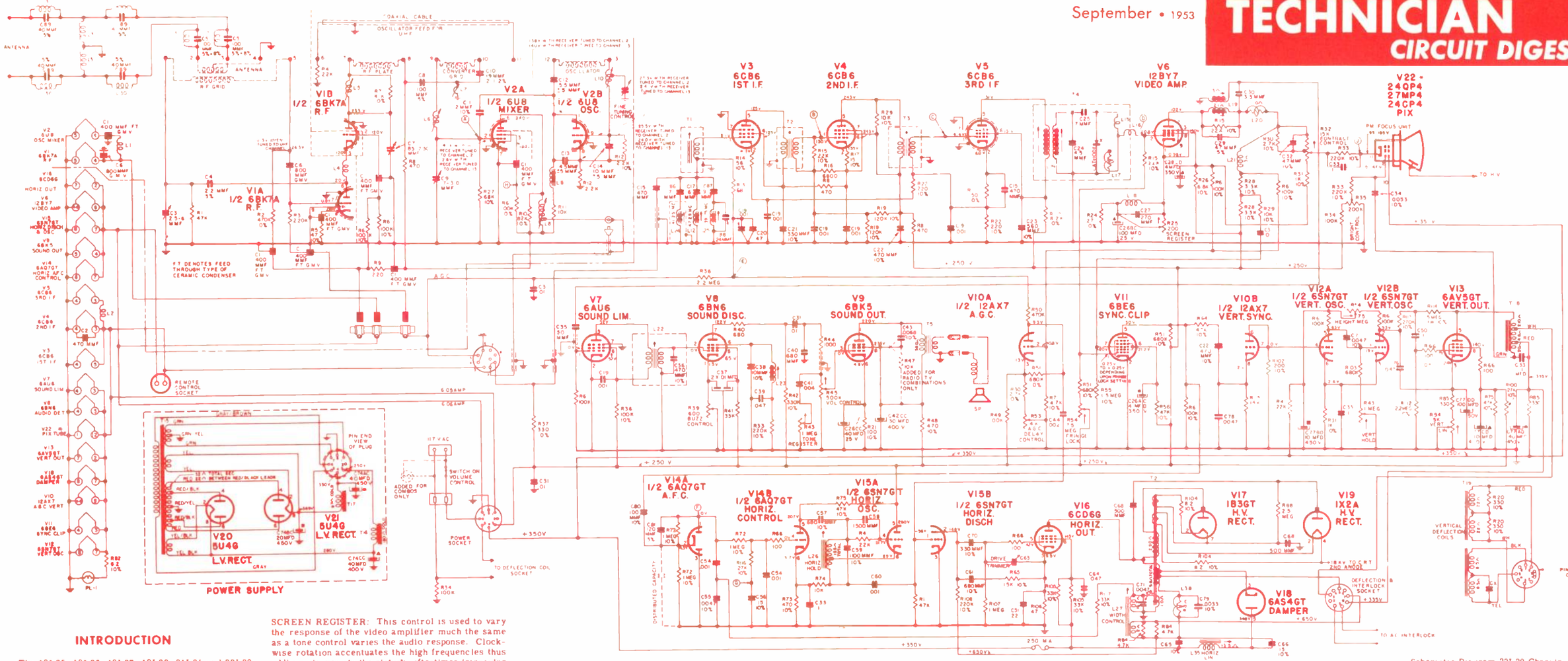


Schematic Diagram 22L20 Chassis

INTRODUCTION

The 19L25, 19L26, 19L27, 19L28, 21L21 and 22L20 chassis . . . . . are basically alike. Alignment and adjustment procedures are identical. The slight differences which exist are as follows:

19L25 This chassis utilizes a 17 inch rectangular picture tube and is the basic chassis

19L26: This chassis is the same as the 19L25 without the screen and tone register controls.

19L27: This is the 19L25 chassis with a 21 inch picture tube.

19L28: This is the 19L26 chassis with a 21" picture tube.

21L21: This chassis is the same as the basic 19L25 chassis except for the 21 inch picture tube and the addition of a 5U4G low voltage rectifier and a 1X2A tube in the high voltage circuit. The 1X2A is used in conjunction with the 1B3GT rectifier to boost the picture tube second anode voltage to 18.5 Kv. This chassis uses a 6CD6 in the horizontal output circuit. PM focusing and centering is utilized.

22L20: This chassis is similar to the 21L21 chassis but has a separate power supply and utilizes either the 24 or 27 inch picture tube. The 12AX7 used as the vertical oscillator in all other "L" chassis is used in the interface circuit of this chassis. This circuit is designed to utilize the actual vertical pulse for triggering, rather than depending on the voltage build-up across an intergrating network. In this circuit the first of the six serration of the vertical pulse is differentiated, clipped by the 12AX7 (used as a diode) and applied to the 6SN7GT vertical oscillator. By using the actual pulse for triggering, the time relationship between alternate fields remains constant and positive interlacing results. This chassis utilizes the 6AV5GT vertical output and the 6AS4GT damper.

All models have provisions for reception of the new Ultra High Frequency stations by the simple addition of UHF strips as required. Connections are also provided for easy addition of Phonevision.

SCREEN REGISTER: This control is used to vary the response of the video amplifier much the same as a tone control varies the audio response. Clockwise rotation accentuates the high frequencies thus adding crispness to the picture, oftentimes improving the quality of the transmitted picture, particularly old films, etc. Counterclockwise rotation of this control is instrumental in reducing the ringing effect (halos, etc.) of certain transmissions and is particularly useful in fringe areas where some smearing of the snow and noise results in a much improved picture. Under normal picture conditions the setting of the control is usually near the center of its range. MIS-ADJUSTMENT OF THIS CONTROL ON A NORMAL PICTURE MAY RESULT IN A SMEARED OR OTHERWISE INFERIOR PICTURE. (NOTE-A number of 21L21 Chassis have been produced in which the screen register action is in reverse to the above. These receivers can be identified by a 100 ohm resistor which is connected to the screen register cable connecting plug)

FRINGE LOCK ADJUSTMENT

1. Turn the fringe lock control fully clockwise and then back it off approximately 1/4 turn. Adjust the vertical and horizontal hold controls and check operation of the receiver to see that it syncs normally when the turret is switched from channel to channel.

2. If the picture jitters or shows evidence of delay, tearing, split phase, etc., back down the fringe lock control further, a few degrees at a time, each time readjusting the hold controls and switching from channel to channel until normal sync action is obtained. It will be found that under normal signal conditions, the correct adjustment will be near the counterclockwise position of the control.

3. In fringe and noisy areas, the best adjustment will be found at or near the maximum clockwise position of the control, however, do not automatically turn the fringe lock fully clockwise in fringe areas as has been done on previous models. Always follow the procedure outlined.

CORRECTOR MAGNET ADJUSTMENT

Two corrector magnets . . . . . are used in all chassis to obtain straight, sharply focused sweep lines across the face of the picture tube. In the 22L20 chassis, the corrector magnets are mounted top and bottom. The corrector magnets are mounted on the deflection coil mounting brackets and can be moved in and out or up and down by bending the flexible arms which support them. The corrector magnets are adjusted at the factory and should not require re-adjustment unless accidentally bent out of position. If this occurs, adjustment can then be made as follows.

1. With the vertical and horizontal size controls, reduce the size of the picture to a point where the four corners and sides of the picture are visable. (In some receivers it may not be possible to reduce the picture size sufficiently to see all the sides and in this case it may be necessary to shift the picture with the centering control to view one side at a time.)

2. Bend the corrector magnet arms until the corners become right angles and the top of the raster is parallel with the bottom and the left side is parallel with the right side. After adjustment, the picture should be restored to normal size.

NOTE: Mis-adjustment of the corrector magnets may cause pincushioning, barreling, keystoning, poor linearity, etc.

BULLS EYE TUNER ADJUSTMENTS

To adjust the receiver for bulls-eye tuning, set the fine tuning control to its approximate center position. . . . . Without further adjustment of the fine tuning control insert a 68-21 alignment wrench into the tuner (See Fig.11) and adjust each operating channel to resonance. It will be noted that tuning to one side of resonance results in a faded, washed-out picture with the spacing between the wedge lines fogged and tuning in the opposite direction causes the spaces between the lines to clear up. However, going beyond this point causes the picture to take on a "wormy" appearance from sound getting into the picture. Correct adjustment is obtained by tuning to the "wormy" picture and then backing the control off slightly until the picture clears up.

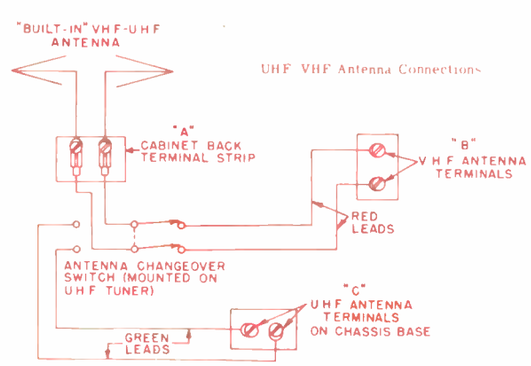
Fig. 11 Bulls-eye Tuning Adjustment.

AFC ADJUSTMENT

The AFC adjustment can effectively be made by setting the horizontal hold control L26 to a position where it is virtually impossible to "throw" the receiver out of horizontal sync when switching from channel to channel.

AGC ADJUSTMENTS

IMPORTANT: THE AGC CONTROL CANNOT BE USED IN ANY WAY TO IMPROVE THE RECEIVER SENSITIVITY. The sole function of this control is to set the level applied to the video amplifier (12BY7) tube so that the output of this tube is approximately 100 volts peak (100% modulated video signal) for application to the picture tube cathode.



The adjustment can also be made by connecting a calibrated oscilloscope through a 10K isolation resistor, to test point "D" . . . . . and, while receiving the strongest TV signal adjust the AGC delay control for 2.5 volts (2.75V on 19L26 and 28 models) peak output.

Satisfactory adjustment can also be made by observing the picture and slowly turning the AGC delay control from its maximum clockwise position, counterclockwise until a point is reached where the picture distorts and buzz is heard in the sound. The control should then be turned slowly clockwise and set at a point comfortably below this level of intercarrier buzz, picture distortion and improper sync.

CAUTION: Misadjustment of the AGC delay control can result in a washed-out picture, distorted picture, buzz in sound OR COMPLETE LOSS OF PICTURE AND SOUND

Chassis 22L20:
models L2571R, L2572R, L2573E, L2574R, L2575E, L2592R, L2593H, L2876E, L2876R, L2878R, L2879E, L2894HU

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Chassis 22L20

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In This Issue (No. 13)

For complete Index to all earlier Circuit Digests, see second preceding right-hand page in main magazine

TV-Electronic Servicemen Acclaim "Circuit Digests" On Feature's First Anniversary

With this issue, *Circuit Digests* starts its second year. You've told us, in thousands of enthusiastic letters, that this is the greatest service ever offered the TV-electronic technician by any publisher. We're going to keep it that way.

We began to publish *Circuit Digests* because you asked for them. More than a year ago, we made a nationwide survey of TV and radio trade problems. In answering that survey, you told us that the most important aids in servicing TV sets are schematics. That was how the famous *Circuit Digests* were born.

Since then, thirteen issues of *Circuit Digests* have appeared — twelve as part of the *Technician Section* of TELEVISION RETAILING—and this, the thirteenth, as a regular feature of the magazine that succeeds TELEVISION RETAILING — the new TECHNICIAN. In these thirteen issues, we have published schematics for 121 chassis, 530 models!

And we've not limited ourselves to television sets. In the *Circuit Digest* section of TECHNICIAN, you will also receive schematics and working data on recorders, phonographs, auto radios, hame radios, clock radios, juke boxes, industrial equipment — on all and any electronic device you may be called on to service.

What's more, our editorial staff gets these circuits to you just when you need them most — just when the sets you'll be asked to service are reaching your customers. You'll have them *first* in TECHNICIAN!

We're proud of the *Circuit Digests* we've prepared — and will continue to prepare — for you. We hope you — like tens of thousands of other servicemen throughout the nation — will work faster, more efficiently, and with greater profit because of them.

RAVES FROM SERVICEMEN

". . . what every TV technician must have on every set to be serviced, and fills the bill to the letter."
H. Jessen, Sr.,
Radio-Tel. Service
Mountain View, California

"TECHNICIANS . . . so far received are far ahead of other sources of data in up-to-date information."
K. A. Richardson,
Lydonville, New York

TECHNICIAN . . . . . "is a great help to me in trouble shooting . . . putting this vitol information in a concise and inexpensive form."
J. Nanes
Nanes Television Service & Repair
Toledo, Ohio

". . . beneficial to our business."
J. D. Root, Service Mgr.,
Root Radio & Television
Newport, Kentucky

"I think this idea is excellent. It seems to help fill in a bad gap in servicing new models."
C. Mathewson,
Mathewson Radio & Television
Largo, Florida

". . . everything nicely condensed, on easy to handle paper, in an easy style, covering every set made and serviced."
J. Churgo
John Churgo Radio & TV Service
Coldwater, Michigan

PROVED PREFERENCE!

A few months ago, an independent survey was conducted by John Falkner Arndt & Company. The question asked of Philadelphia dealers and servicemen was, "What radio-TV publications do you read regularly?" No. 1 choice was Television Retailing TECHNICIAN! That was when TECHNICIAN was just a part of TELEVISION RETAILING. Now that TECHNICIAN is a full-scale magazine — it will be the overwhelming choice of TV-electronic servicemen everywhere.
Yes, it's only the beginning!

"I think it is a wonderful service."
R. V. Witt
Riviera Beach, Florida

". . . it will certainly help out in the shop."
R. L. Hutchison
Dick's Radio Service
Denver, Colorado

". . . very helpful in my work."
R. H. Wright
Bab's Radio Hospital
Hubbard, Ohio

". . . it is a terrific help to us."
R. S. Fallgatter,
R. S. Fallgatter Radio
Denver, Colorado

"I believe you are giving us servicemen the greatest information that is available."
J. O'Shea
O'Shea Radio, TV & Electric Service
Jersey City, New Jersey

". . . welcome on every workbench. A very valuable addition to any electronic engineer's technical library indeed."
R. J. Fogg
Electronic Servicing
Grand Rapids, Michigan

". . . give a very clear picture of the latest models and I believe they will help me greatly to service these latest sets."
I. E. Liscum
Liscum's Radio & TV Service
Schenectady, New York

"Something we've been waiting for withaut hope."
M. Tworck
Tworck's Electric
Detroit, Michigan

"It is something that has been needed for a long time and you surely deserve credit for being the first to bring it to the service field. It contains a wealth of information for the serviceman."
G. H. Doty
Doty Radio Sales & Service
Dayton, Ohio

"It's good, it's great — I like it."
T. Love, Ted Love Radio
Trenton, Missouri

". . . the answer to the TV technician's prayer."
F. P. Lea, Lea Radio Service
Portland, Maine

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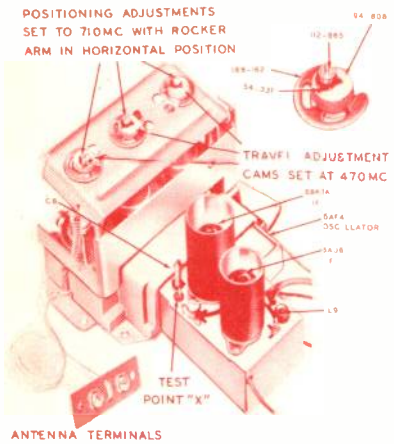

Fig. 25 Top View S-19670 Tuner

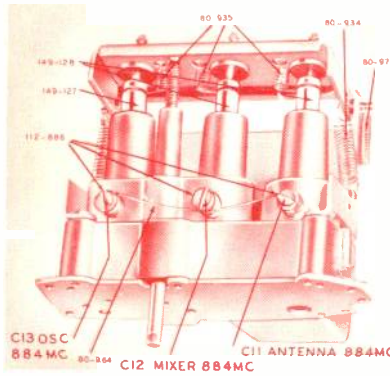

Fig. 26 Side View S-19670 Tuner

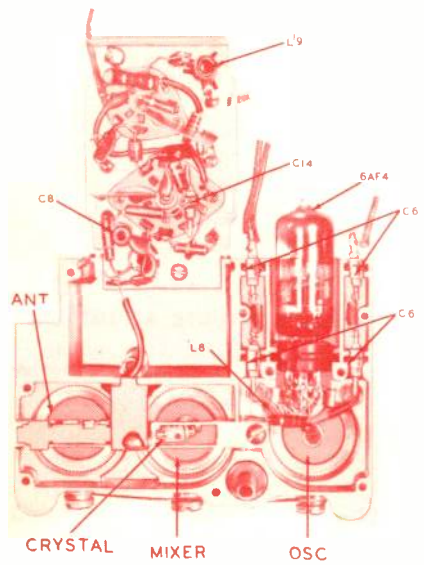

Fig. 27 Bottom View S-19670 Continuous Tuner.

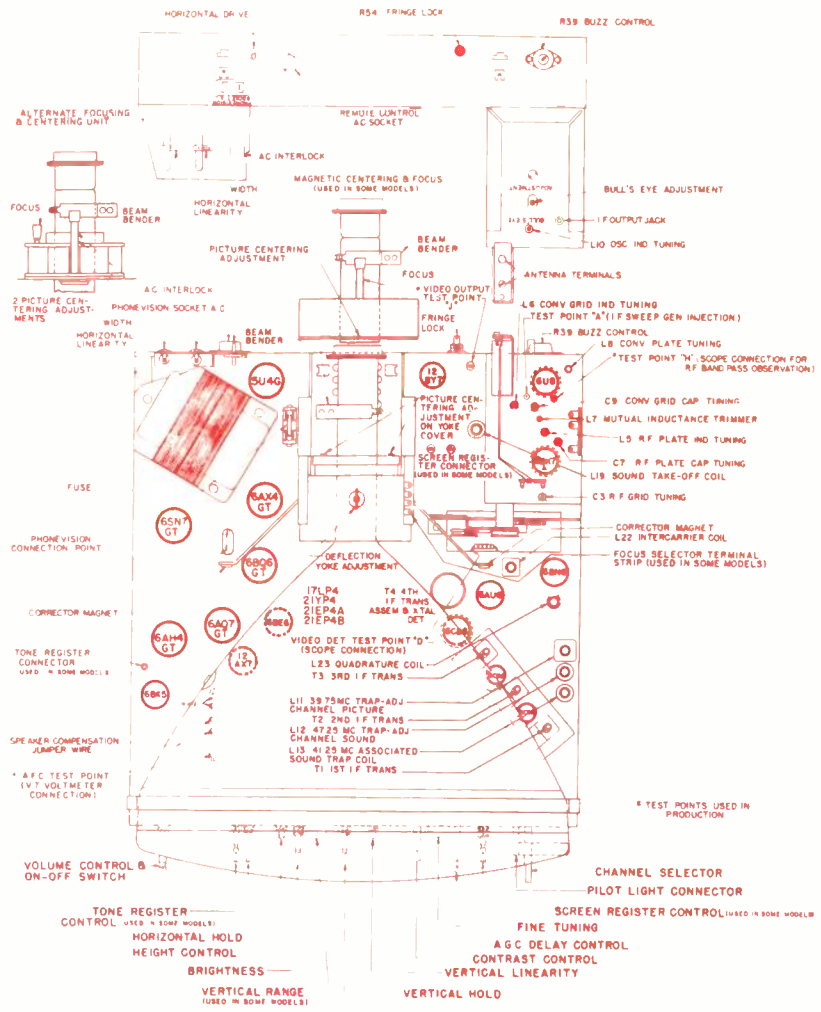

Fig. 1 Representative Chassis Layout "L" Models.

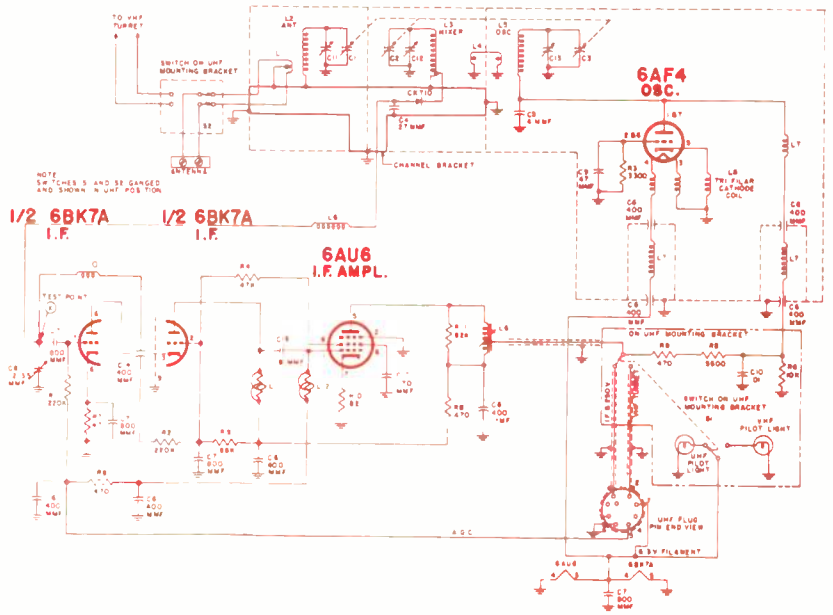

Fig. 28 Schematic Diagram S-19670 Continuous Tuner.

ITEM NO	PART NO	DESCRIPTION	
C1	149-128	ANTENNA SLUG	
C2	149-128	MIXER SLUG	
C3	149-127	OSCILLATOR SLUG	
C4	23-2509	27 MMF-11 MMF CER DISC CAP	500V
C5	23-2454	4 MMF-1 1/2 MMF + -	500V
C6	23-2404	400 MMF GMV FT CAP	500V
C7	23-2151	300 MMF GMV CER DISC CAP	500V
C8	23-2405	2.5 MMF CER TRIM CAP	500V
C9	23-1867	47 MMF CER DISC CAP	500V
C10	23-3	.01 MFD-20+100%	500V
C11	112-886	ANTENNA TRIMMER	
C12	112-886	MIXER TRIMMER	
C13	112-886	OSCILLATOR TRIMMER	
C14	23-2503	400 MMF GMV FT CAP	500V
C15	23-2302	470 MMF CER	500V
C16	23-2428	8 MMF MOULDED SIMMIC	500V

R1	63-1884	820K OHM	20%	1/2 W
R2	63-1885	220K OHM	10%	1/2 W
R3	63-1806	3300 OHM	10%	1/2 W
R4	63-1855	47K OHM	10%	1/2 W
R5	63-3136	3300 OHM	10% WE	10 W
R6	63-1198	10K OHM	10%	1 W
R7	63-1729	47 OHM	10%	1/2 W
R8	63-1779	470 OHM	20%	1/2 W
R9	63-1855	68K OHM	10%	1/2 W
R10	63-1745	82 OHM	10%	1/2 W
R11	63-1845	82K OHM	10%	1/2 W

L1	5-19683	FINAL ANT LEAD ASSEM
L2	20-428	ANT TUNING COIL
L3	20-426	MIXER TUNING COIL
L4	20-488	COUPLING COIL
L5	20-486	OSC TUNING COIL
L6	5-20535	GRID COIL ASSEM
L7	20-425	R F CHOKE
L8	20-423	TRI-FILAR CATHODE COIL
L9	5-20808	PENTODE PLATE COIL ASSEM
L10	5-19841	NEUTRALIZING COIL ASSEM
L11	5-20607	CASCODE PLATE COIL ASSEM
L12	5-20610	PENTODE GRID COIL ASSEM

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capacitor replacements FOR SETS OF THE MONTH

CROSLEY CHASSIS 402, 403, 404, 402-1, 403-1, 404-1

Symbol No.	Rating MF @ Volts	Crosley Part No.	Sprague Replacement
C125	5 @ 50	154103	TVA-1303
C140	10 @ 300/200+140+30 @ 150	155438	TVL-4559
C141	20 @ 450	154097	TVA-1709
C142	10 @ 50	154104	TVA-1304
C147	140 @ 150	155684	TVL-1428
C148	200+5 @ 150	155426	TVL-2444

FADA MODELS U2100C, U2150C, U2100T, UDL2100T, UH21T

Symbol No.	Rating MF @ Volts	Fada Part No.	Sprague Replacement
C24	40+20 @ 450/80+10 @ 350		TVL-3727 / TVA-1712
C46	20+20+20 @ 450/100 @ 50	22.81	TVL-4740
C63	5 @ 50	22.56	TVA-1303
C68	50+40 @ 475	22.79[1]	TVL-3843
C50,C51,C52 R56,R57,R58	Integrator Plate	167.1	101C1

[1] Parallel Sections

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GENERAL ELECTRIC MODELS 21T14, 21C115

Symbol No.	Rating MF @ Volts	Genl. Elec. Part No.	Sprague Replacement
C167	1 @ 50	RCE-090	TVA-1300
C309	10 @ 25	RCE-164	TVA-1204
C401	90+30+5 @ 350/100 @ 25	RCE-163	TVL-4625
C402	40+40+30 @ 350/10 @ 25	RCE-161	TVL-4622

SENTINEL MODELS 1U-532, 552, 554

Symbol No.	Rating MF @ Volts	Sentinel Part No.	Sprague Replacement
C23	10 @ 50	25E67	TVA-1304
C28	10 @ 50	25E66	TVA-1304
C81	20 @ 450	25E64	TVA-1709
C82	20+10 @ 350/100 @ 50	25E71	TVL-3817
C83	60+5 @ 250	25E62	R-1291
C84	40+40 @ 350/100 @ 200	25E65	TVL-3764

SYLVANIA MODELS C31M, C32M, C33M UHF CONVERTERS

Models C31M, C32M

Symbol No.	Rating MF @ Volts	Sylvania Part No.	Sprague Replacement
C17, C19, C22	20 @ 200/20 @ 175/20 @ 150		TVL-2515 / TVA-1410

Model C33M

Symbol No.	Rating MF @ Volts	Sylvania Part No.	Sprague Replacement
C17, C20	30+30 @ 150		TV[illegible]

ZENITH CHASSIS 22[illegible]

Symbol No.	Rating MF @ Volts	Zenit Part N[illegible]	
C26	4 @ 350/100+40 @ 25	22-2367	[illegible] / TVA[illegible]
C74	40+20 @ 450/40 @ 400		TVL-37[illegible]
C77	40+10 @ 450/10 @ 400/100 @ 50		TVL-3762 / TVA-1705

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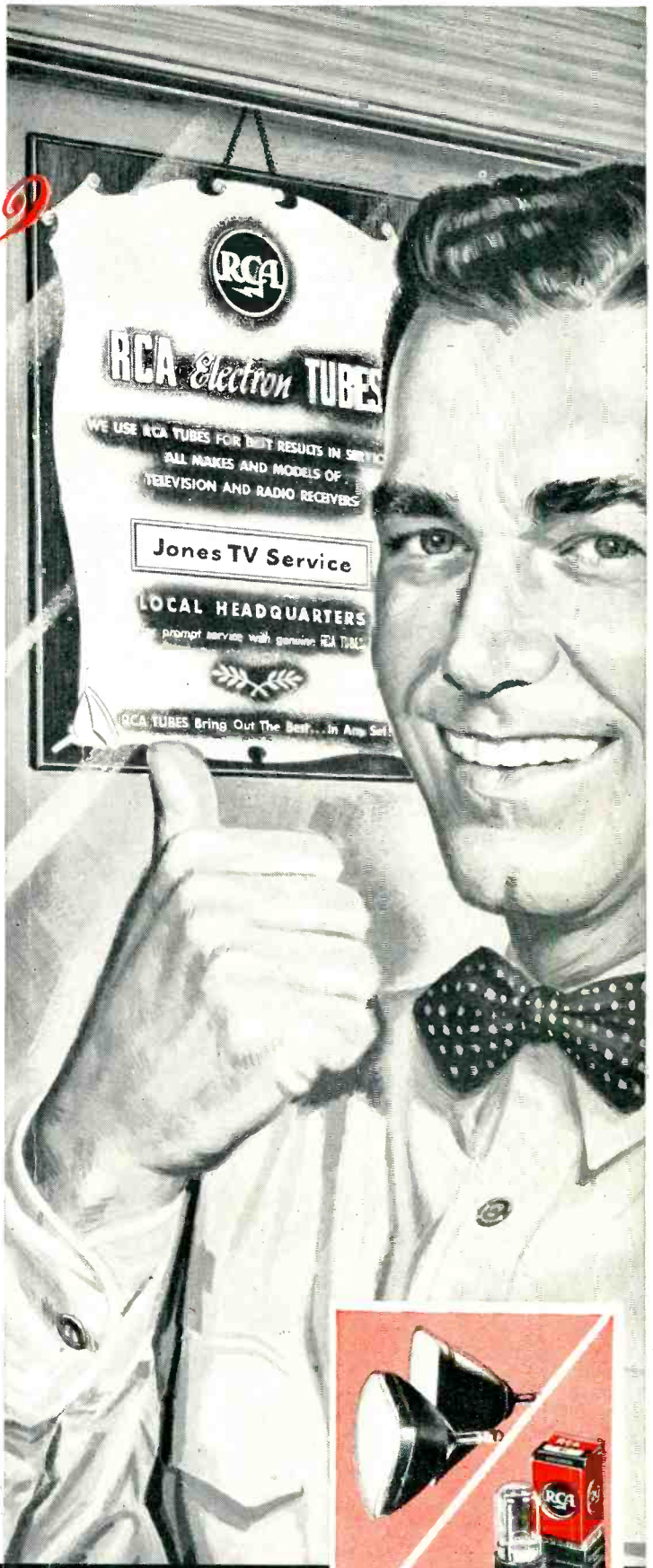

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