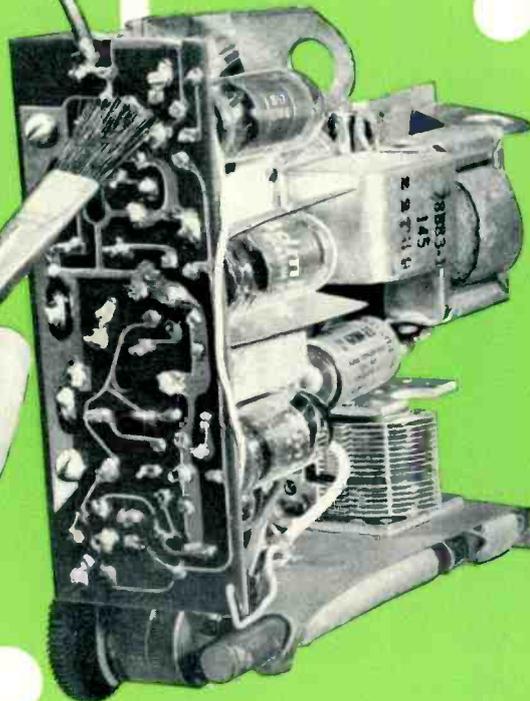


TECHNICIAN

& *Circuit Digests*

**Servicing
"Etched"
Circuits**



March • 1954

NO. 1

CHOICE

of service technicians for

TV CONTROLS*



*Not Claims! Not Predictions!
But Plain Facts! More Service
Technicians prefer IRC TV Controls
than the next 2 brands combined.
Proved by unbiased, authoritative,
independent surveys.*



**ASK FOR *IRC* TV CONTROLS...
MOST SERVICE TECHNICIANS DO!**



INTERNATIONAL RESISTANCE COMPANY

425 N. Broad Street, Philadelphia 8, Pa.

Wherever the Circuit Says 

In Canada: International Resistance Co., Ltd., Toronto, Licensee

TECHNICIAN

& Circuit Digests

TELEVISION • ELECTRONIC • RADIO • AUDIO • SERVICE

M. CLEMENTS O. H. CALDWELL
Publisher Editorial Director

SOL HELLER, *Managing Editor*

SIDNEY C. SILVER, *Associate Editor*

ANN O'ROURKE, *Assistant Editor*

J. L. STOUTENBURGH, *Consulting Editor*

CHARLES F. DREYER, *Art Director*

ELMER KETTERER, *Circuit-Digest Production*

GEORGE PUGLICI, *Circuit Diagrams*

BUSINESS DEPARTMENT

M. H. NEWTON, *Business Manager*

H. A. REED, *General Sales Manager*

DIXON SCOTT, *District Manager*

LEE GRAVES, *District Manager*

CHARLES S. ROEVER, *District Manager*

N. McALLISTER, *Asst. Business Manager*

MARTHA USDIN, *Production Manager*

KATHLEEN CAFARO, *Reader Service*

WARREN S. BROWN, *Circulation Manager*

M. GROENING, *Asst. Circulation Manager*

JOHN J. BORGHI, *Controller*

W. W. SWIGERT, *Credit Manager*

480 Lexington Ave., New York 17, N. Y.
 Telephone PLaza 9-7880

S. M. GASKINS, *Western Manager*

JOHN D. LUPTON, *District Manager*

201 N. Wells St., Chicago 6, Ill.

Telephone RAndolph 6-9225

CHRIS DUNKLE & ASSOCIATES

California Representative

3257 W. 6th Street, Los Angeles 5, Calif.

Telephone DUmkirk 7-6149

1355 Market Street, San Francisco

Telephone KLondike 2-2311, Ext. 579

CIRCULATION

50,000

—serving the industry's largest group of service technicians, service managers and installation specialists.

TECHNICIAN, March 1954, Vol. 59, No. 3, 50 cents a copy. Published monthly 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., Nov. 4, 1953, under the act of March 3, 1879. M. Clements, President; M. H. Newton, Assistant to President; John J. Borghi, Vice President and Secretary; Marguerite B. Clements, 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 for three years. Printed in U.S.A.

Copyright by
 Caldwell-Clements, Inc., 1954

MARCH, 1954

TECHNICIAN'S COVER illustrates soldering operation on an etched-metal radio. A glue brush and a low-wattage soldering iron are being used. For further details, consult Jack Bayha's article, *Servicing Printed Chassis*, on page 29 of this issue.

So Much for So Little!	23
"Tuning in the Picture"	24
Serviceman's Analysis of Color Stages	26
<i>Peter Orne & Sol Heller</i>	
Servicing Printed Chassis	29
<i>Jack Bayha</i>	
Ringing Circuit Problems in TV Sets	30
<i>James McRoberts</i>	
First Printed TV Chassis	34
Eliminating Sound TVI	35
The Chromatron: A Single-Gun Color Tube	36
<i>Sidney C. Silver</i>	
Tractor Radio to Lighten Farmer's Chores	38
New Antennas & Related Products	42
Electronic-TV Technician	44
Prevent Paperwork Losses	46
DB Measurement	60
<i>George P. Kearse</i>	
Circuit Digest Cumulative Index	69

*CIRCUIT DIGESTS (See pages following p. 72)

BENDIX: Chassis T14-3, T14-10, T14-11

DUMONT: Chassis RA-301, 302

PACKARD-BELL: Chassis 2740

PHILCO: Chassis R-191, D-191

RCA: Chassis KCS84C, KCS84E

DEPARTMENTS

Letters to the Editors	12	Service Ass'n. Reports	55
New Products	40	Calendar of Coming Events	55
Color Shorts	45	News of the Trade	58
Shop Hints	48	New Books	62
"Tough Dog" Corner	50	Manufacturers' Catalogs & Bulletins ..	63

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

REVOLUTIONARY NEW

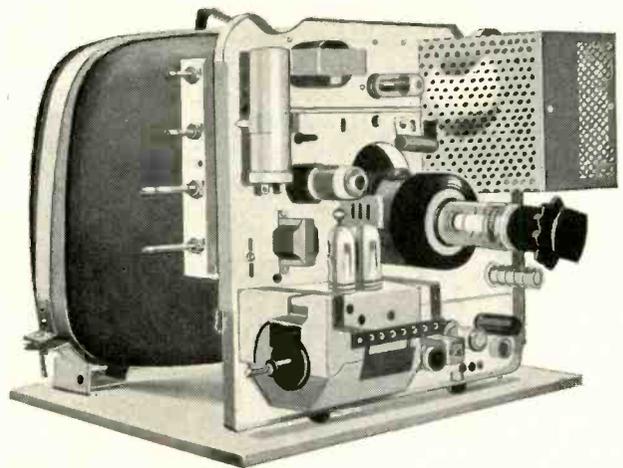
(Most compact TV set ever designed) **IS A**

Crosley Super-V is dramatically different inside!

Here's one set that is designed with the TV service man in mind. Removing the back of the Super-V plainly exposes all secondary controls and every tube in the set. And as you know, 9 out of 10 service calls merely require the change of a tube.

For any other service job, it's as simple as opening the hood of your car, no chassis to pull, just slide the entire Super-V cabinet up off the chassis. More repairs can be made in the home. You can get at the works immediately and without obstruction, service the Super-V in lots less time than you'd spend on an ordinary set.

The Super-V is a cinch to install. It's compact, weighs only 53 pounds. And

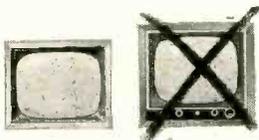


in many places, you'll find its built-in antenna is all you need for perfect reception. Service men who've seen the Super-V call it the greatest forward step ever taken in TV chassis design.

Crosley Super-V is dramatically different outside!

How? The Super-V is the most compact TV set ever designed . . . takes up $\frac{1}{3}$ less space than other 17" sets. It'll fit in places you couldn't *think* of putting other sets, actually make it possible for your customer to have TV in any room in his house!

The front of the Super-V is *all screen*—for added convenience and extra good looks, the controls are on the side.



Be ready when Super-V Day hits your town.
Call your Crosley distributor now.

Your customers will hear about the revolutionary Crosley Super-V on their favorite musical show—"Your Hit Parade." They'll come in and buy one faster when they see your name alongside Crosley's big newspaper ads. They'll stop and look when your window flies the colorful Super-V banners.

Your Crosley distributor has hard-working co-op advertisements, counter cards, specification sheets—and ideas to help you make a bonanza on the Crosley Super-V. Get in touch with him . . . TODAY!

You can **SELL** them

CROSLEY SUPER-V SERVICE MAN'S DREAM !



Featured on
"YOUR HIT PARADE"
starting in March
on NBC-TV Network.

A triumph of Crosley's 33 years' electronic research

- TAKES UP TO $\frac{1}{3}$ LESS SPACE THAN OTHER 17" TVs—FITS WHERE OTHER SETS WON'T
- FRONT ALL SCREEN—CONTROLS ON THE SIDE
- CHOICE OF THREE FINISHES (MAHOGANY, WALNUT, BLOND)
- FULL-YEAR WARRANTY ON PICTURE TUBE—90 DAYS ON CHASSIS PARTS
- ROLLING OFF CROSLEY PRODUCTION LINE IN VOLUME—PRICED FOR PROFITS AND ACTION NOW!

17-INCH
Super-V

Suggested retail prices start at

\$ **139** ⁹⁵

Coast to coast.

(Walnut-Finished)

better on a CROSLEY

Division  Cincinnati 25, Ohio

Contra wound bi-filar coils

Wide Band Amplification... Ready for color

It's Push Pull!! It's Neutralized!!

Accurate 300 Ohm input and output

Covers VHF Channels 2 through 13

3 Tuned Circuits

Single Tuning knob... large... easy to read

Cascade Amplifier, Grounded grid output stage

TWICE AS MUCH GAIN AS ANY EVER MADE

Ceramic switches

Underwriters Laboratory approved

Largest selling booster at any price



Regency MODEL DB55

**CASCADE TWO-STAGE VHF BOOSTER
ONLY \$37⁵⁰**

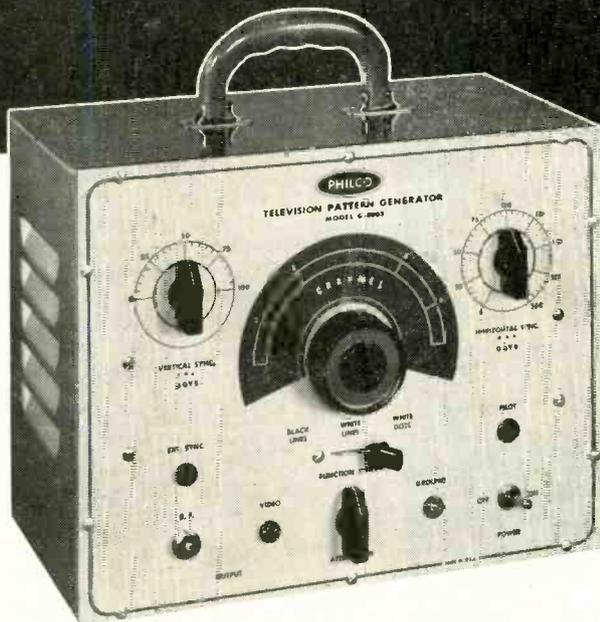
Your Own Portable "TV Station" For Receiver Adjustment

NEW!

PHILCO

TELEVISION PATTERN GENERATOR

**DEVELOPS BOTH RF
AND VIDEO OUTPUT**



A Must for Areas Where Continuous Station Broadcasts are Not Available

Now use the dot and line patterns from the new PHILCO Model G-8005 to check linearity, focus, astigmatism, blooming and high voltage regulation. Trouble shoot receivers on any channel, 2 through 6, or with video output. The PHILCO G-8005 Television Pattern Generator is an instrument especially adapted for service work . . . designed to save you time.

Look at These Philco Features . . .

1. Provides new white dot pattern and either white or black vertical lines for *all* cathode ray tube circuits.
2. Easy to operate: connect Pattern Generator output to TV set. Select proper test pattern. Accurately check both the vertical and horizontal sweep circuit performance.
3. External Sync. Jack improves stabilization in many special cases. Provides wide range operation.
4. A custom type instrument with new and novel circuits designed to reduce service time in both laboratories and service shops.

**AVAILABLE THROUGH YOUR PHILCO DISTRIBUTOR
ON A NEW SPECIAL PAYMENT PLAN**

PHILCO MODEL S-8200 3" OSCILLOSCOPE

A sensitive, portable unit adaptable to either bench or field service. **VERTICAL AMPLIFIER:** DC coupled, Sensitivity—0.05V rms/inch. Frequency Response—0.1 mc/s within 6DB. DC coupled Vert. Amplifier circuits and low capacity probes facilitate video circuit trouble shooting. Built-in voltage calibrator permits use as high sensitivity vacuum tube voltmeter. **HORIZONTAL AMPLIFIER:** Sensitivity—0.5V rms/inch. Frequency Response—10 cps to 125 KC/s within 6DB. Sweep Circuit Frequency—Variable 15 to 30,000 cps . . . preset frequencies at vertical and horizontal sweep rates.



Take advantage of the great
SHARE and PROFIT Program
on Philco Receiving Tubes
Parts and Accessories
NOW AT YOUR PHILCO DISTRIBUTOR



See **PHILCO** Exhibit at IRE Show, March 22-25, Kingsbridge Armory, New York City

TRIPPLET 630 Volt-Ohm-Mil-Ammeter

"speaks" for itself in any company



ing 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, Milli-amperes, 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 Triplet 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.*

TRIPPLET 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, Triplet 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. Triplet engineers have created in Triplet 630 the longest scales available in this size tester. (The upper arc by actual measurement is four and three-eighths 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.

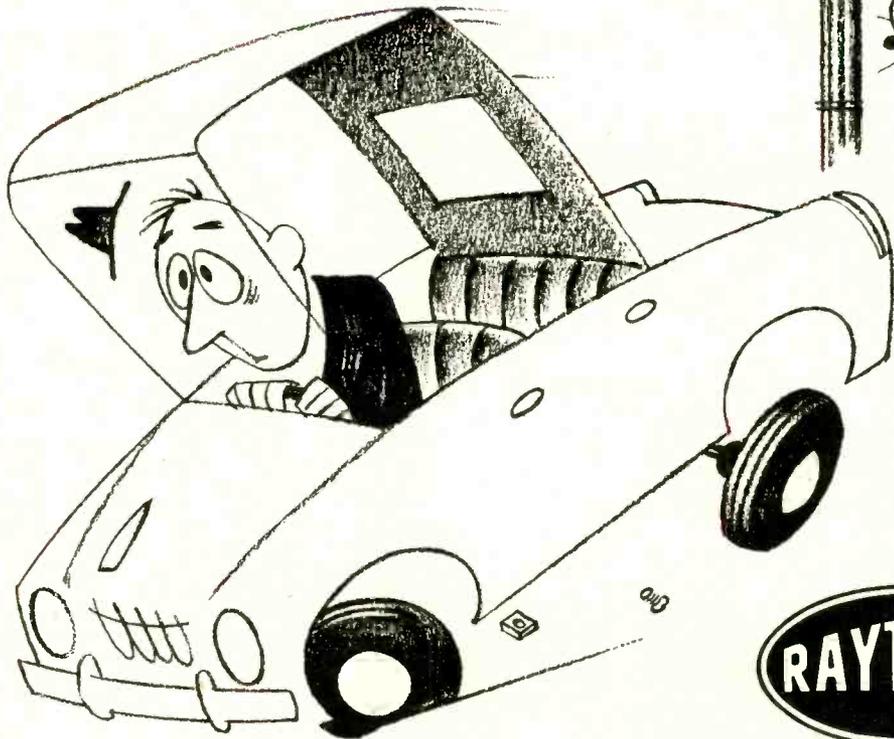
The Single Switch

Further indication of the practical skill and engineering "know-how" behind Triplet 630 is the Single Switch. Its simplicity of operation assures no burn-outs thru momentary memory lapses. There is instant switch-

Get a Triplet 630 into your own hands at your distributor.
U.S.A. Dealer Net \$3950

TRIPPLET ELECTRICAL INSTRUMENT COMPANY
BLUFFTON, OHIO

CALL BACKS COST MONEY...



AVOID
THEM
WITH
THE



SERVICE SAVER PLAN

available through your RAYTHEON TUBE DISTRIBUTOR

The Raytheon Service Saver Plan, which permits customers to identify about 85% of all the troubles that may occur on the screen of a defective TV receiver — and accurately transmit this information to the Service Dealer via telephone — is helping to minimize costly call-backs two ways.

First, when a Service Dealer goes on a call knowing in advance what ails a TV receiver (thanks to Raytheon's Service Saver Plan), he goes completely equipped to do

the job — no more running back to the shop for tubes or parts.

Second, customers frequently call about TV receiver trouble when a minor control adjustment is all that is needed to correct the fault. The Raytheon Service Saver Plan helps Service Dealers avoid these needless, unprofitable calls.

Ask your Raytheon Tube Distributor to tell you how to put the Raytheon Service Saver Plan to work for you.

RAYTHEON RADIO AND TELEVISION TUBES cut call-backs, too! Their outstanding quality reduces early tube failures to a minimum. Use them. You'll find them Right... for Sound and Sight... and you!



RAYTHEON MANUFACTURING COMPANY

Receiving Tube Division
Newton, Mass., Chicago, Ill., Atlanta, Ga., Los Angeles, Cal.

RAYTHEON MAKES ALL THESE:

RECEIVING AND PICTURE TUBES • RELIABLE SUBMINIATURE AND MINIATURE TUBES • SEMICONDUCTOR DIODES AND TRANSISTORS • NUCLEONIC TUBES • MICROWAVE TUBES



Excellence in Electronics

over **100,000**
already installed!



CHANNEL MASTER'S fabulous
CHAMPION*

the world's most powerful
all-channel VHF antenna
—OUT-PERFORMS AND OUT-SELLS THEM ALL!

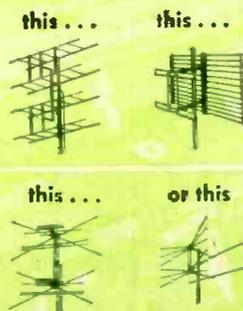
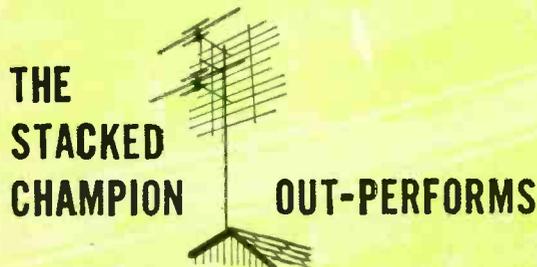
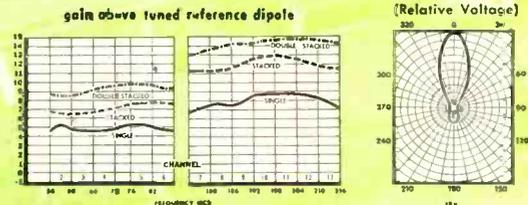
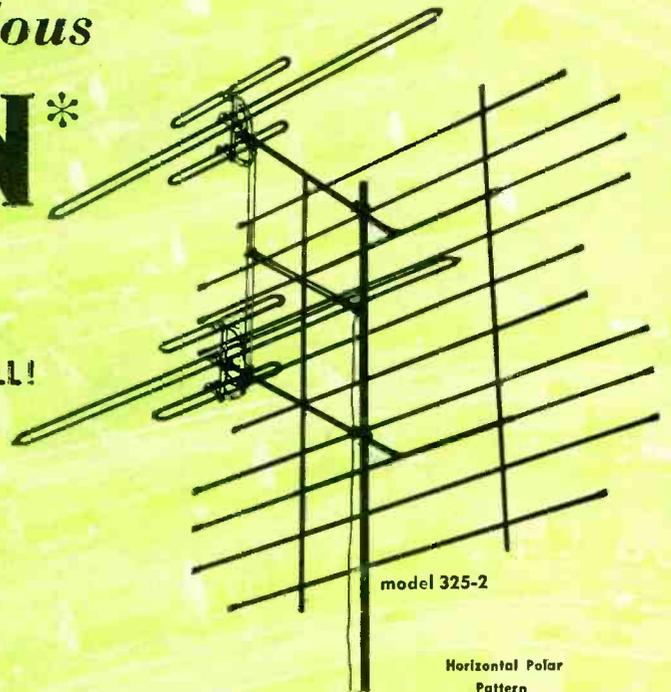
Never before in the history of television has an antenna received such an overwhelming reception. Channel Master's CHAMPION — in a few short months — has rocketed to the top as the nation's most-wanted, best-selling, best-performing VHF antenna!

CHAMPIONSHIP Performance: Only the CHAMPION has the unique new "Tri-Pole", a triple-powered dipole system in which the Low Band dipole also functions as three dipoles tied together, in phase, on the High Band.

All-aluminum. Assembles faster than a 5-element Yagi! The CHAMPION is another great contribution of the Channel Master Antenna Development Laboratories.

CHAMPIONSHIP Promotion: The CHAMPION is the antenna America knows best!

- Publicized in leading magazines!
- Outstanding dealer Cooperative Advertising Program!
- Free newspaper mats, window streamers and TV film commercials!



THE STACKED CHAMPION PROVIDES:

11-13 DB High Band gain
6 1/2-7 1/2 DB Low Band gain

Model No.		List Price
325	Single Bay	\$20.83
325-2	2-Bay	\$42.36
325-4	4-Bay	\$88.89
Separate Stacking Harness		
325-3	2-Bay Harness	\$ 2.08
325-5	4-Bay Harness	\$ 4.17



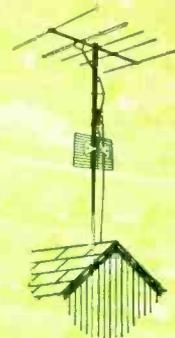
CHANNEL MASTER CORP.

ELLENVILLE, N. Y.

WORLD'S LARGEST MANUFACTURER OF TELEVISION ANTENNAS

*pat. pending

TIE SEPARATE ANTENNAS TO ONLY ONE TRANSMISSION LINE



CHANNEL MASTER inter-action filters

Only Channel Master VHF-UHF filters are permanently sealed in a block of moisture-proof, high melting-point electrical wax, locked in an attractive styrene case.

- Single lead
- No switching
- No signal loss
- No inter-action, effective isolation.

New!
VHF only
TENNA-TIE

model
no.
9033-A



Use with leads of any length! New, specially designed High and Low Pass filters entirely eliminate the need for critical lead lengths! This new, extremely effective circuit makes the TENNA-TIE the most effective filter of its type now available.
— only \$3.50

VHF-UHF
ULTRA-TIE

model
no.
9034



JOINS — separate VHF and UHF antennas for use with a single lead.

SEPARATES — VHF and UHF signals at the set or converter where separate terminals are provided. "Free-space" terminals.
new low price — \$3.75

VHF-UHF
TRIPLE-TIE

model
no.
9035



Ties together all three TV reception bands:

1. Low Band VHF
2. High Band VHF
3. All UHF

High and Low Pass filters enable the Triple-Tie to adapt all Hi-Lo VHF installations to UHF — quickly and effectively. "Free-Space" terminals for perfect all-weather UHF reception.
new low price — \$4.86

THE ANTENNA IN COLOR TELEVISION

by Harold Harris, Vice President, Sales and Engineering

Now that color telecasting is a reality, we will see an ever-increasing flow of color sets to the consumer. Although much is being said and written on the subject of color sets, many unanswered questions remain about the role of the television receiving antenna in color television.

Will present antennas work on color?

Will a special antenna be needed?

The results of thorough laboratory and field tests made by engineers of the Channel Master Antenna Development Laboratories show that practically all present TV antenna types will perform satisfactorily on color. Gain variations as high as 3 DB across one channel can be tolerated. When this figure is exceeded blurring or smearing of the picture may occur. Although there are certain antennas on the market which do have excessive gain variation, this is not the case of the vast majority of present installations.

There are also indications that fringe area color reception may be more critical. This may necessitate the use of fringe area antennas in areas closer to the TV station.

In the nation's most advanced television research laboratory, Channel Master antennas have always been designed for full band width and minimum variation in gain on any one channel.

For this reason, every Channel Master antenna which you have installed in the past, as well as the ones you install today, will provide reception of outstanding quality when color TV comes to your area.

Channel Master antennas were the antennas selected for the tests which led to the F.C.C.'s approval of the National Television Standards Committee color system.



FIRST
... in
more ways
than one!



First On The Market . . . more than 20 years ago Mallory produced the first commercial Vibrators.

First As Original Equipment . . . today Mallory produces more Vibrators for set manufacturers than all other makes combined.

First With Servicemen . . . surveys show that Mallory Vibrators are preferred and used by 5 out of 6 servicemen.

Your Work Is Right The First Time when you use Mallory Vibrators. The patented, tuned mechanism assures completely dependable performance... always. Ask for Mallory Vibrators by name.

**Cover 75% of Your Replacement Needs
with just 6 Mallory Vibrators!**

Ask your Distributor about Mallory Deal 2448 which includes these 6 fast moving Vibrators.

And be sure you have a copy of the current Mallory Vibrator Guide. It is a complete cross reference listing and service guide—the most recent edition of a publication serving servicemen for nearly 25 years.

P. R. MALLORY & CO. Inc.
MALLORY

**CAPACITORS • CONTROLS • VIBRATORS • SWITCHES • RESISTORS
RECTIFIERS • POWER SUPPLIES • FILTERS • MERCURY BATTERIES
APPROVED PRECISION PRODUCTS**

P. R. MALLORY & CO. Inc., INDIANAPOLIS 6, INDIANA

THE MOST
SPECTACULAR

ANTENNA
DEVELOPMENT
IN YEARS...

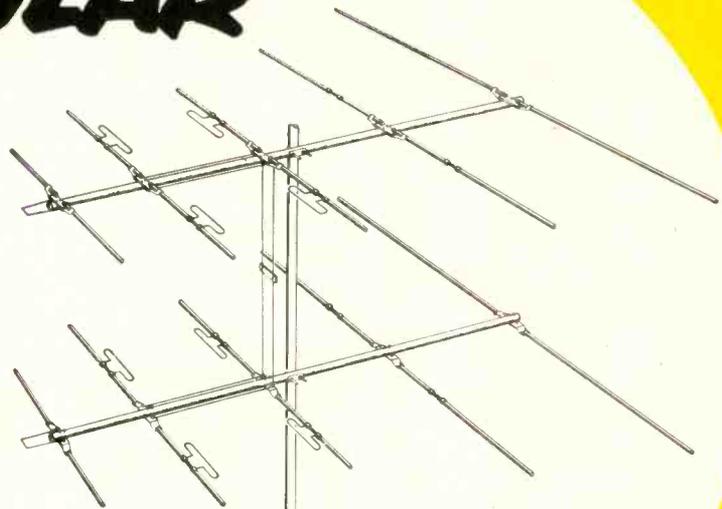
THE

TACO

TRAPPER

FOR CHANNELS

2
thru
13



GAIN:

Up to 10 DB single and
13 DB two bay stacked

DIRECTIVITY:

Excellent pattern and
high front-to back ratio
for ghost-free performance

SIZE:

No larger than a single
channel five element
low band Yagi

DURABILITY:

High tensile strength
aluminum and Fiber-
glas insulation assures
stability

APPEARANCE:

Streamlined and sym-
metrical. Provides
neat installation

COLOR TV:

Sharply directional, a
color TV requirement

PACKAGING:

No KING SIZE cartons
—easily transported &
stored

PRICE:

Cat. No. 1880 Trapper.
List: \$19.75 ea.
Cat. No. 1882 Stacking
lines. List: \$1.75 pr.

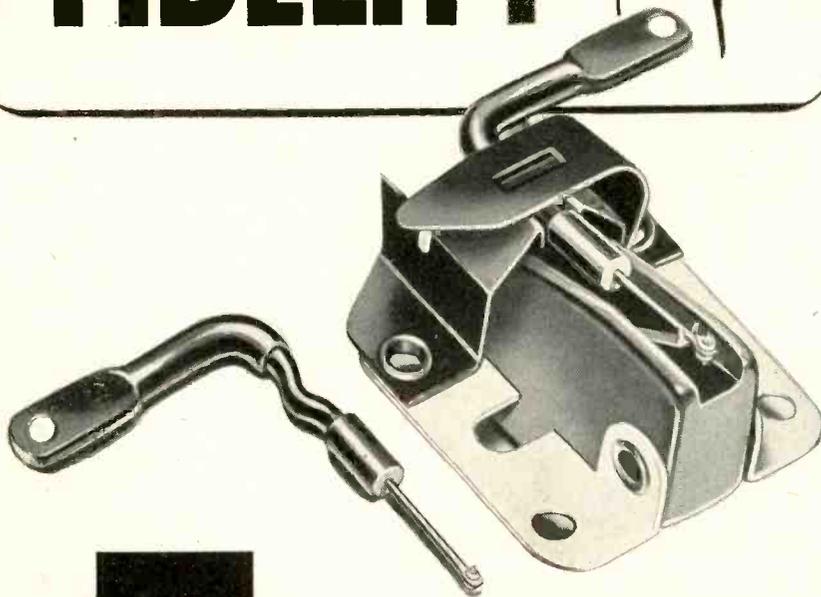
All around, your BEST antenna buy!

AT LAST, A SINGLE MODEL PACKAGED TWO PER CARTON, TO FILL
EVERY VHF INSTALLATION NEED. REDUCES INVENTORY.

TECHNICAL APPLIANCE CORPORATION, SHERBURNE, N. Y. In Canada: Hackbusch Electronics, Ltd., Toronto 4, Ontario

The *FIRST STEP* in

**HIGH
FIDELITY**



TITONE

CERAMIC CARTRIDGE

There is no wiser investment a phonograph owner can make than a TITONE ceramic cartridge.

Costing no more than ordinary "replacement" cartridges, TITONE gives a world of difference in results — an entirely new experience in true high-fidelity sound, no matter what the make of phonograph.

And only *two models* will replace most present-day installations!

No other cartridge gives all these features!

No preamplifier or equalizer needed • Unaffected by moisture or temperature • Wide frequency range • Outstanding response • High sensitivity • Low distortion • High compliance • No hum pickup • Superior tracking ability • Wide adaptability • Proper groove fit • Only needle rotates • Simple to replace

(Used by America's foremost manufacturers of high-fidelity phonographs, TITONE is an original discovery and development of the Sonotone laboratories. Literature available.)

ELECTRONIC APPLICATIONS DIVISION

SONOTONE CORPORATION

Elmsford, New York

LETTERS To the Editors

Author Answers Critic

EDITORS, TECHNICIAN:

With respect to Mr. Green's comments regarding the "misinformation" in my article, *VHF Antenna Installation Problems* (December '53 *TECHNICIAN*), I would like to make the following comments.

1—In my use of the term *oscillating lines* (to which Mr. Green objects), I was not using standard nomenclature. I was trying to get across the idea that a transmission line in which standing waves are present will radiate energy in much the same way that an oscillator will, even though no amplification exists in the transmission line system. The existence of such radiations can be verified with a field strength meter.

2—With regard to my recommending an open-ended quarter-wave stub across the antenna: this was an oversight on my part. The manuscript should have said *closed-end* quarter-wave stub.

3—Mr. Green objects to my recommending a pad to eliminate "ghosts." He says:

"When 'ghosts' are due to reflections in the transmission line, due to mismatch at its ends, the use of a pad will help. However, in the case of 'ghosts' due to multipath reception, the ratio of the direct signal to the reflected signal is not changed by a pad. Therefore a pad will not help at all to reduce 'ghosts' due to multipath reception. Furthermore, the formula given in this paragraph will not give the straight line distance to the reflecting obstacle; it will give the difference in total path lengths of the direct and reflected signals."

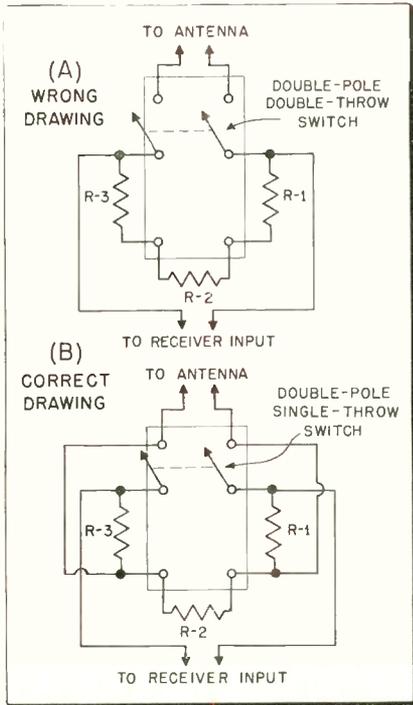
In the case of multipath signals, the attenuating pad is not supposed to change any ratio. Consider the fact that the "ghost" signal is usually much weaker than the direct, or desired, signal. Therefore, if the pad cuts down the signal strength of both signals, it is possible to reduce the "ghost" to an unobjectionable level while still retaining enough "direct" signal to permit a viewable picture. A judicious choice of attenuating pad will, in most cases, accomplish the desired result.

Incidentally, Mr. Green claims a pad will help eliminate "ghosts" due to line reflections when mismatch is present. In such a case, however, the unit used is no longer called a pad—it is, rather, referred to as a *matching device*. The word *pad* connotes attenuation.

With respect to Mr. Green's remarks on my formula for determining the approximate straight line distance between the receiving antenna and a reflecting surface responsible for a ghost: For many (but not all) practical cases, the formula present will give the desired distance to be set off as a radius from the receiving antenna loca-

tion. On a map of the area in question, use this radius to draw a circle with the receiving antenna as the center. The enclosed area will often include just one, or a very few, logical locations for the reflecting object.

While not accurate in all cases, the formula is, in practice, helpful.



Incidentally, an error is present in one of the drawings for which I must disclaim responsibility. Fig. 2 was drawn as shown in sketch A. It should actually have been drawn as in sketch B (Our fault—Ed.).

PHILIP THIER

East Meadow
Long Island, N.Y.

Another Valentine

EDITORS, TECHNICIAN:

Keep up the good work. Your magazine is the only one that tells how and why a fault occurs as well as how to correct it.

P. E. CAUBLE

Cauble's TV & Radio Service
114-44 226th Street
Cambria Heights, N. Y.

Wants More Theory

EDITORS, TECHNICIAN:

I enjoy your publication very much. I have found it to be interesting, informative, richly filled with new manufacturers' products and a definite aid to better business.

I hope that you will come out with more deeply technical articles on the . . . synchroguide horizontal oscillator. Most articles just explain a few of the basic principles of all oscillators and give a few service hints. What I would like to read is a good text-book approach with a few derived formulas illustrating the time constants and reasons for the values of the components

(Continued on page 20)

B-T LABS Ultravert

THE ALL CHANNEL UHF CONVERTER THAT OFFERS YOU *Everything*



PRICE
PERFORMANCE
SALES APPEAL
EXCLUSIVE FEATURES
and GREATER
PROFIT MARGIN

✓ LIST PRICE IS ONLY \$39⁹⁵

✓ High Gain with Lowest Noise Factor

✓ Makes ANY TV Set a Modern 82 Channel Receiver

✓ Rapid Dual-Speed Tuning Controls

✓ Has No Power-Switch—'On-Off' Automatically Controlled by TV Set

✓ Rugged Construction, Attractive Styling, and Rubber Protective Feet

✓ Exclusively Designed 3-Section B-T Ultratuner

✓ Better Discounts for Greater Profits.

Make Your Own
Point By Point
Comparison:



Supported By Hard Hitting Sales Promotion

- ✓ National Advertising in Consumer, Dealer, and Service Publications.
- ✓ Cooperative Newspaper Advertising
- ✓ FREE Attention-Getting Sales Displays for Dealers
- ✓ Catalog Sheets, Service Data, other Sales Aids

It's *Ultra* POWERFUL . . . It's *Ultra* DEPENDABLE

For complete details, write to Dept OC-18

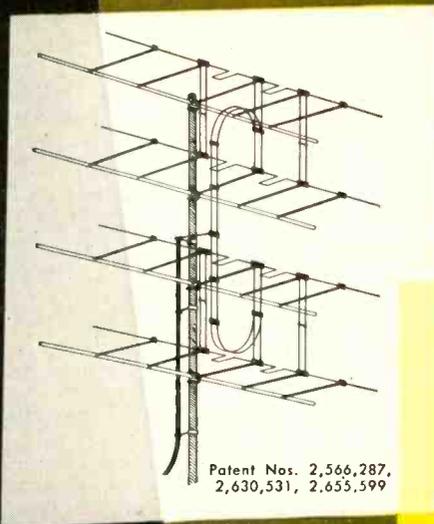
B-T LABS

BLONDER-TONGUE LABORATORIES
WESTFIELD, N. J.

Manufacturers of TELEVISION AMPLIFIERS, UHF CONVERTERS, MIXERS, DISTRIBUTION UNITS and TV ACCESSORIES

Great Antennas by **FINCO**[®]

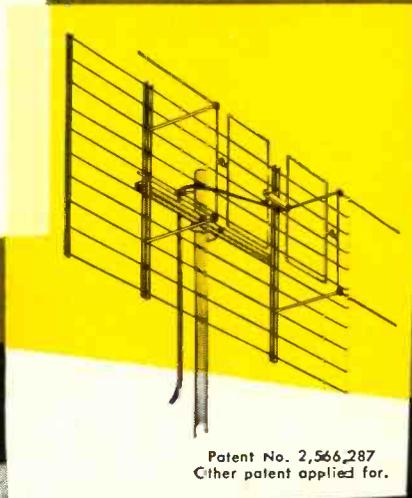
**DESIGNERS AND PATENT HOLDERS OF THE WORLD'S
MOST ADVANCED ANTENNA PRINCIPLES**



Patent Nos. 2,566,287,
2,630,531, 2,655,599

FINCO 400-A UHF-VHF

The acknowledged leader in the fringe area market — Perfect pictures, all channels 2 to 83, up to 150 miles and MORE from station. Protected by exclusive electronic and mechanical patents.



Patent No. 2,566,287
Other patent applied for.

FINCO 500 Series UHF

Consistently out-performs all others an entire UHF band — in close-to the station and in the super-fringe. Very high gain and narrow pattern for complete elimination of ghosts.

The FINNEY COMPANY

THE FINNEY COMPANY
Dept. T-34 • 4612 St. Clair Avenue • Cleveland 3, Ohio

WRITE FOR COMPLETE INFORMATION
ON THESE VERY PROFITABLE ANTENNAS

- information on the 400-A
- information on the new "500" series UHF antennas
- information on advertising program

NAME

COMPANY NAME

ADDRESS

CITY ZONE STATE

**LIFE
RADIO • TV**

NEWSPAPER • FARM PAPERS

OFFERING YOU THE MOST POWERFUL NATIONAL
ADVERTISING PROGRAM IN THE INDUSTRY... a program
in which you can participate at no cost! A program
that has been so very successful with jobbers and
dealers and servicemen all over the nation!

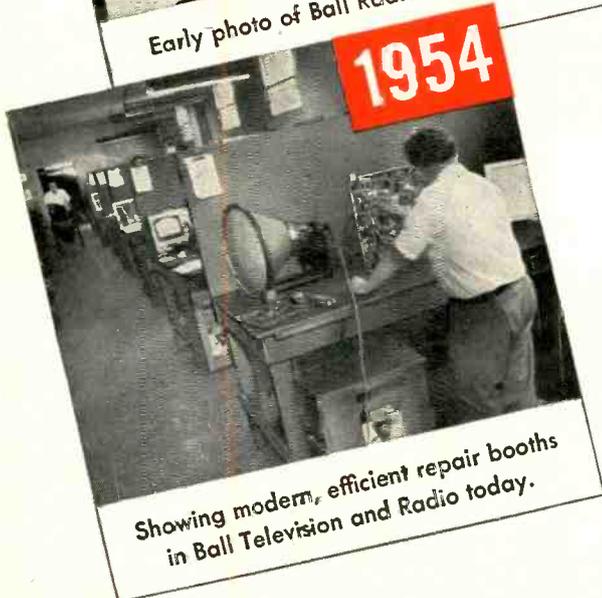
Copyright, The Binney Company, 1953

Another Outstanding Service Success Story...

with SYLVANIA!

From Basement Repair Shop
to prosperous Service Business...
featuring Sylvania Tubes, Parts
and Promotion Programs!

The steady and substantial growth of the Ball Television and Radio Service, from basement shop to the large handsome brick building, shown below, is a tribute to the fair practices and alert policies of the owner, Mr. Ted Ball.



Says Mr. Ball: "My men are as skilled and experienced as any you'll find anywhere, and each is instructed to do the best job possible with the best of parts... and that, of course, includes Sylvania Tubes."

Ted Ball is another important Radio-TV Service Manager that appreciates the quality performance, dependability, and the nation-wide high reputation of Sylvania products.

Mr. Ball also knows about the business-boosting power of Sylvania's promotion and display offers. Find out how Sylvania can step up *your* business. Your friendly Sylvania Distributor is ready and anxious to give you full cooperation. Call him today.

SYLVANIA

Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y



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

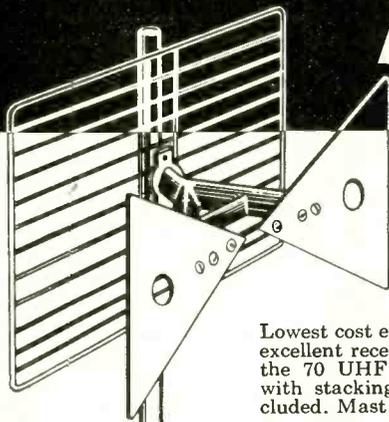
LIGHTING • RADIO • ELECTRONICS • TELEVISION

Admiral

ALL-CHANNEL

UHF ANTENNAS

**HIGH GAIN
LOW COST**

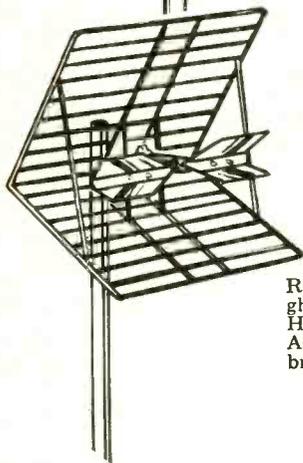


Admiral BOW TIE

Lowest cost ever for a quality UHF antenna. Gets excellent reception in good signal areas on any of the 70 UHF channels. Each antenna furnished with stacking bar. Mast mounting brackets included. Mast not included.

No. AN65A—Deluxe—Shipped completely assembled. Suggested list price **\$5.95**

No. AN65B—Standard—Similar to above, smaller reflector screen. Shipped knocked-down. Sug. list price . . . **\$3.95**



Admiral CORNER REFLECTOR

Recommended for troublesome locations where ghosts, reflections and interference are encountered. High gain, 14db. Front to back ratio 15 to 1. Assembled, ready to put up. Mast mounting bracket included. Mast not included.

No. AN56A—One bracket mounting. Suggested list price **\$11.25**

No. AN56B—Same as above, front mounting. Suggested list price **\$11.25**

INDOOR UHF ANTENNAS



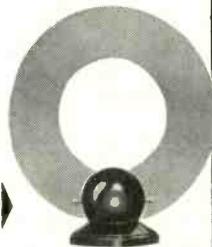
Admiral Super

Recommended for troublesome locations. Exceptionally high gain . . . over 7 db . . . excellent ghost suppression. Only 12 inches wide. Weighted and felt padded base.

No. 94A10-6—Complete with lead-in. Suggested **\$12.95** list price..

Admiral Target

Smartly styled in rose-gold colored anodized aluminum with mahogany phenolic base. Stands only 10 inches high. Base is weighted and felt padded . . . can be placed on top of receiver . . . picks up all UHF channels.



No. 94A10-7—Complete with lead-in. Suggested **\$4.95** list price.

You'll make an *extra profit* on every installation using these high gain UHF antennas. Ask your Admiral distributor about the *extra large discounts* from the list prices quoted here.

You'll be giving your customer extra value, too! All these antennas are finest quality . . . made with aircraft aluminum antenna elements and vibration-proof reflectors. "A-frame" insulators provide plenty of free air space around elements. The units have high mechanical strength and low resistance. They are *double plated* for extra resistance to weathering . . . first zinc plated, then dipped in zinc dichromate which gives them a beautiful gold finish. These antennas can be easily fastened to existing masts and towers. Order by part number from your Admiral distributor.

Ask your **Admiral** distributor for
FREE CATALOG
with complete line of **Admiral**
TV antennas and accessories

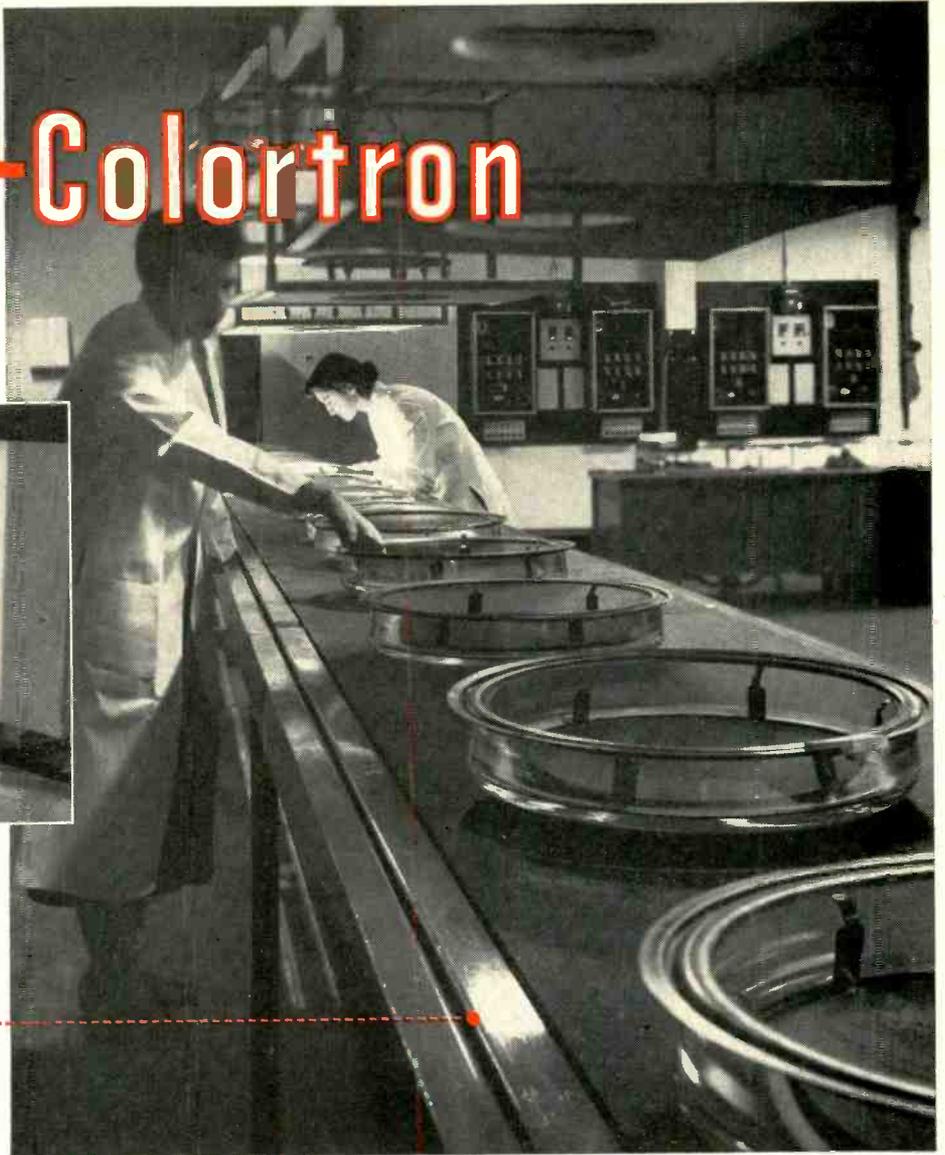
Admiral Corporation
Accessories and Equipment Division,
Chicago 47, Illinois

New CBS-Colortron

NOW IN MASS PRODUCTION



Unique photographic process, like photoengraving, uses aperture masks as negatives to print consecutively the red, green, and blue phosphor dots (250,000 of each) on CBS-Colortron screens.



After tri-color screens are printed, aperture masks are temporarily removed and face plates move on to critical inspection for screen imperfections.

COLOR TV IS COMING . . . faster than you think. The revolutionary new CBS-Colortron . . . a practical color picture tube . . . hastens the day. Already it is in lower-cost, mass production . . . made possible by its simplified, advanced design.

As in black-and-white tubes, the CBS-Colortron's screen is deposited directly onto the inside of its face plate. A unique photographic technique makes this possible. Because each aperture mask serves as a negative to print its tri-color screen, perfect register of mask and screen is automatically achieved

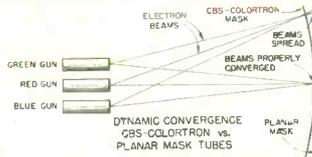
and maintained. The rugged, simple, light-weight mask sharply reduces assembly and exhaust problems. And the spherical design of mask and screen simplifies convergence circuitry and adjustment.

The CBS-Colortron is now a 15-inch, round tube. But, as soon as tooling is completed, it will be made in larger sizes. Watch for the new CBS-Colortrons. You'll see plenty of them soon. And you'll be sold on sight by their logical simplicity . . . their superior performance . . . their many advantages.

CBS-Colortron OFFERS MANY ADVANTAGES



Cross-section (face plate, aperture mask, funnel, tri-color electron gun) shows simplicity of CBS-Colortron and its adaptability to low-cost, mass production.



Spherical screen and aperture mask of CBS-Colortron simplify convergence and focus. Electron beams remain in focus over entire surface of screen.



Light-weight (6 oz.), rugged, simple aperture mask of CBS-Colortron minimizes problems of exhaust, handling, and assembly.

COMPLETE CBS-Colortron DATA FREE!

Take a look into the future. Write today for complete information on CBS-Colortron 15HP22: Construction . . . operation . . . application . . . installation and adjustment . . . electrical and mechanical data. Four packed pages . . . free!



CBS-HYTRON, Main Office: Danvers, Massachusetts

Manufacturers of Receiving Tubes Since 1921

A Division of Columbia Broadcasting System, Inc.

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

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

it's new
it's new
it's new

It's What You've Been Asking For!

it's new

it's new
it's new

it's new
it's new

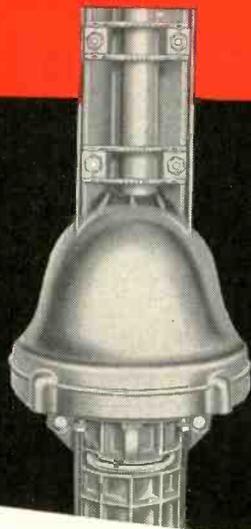
it's new
it's new

it's new
it's new

the TR-4 C★D★R Rotor

still the most powerful TV rotor, enough power to turn any array.

NOW... With Meter Cabinet Using 4-Wire Cable



Model TR-4

the de-luxe HEAVY DUTY ROTOR complete with modern design meter control dial cabinet, using 4 wire cable.

\$53.95

also these models **TR-2 • TR-11 • TR-12**

CORNELL-DUBILIER
SOUTH PLAINFIELD, N. J.



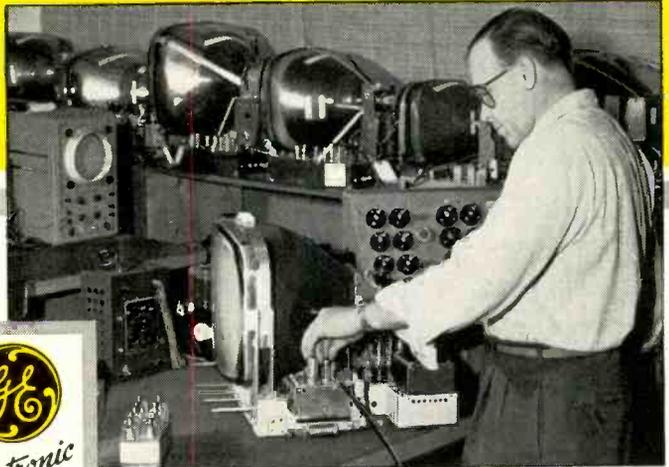
THE RADIART CORP.
CLEVELAND 13, OHIO

Now

G-E TUBES ARE SERVICE-TESTED FOR TV-SET INTERCHANGEABILITY!

IN INDIANAPOLIS:

Howard W. Sams & Co., Inc., regularly checks the performance of current-production G-E tubes in all popular TV chassis, at various line voltages.

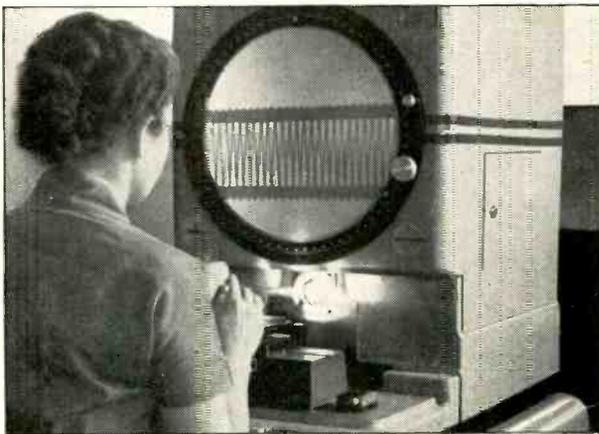


AT GENERAL ELECTRIC:

the Howard Sams reports are studied, and any case of unsatisfactory tube performance receives detailed investigation. Corrective steps in manufacture or testing follow at once.



● A General Electric executive micro-inspects a tube structure for proper assembly.



● A General Electric plant employee, using a comparator, checks a greatly magnified tube grid.

Simplify your tube requirements, reduce call-backs, with G-E interchangeable tubes!

SINCE September, 1953, the Howard Sams TV-radio technical organization has checked G-E receiving tubes for servicing interchangeability. A number of tubes of each type—fully representative of normal production—are tested periodically in TV chassis of different makes. Accurate instrumentation is employed.

Any unsatisfactory tube performance in any chassis is reported to General Electric. There, further tests are held to confirm the Howard Sams finding, and establish the cause of the difficulty. With the aid of laboratory study, corrective steps are decided on by G-E tube management and applied immediately. These may take the form of an improvement in manufacture or inspection, or revised test specifications.

Result: you are always installing tubes that are more fully interchangeable and high-quality! Your General Electric tube distributor is your source for a product that is constantly being improved! *Tube Department, General Electric Company, Schenectady 5, New York.*

GENERAL ELECTRIC

161-1A2

7 Out of 8 Times

THE ORIGINAL CRYSTAL CARTRIDGE IS ASTATIC

SCIENTIFICALLY SELECTED
BY MANUFACTURERS AND
THEIR ENGINEERS

Player and changer manufacturers have made Astatic Crystal Cartridges their overwhelming choice . . . because of Astatic's ability to match exactly the performance characteristics called for . . . because of Astatic's ability to turn out hundreds of thousands of uniform duplicates of each cartridge from its unparalleled precision production lines. These same factors work to assure perfect matching of requirements . . . perfect results . . . when you REPLACE THE ORIGINAL WITH ANOTHER ASTATIC CRYSTAL CARTRIDGE!

KNOWN THE WORLD OVER
. . . FOR HIGHEST QUALITY
AT LOWEST POSSIBLE COST



Ask for details on the new, FREE steel storage cabinet and dispenser for Astatic Crystal Cartridges.

EXPORT REPRESENTATIVE . . . 401 Broadway, New York 13, N. Y.
Cable Address . . . ASTATIC, N. Y.

(Continued from page 13)

used in the circuit . . .

You may now say, "Wait; we publish the magazine for service personnel who . . . do not have time to take for a complete analysis . . ." Print only one such article . . . This feeler article, I am sure, will be acclaimed by the more serious technicians, which I am also sure portray the bulk of your subscribers.

ELLERY EARLE CADIZ

Electronic Service Laboratory
166 Lakota Avenue
Akron, Ohio

Price Cuts vs. Salesmanship

EDITORS, TECHNICIAN:

I want to bring to your attention the enclosed newspaper article that was clipped from the Miami Herald this week.

(Reference is to a report on a speech by Robert S. Armacost, pres. of the National Automobile Dealers Association. Armacost asked auto dealers to halt the type of "cut-throat competition that has had a serious effect on television and radio markets." Condemning price-cutting on "products worth every cent of their legitimate list price," Armacost said, "We must find a way to correct the situation in which one partner—the factory—realizes its full profit . . . while the other partner—the dealer—is called upon to make all the sacrifice.")

Mr. Armacost brings out some very important points and also reveals that people outside our industry know that there are no such things as salesmen in our midst. If this article doesn't read off TV salesmen as they are, I don't know what does. During our recent run on UHF converters and antenna installations, these zanies in Miami were cutting prices when the merchandise could have been sold just as fast at the fair and reasonable retail price it was designed to sell for. But we are not the only town with that fault, I understand.

HARRY C. KELLER

Keller TV Radio Service
750 East 10 Street
Hialeah, Florida

• We're in your corner!—Ed.

McRoberts' Fan

EDITORS, TECHNICIAN:

I should like to take this opportunity to commend you for the series of articles by James A. McRoberts dealing with TVI problems. These articles are not only exceptionally well written, but are most informative. When so many writers deal largely in generalities, it is a pleasure to read something that is specific, informative, and clearly stated. I hope you will give us many more articles on other subjects by the same writer.

G. WARREN HEATH

182 East 19 Street
Brooklyn, New York

• No sooner said than done. See McRoberts piece on ringing circuits in this issue.—Ed.

Now a

COLOR

TELEVISION

HOME STUDY COURSE

by RCA Institutes



"Color Television is here—not around the corner, or in the developmental labs, but here! The big question now is . . . Are You ready for Color TV?"

"You may now have a successful TV servicing business. When color sets come to your bench for servicing, will you be able to handle them?"

"Color Television is a vast new field, embodying entirely new concepts . . . principles of light and vision, radically new circuitry."

First Home Study Course in Color TV

Now is the time to prepare. Now, for the first time, you can train yourself for the

opportunities in this brand-new field. The just-announced RCA Institutes Home Study Course is the *first* home study course covering all phases of color television. Offered only to those already experienced in radio-television servicing, it explains the "why" of basic theory, as well as the "how-to-do-it" of servicing techniques.

Planned and written by RCA instructors, the entire course is based on the practical experience of RCA engineers—the men who have pioneered in the research and development of color television since the very first color experiments, many years ago.

Remember when black-and-white television first became a reality? Overnight, the demand for men who knew television grew. Even now, a shortage of qualified servicemen exists. Think, then—of the even greater demand for servicemen who will understand the many additional problems of color reception!

Costs so little to gain so much

RCA Institutes makes it easy for you to prepare yourself now for color television. Not only is the cost of the home study course for qualified servicemen extremely low, but you pay for the course on a pay-as-you-learn basis.

RCA Institutes conducts a resident school in New York City offering day and evening courses in Radio and TV Servicing, Radio Code and Radio Operating, Radio Broadcasting, Advanced Technology. Write for free catalog on resident courses.

Send for FREE Booklet—Mail the coupon, today. Get complete information on the RCA INSTITUTES Home Study Course in Color Television. Booklet gives you a general outline of the course lesson by lesson. See how thoroughly you can learn Color TV. Mail coupon in envelope or paste on postal card.



MAIL COUPON NOW!

RCA INSTITUTES, INC., Home Study Dept. T354
350 West Fourth Street, New York 14, N. Y.

Without obligation on my part, please send me copy of booklet "RCA INSTITUTES Home Study Course in COLOR TELEVISION." (No salesman will call.)

Name _____ (please print)
Address _____
City _____ Zone _____ State _____



RCA INSTITUTES, INC.
A SERVICE OF RADIO CORPORATION of AMERICA
350 WEST FOURTH STREET, NEW YORK 14, N.Y.



*Only One . . .
of its kind!*

NEW!

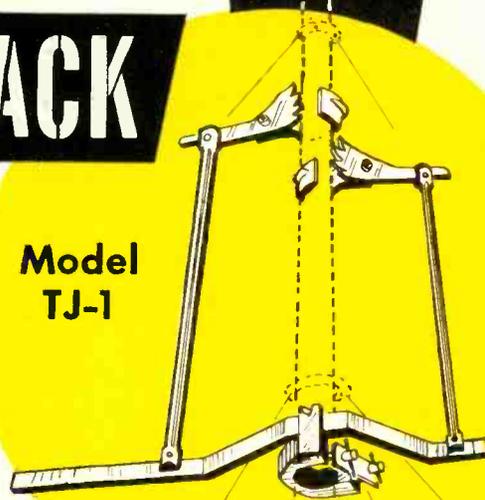
UNIQUE!

DIFFERENT!

WARD'S
Exclusive **TOWER-JACK**

• Now, WARD'S TOWER-JACK makes erecting Telescopic Masts a one man job. Just mount the antenna on the top section — and then raise it away. Each section is held firmly until secured with pin and guy-wires. WARD'S TOWER-JACK is then attached to the next succeeding sections until the mast is fully extended. Completely pre-assembled, the TOWER-JACK is easy to use . . . easy to carry from job to job. Handles any two-to-five section mast from 1¼" to 2¼" in diameter. Greatest time and money saver for telescopic mast erecting ever devised . . . Order your WARD TOWER-JACK today. Model TJ-1.

**Model
TJ-1**



Shipping
Wt. 11 lbs.

WARD PRODUCTS CORP.

DIVISION OF THE GABRIEL COMPANY
1148 EUCLID AVE. CLEVELAND 15, OHIO

In Canada: Atlas Radio Co., Ltd., Toronto, Ont.



TECHNICIAN

& Circuit Digests

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

So MUCH for So Little!

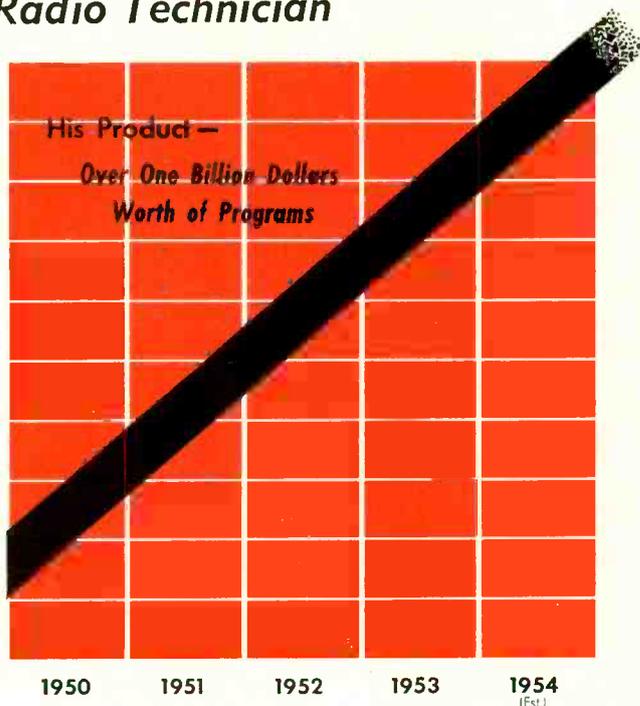
A Tribute to the TV-Radio Technician

There are wonderful TV-radio programs ahead for John Q. Public. Competition between TV and radio on the one hand, and TV and movies on the other, has greatly improved the quality of the shows being broadcast. Quantitatively as well, broadcasts have shot up. You, Mr. Public, are currently getting more than one billion dollars worth of entertainment per year.

And the man who makes possible this continuous flow of programming is the TV-radio technician. He is the key man in this great amusement structure, and nights would be much longer indeed if he suddenly ceased to exist. Mr. TV-Radio Technician is also one of the least appreciated persons in the technical and business world. Let's detail this comment a bit.

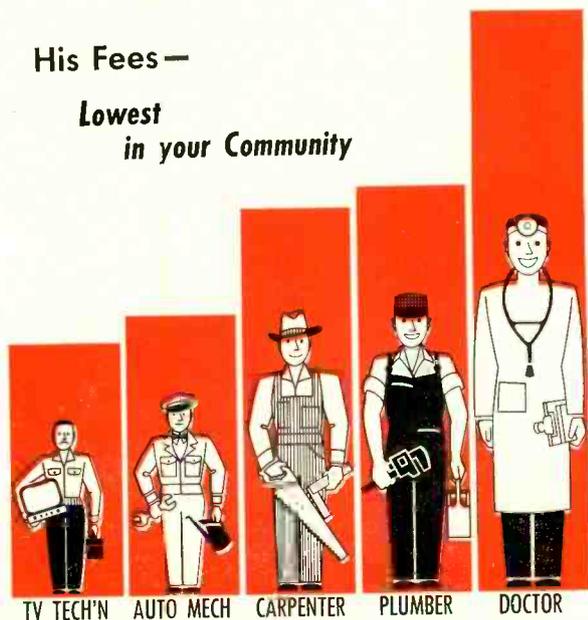
Your TV-radio serviceman spends many years acquiring the intricate know-how necessary for servicing the many makes of radio and TV chassis. Even when he has mastered his field he must still spend many hours per week reading technical journals and books, to keep up with the changes and developments that are constantly taking place. These hours of study must, of course, come after a long work day.

The coming of color TV will put additional pressure on the serviceman, and require still further after-hour



His Fees —

Lowest
in your Community



study. A large investment in expensive test equipment, tools and parts is necessary, before the technician-dealer can open his service establishment.

And with these burdensome investments of time and money, what does the TV-radio technician earn? *Less per hour than technical people in four other comparable fields of activity (see chart).* Furthermore, this overworked and underpaid serviceman is regularly made the butt of sensational slanders, whipped up by those who have not yet ferreted out the black sheep in their own industry.

This little guy doesn't have a loud enough voice to answer the slanders. Besides, he'd be too busy to answer back, even if he had the power to make himself heard. We, the editors and publishers of TECHNICIAN, can speak up for him, however, and we welcome the opportunity to do so.

The American public is spending more time in front of its radios and TV sets than it is riding in automobiles, eating or, in fact, any other activity except sleeping. The healthy man as well as the sick one gets enormous pleasure from his TV-radio set.

Let's salute the man who makes all this possible.

(Giant blow-ups of this page for store display, 15¢ cash or stamps.)

Tuning In the

SPACE CADETS have nothing on Atlantic City police, who are walking their beats with tiny aerials protruding up from behind the badges on their caps. Tiny 4-tube receivers, slightly larger than cigarette lighters and weighing less than 5 oz. with batteries, make no bulges in the patrolmen's hats, keep them in constant touch with headquarters.

RADIO HELMETS for firemen, also in Atlantic City, will be in use soon. These two-way affairs will have 20-mi. range and will even operate in steel buildings or below sea level.

AMAZING HOW SOME TV TECHNICIANS can see and hear TV programs without responding to anything but the presence of sound and black and white images, while others who work on sets know just about every program and performer on the air. Servicemen who can readily identify a program often find this knowledge helpful, particularly when front-end misalignment is being cleared up.

MAKE SURE YOUR OUTSIDE SERVICER presents a good appearance to the customer. One technician we know commented wryly on the fact that income (which was based on a percentage of the total home-call take) dropped sharply on days when he wore a lumberjacket, or unpressed pants, or a none-too-spotless shirt. "It would pay me to clean my suit daily, and put on a clean, starched white shirt on every service call," the man remarked thoughtfully. Many other sources confirm the importance of dressing carefully, especially when a house on the "better side of the tracks" is to be visited.



"Hello . . . is this Bob's TV Service? I'm having a little trouble with my set . . ."

SERVICING, SELLING AND RENTING SOUND EQUIPMENT is sound business for the progressive shop. Activities in the PA and intercom field pay off handsomely for numbers of technician-dealers, and keep service volume up during periods when TV-radio set repairs are slow. Sources of business: Schools, offices, factories, amusement parks, restaurants, arenas and the many prospects for mobile equipment in political, advertising and similar fields.

THE SERVICER IS THE VICTIM of another instance of unfair publicity. A daily in a suburban area near New York City concluded a recent series based on its survey of honesty amongst TV repairmen. Basis of the test was a receiver that was in operating condition except for one bad tube, which had been deliberately inserted. Most technicians called in on the complaint replaced the tube, charged the correct list price for same, and added their normal fee for house calls. Some tried to sell additional tubes to replace those they said were getting weak. Their argument was that this procedure would save service charges on future calls, since the tubes would soon need replacement anyhow. This is bad? The daily in question thought so.

VERY FEW TECHNICIANS tried to pull the set or build up a phoney charge. One such instance seemed to be the result of an honest mistake, although the paper wouldn't yield on this point. How was the series presented to readers? With daily scare headlines about TV gyps, video victims and the service "racket," although careful reading of the articles showed the truth to be the opposite of the headline slant. The series concluded with a plea for stringent legislation to regulate the activities of TV technicians, along with stiff penalties for violations. A conclusion more in line with the data presented would have been: "TV servicers honest; rates fair; slanders without foundation."

SERVICE ASSOCIATIONS are entitled to pats on the back for the showing their members made on the daily's survey. All technicians called in on the check-up who were members of these associations did no more than replace the tube at list price plus service fee. One member-technician went this far: On discovering that the defective receiver was still under first-year warranty, he offered to withdraw without a fee. He told the set owner that it would be cheaper to call the dealer from whom the receiver was purchased and pay for the call, saving money on the guaranteed tube. Naturally, this incident was not played up in the newspaper.

AN EASTERN TECHNICIAN advised a customer to buy a new set, rather than keep on spending money in trying to keep a "dog" percolating. "I'm going to make it do until I size up the color television situation," the owner said. And plenty of others are doing that very thing right now. Under the circumstances, service problems may, in many cases, become considerably tougher.

FOR A SOURCE OF NEW SERVICE REVENUE, consider tape recorders. Market experts estimate that this year will see an increase in sales of almost 50 per cent over '53. Forecast for this year made by **TECHNICIAN** editors: 400,000 recorders will be sold to non-commercial users.

Picture



COLOR-TV SERVICE, which will be needed more frequently and will cost a lot more than b & w service, will increase the squawks over high service charges—unless YOU do something about it. One of the reasons that people who pay high fees for other services scream about TV charges is ignorance. Let them know WHY they have to pay. Color sets will have many more components; there will therefore be many more things that can go wrong. Also, replacement cost for color components will be higher. These are facts. You can help illustrate them with the following chart, which compares the number of parts used in present-day monochrome sets with those expected in color units:

Type of Component	Amt. in B & W Set	Amt. in Color Set
Tubes	21	34-46
Fixed circuit components (resistors, condensers, coils, interstage transformers)	230	500-600
Controls (external and internal)	13	40
Large components (iron-core transformers, electrolytic condensers)	17	40

CUSTOMERS ARE NOT PAYING THEIR BILLS as promptly as they did a year ago, report a number of service managers in several large cities. One of the reasons, according to certain technician-dealers, is growing unemployment in some industrial centers. These dealers also point out that they've lost varying sums of money in cases where families have moved away to seek employment in other localities.

HOW MANY MODELS? Ever wonder how many radio, television or phonograph models are manufactured each year? Here are some interesting 1954 figures made available by our research department. Television receivers: 52 companies report 753 models. Radios: 37 companies make 363 models. Phonographs: 45 companies, 383 models. These figures represent returns from about 85% of all manufacturers in the industry.

MORE RADIO SERVICING BIZ is a possibility not to be overlooked, especially if you have been concentrating on TV only or TV mainly. Despite TV tail-off, AM set sales are going up sharply. About 40% more radio receivers were purchased in TV areas in 1953 than in the preceding year.

ANTENNA SALES, SERVICE, INSTALLATION due for big upswing in 1954 both in dollar and unit volume, informed sources believe. There are several reasons for the anticipated increase. One big factor, important on several counts, is the increase in new stations. Old TV areas, as well as new ones, will be affected. In old areas, there will be replacements of single-channel antennas by broad-band designs. Even broad-band VHF designs will give way, in many cases, to combined UHF-VHF units. Physical obsolescence is another factor, one whose impact is just being felt. A steady annual replacement rate extending into the millions is expected in future years.

A SPRING CAMPAIGN TO REPLACE or repair outdoor antennas which have gone through a tough winter is now in order. Ways to get business: 1. Advertise in newspapers. 2. Send out direct-mail pieces. 3. Solicit regular customers via phone. Point out that replacement or "revamping" of customer's antenna can often result in a 50 per cent improvement in reception—and that's a conservative estimate.



"Ya mind holdin' off the enemy until this program ends?"

Serviceman's Analysis

Operation of Chrominance Sections of the Receiver;

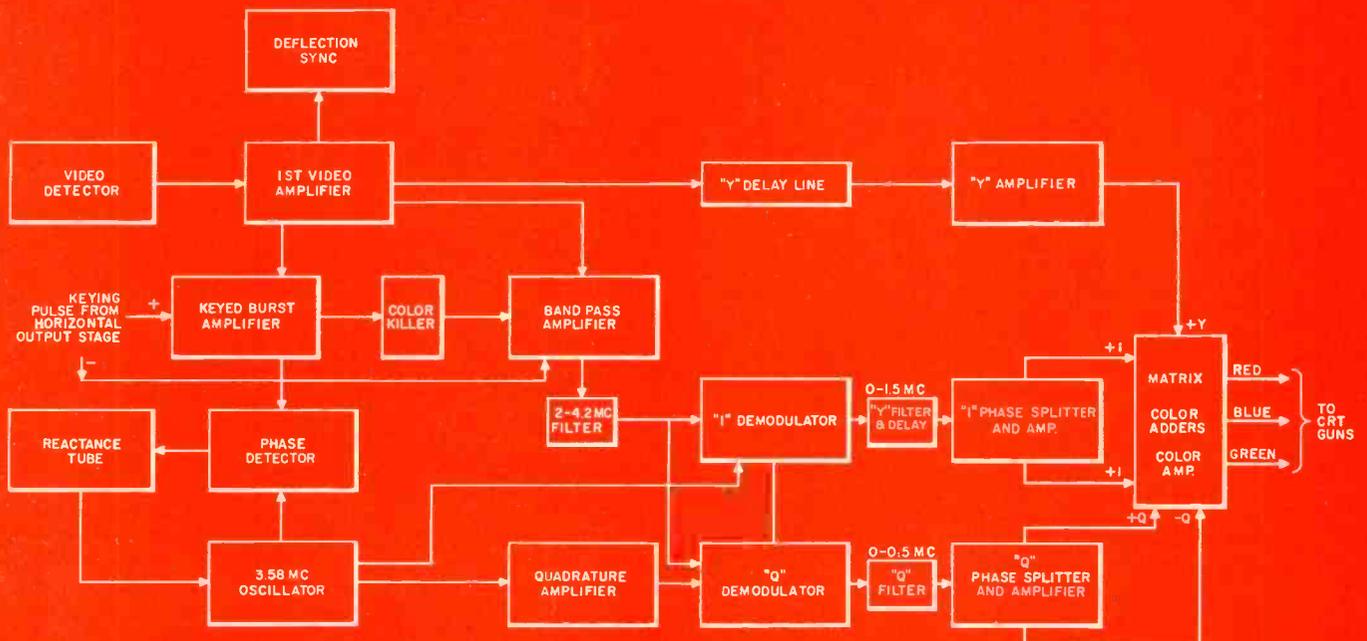


Fig. 1—Block diagram of color stages in color TV receiver. Output of matrix-adder-amplifier block goes to the red, blue and green guns of the crt.

BY PETER ORNE
AND
SOL HELLER
Managing Editor, *TECHNICIAN*

• In an article published some months ago (Nov. '53 *TECHNICIAN*), we discussed sections in the color TV set similar to corresponding portions of the black and white receiver. In our most recent pieces, we analyzed color television standards, so that we might better understand the make-up of the color signal. We are now prepared to talk in some detail about the block diagram of the color section of the receiver. In this discussion, we will concentrate on the function of each section, and the effect of trouble in it on the picture, leaving a closer circuitry analysis for future articles.

Let's start with the first stage in the block diagram of Fig. 1, and examine the video signal after detection. The sync portion of the signal contains the horizontal, vertical, and equalizing pulses and in addition, a burst of about 8 cycles of

color subcarrier that appears after each horizontal sync pulse. The video portion contains the "Y" signal, ready for application to the picture tube after proper amplification; also present is the color information, in the form of sidebands of the subcarrier (the subcarrier itself is suppressed in the transmitter, to minimize interference).

We can now consider what is done to this detected information, in order to obtain the color signal needed for each of the three guns in the crt. The first video amplifier supplies the take-off point for the different signals that must be processed. First, there are the deflection sync signals, which are supplied to the deflection sync section to provide vertical and horizontal synchronization (described in a previous article).

At another video amplifier take-off point, signal is supplied for the keyed burst amplifier. The keyed burst, the reader will remember, is needed to keep the receiver's 3.58 mc oscillator in step, in respect to frequency and phase, with the trans-

mitter subcarrier oscillator. This burst, incidentally, constitutes one of the major differences between the signals sent out during a black-and-white transmission on the one hand, and a color telecast, on the other.

The keyed burst amplifier separates the burst from the rest of the signal, amplifies it, and applies it to the phase detector. The burst cannot be removed in the same way that the deflection sync pulses are stripped from the composite video signal in a black-and-white (or color) receiver—i.e., by permitting only the top of the composite signal (the sync pulse) to get through, while the rest of it is cut off. This method of *amplitude discrimination* would be ineffective (see Fig. 2) because the burst and the sync pulses fall into the same amplitude region, and *both* would, therefore, be passed, instead of the burst signal only, if the kind of clipper we are familiar with was employed.

The burst is separated by a different method, one which involves keying the amplifier (the keyed burst amplifier). This amplifier is

of Color Stages

Theory and Service Data; Trouble Symptoms.

designed to operate only when a pulse from the horizontal sweep section arrives; the pulse is so timed that the amplifier functions only when the burst is present at its input (see Fig. 3).

The output of the keyed burst amplifier operates the *color killer*. This stage, you may remember, cuts off the color receiver sections when the burst is absent. (If the color stages were permitted to operate when a black-and-white transmission was being received, colored snow would be seen at the edges of all objects or persons.) If the burst amplifier is defective, no color will be visible in a color transmission, since the color killer will not allow the color stages to operate.

APC System

The burst from the burst amplifier is fed to the phase detector, where it is compared to the output of the local 3.58 mc oscillator. If there is any phase difference between the two signals, the phase detector will develop a (corrective) output voltage; if no phase difference is present, on the other hand (indicating that the local 3.58 mc oscillator is locked in step with the transmitter sub-carrier generator), the output voltage of the phase detector is zero.

The phase detector output is applied to the grid of a reactance tube; as the reader no doubt knows, the effective reactance of this tube changes with a change in grid voltage. The reactance tube is in parallel with the oscillator tank circuit, and thus controls the frequency and phase of the receiver's 3.58 mc oscillator. This whole system—phase detector, local 3.58 mc oscillator and reactance tube—are referred to as the apc (automatic phase control) system.

Before we consider what symptoms may be expected when trouble is present in this section, we should remind ourselves of the function of the local 3.58 mc oscillator. This oscillator is needed to produce a signal which, when it beats with the color sideband signals, will reproduce the

original chrominance signals generated at the transmitter. The action is similar to that taking place in a broadcast receiver's 2nd detector, which reproduces the audio signals by beating the i-f carrier and its sidebands together.

If the 3.58 mc oscillator becomes completely inoperative, all pictures will appear black and white, since the color sideband signals are not detected in this case. Let's consider how the oscillator may be checked, to determine if it is the source of trouble when no color pix is coming through.

In the RCA receiver on which we are basing all our discussions, the noise between stations will be sufficient to cause the color killer to leave the color stages operative at between-station settings, *when circuit operation is normal*; colored snow (also known as "confetti") will be seen in consequence, when the set is tuned to a between-station point. This fact permits a quick check for the operation of the color oscillator to be made as follows: Tune to a point between channels, and note whether "confetti" becomes visible. If "confetti" is seen, the 3.58 mc oscillator must be in working order; if black and white snow alone is noted, the oscillator may be defective.

When trouble in the reactance tube or phase detector is present,

the 3.58 mc oscillator will be off frequency. If the frequency is close to the correct one, slanted bars of intense colors will appear superimposed on normal black-and-white information; that is, the color information is torn out (the condition is comparable to horizontal loss of sync in a b & w set), while the monochrome information remains ok.

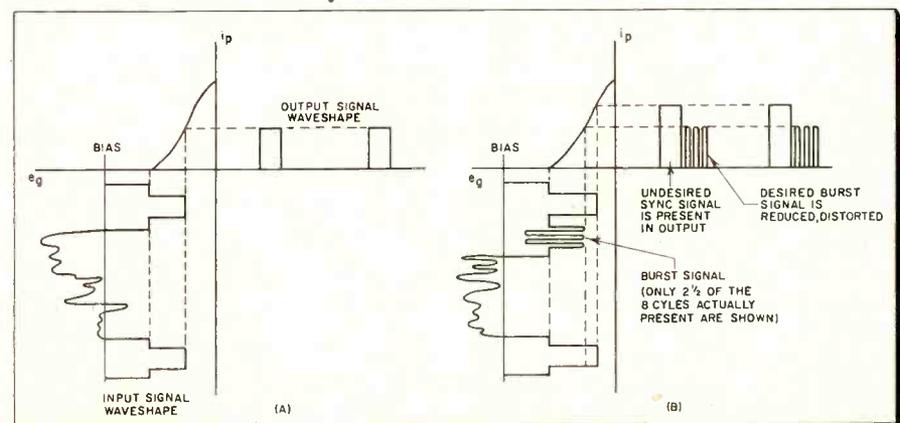
APC Trouble

If the frequency is *very far off*, an unmarred black and white picture will be seen, since the uniformly mixed color information present will blend together and become white (effectively invisible). Thus a set in which confetti can be seen, that reproduces a color transmission only in black and white, may have a defective or completely misadjusted apc system.

The same symptoms may be produced when the keyed burst signal has insufficient amplitude. The color killer will keep the color section of the receiver inoperative under the circumstances.

To distinguish between the two troubles (insufficient burst amplitude, and improperly-operating apc system), remove the color killer tube. If the color stages now become operative, causing a normal color picture to be seen, the source of

Fig. 2A—Input and output of conventional sync separator when a black-and-white composite video signal is applied to it. Only sync pulse appears at output. B—What the input and output of the same separator would look like if a color composite video signal was applied. The (undesired) sync pulse would be passed; the (desired) burst signal would be clipped, distorted.



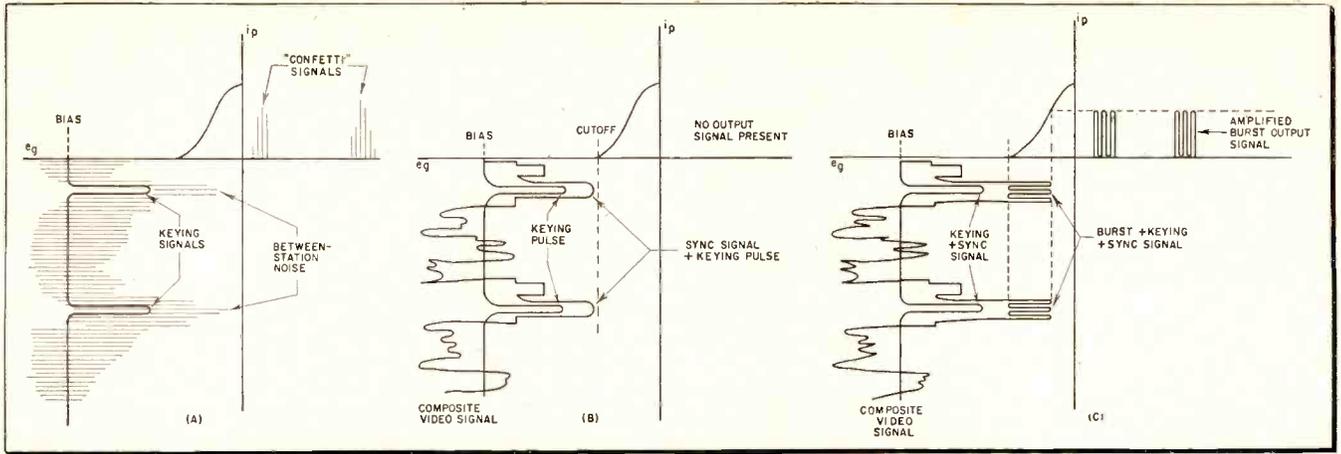


Fig. 3—How the keyed burst separator operates. Dotted line represents the d-c bias; note that this bias extends well beyond cutoff. The solid-line waveform is the keying pulse; it combines with the d-c bias. Note that the sum of the d-c bias voltage and the keying pulse does not extend beyond cutoff. Between-station noise is amplified during keying time, causing "confetti" to be produced (A). When

a black-and-white transmission is being received, the sum of the bias, keying and sync pulse voltages still does not extend above cutoff, and the burst amplifier therefore has no output (B). When a color transmission is coming in, the sum of the burst and keying signals extends well above cutoff, causing the burst amplifier to conduct and develop an amplified burst output signal (C).

trouble is either insufficient burst signal amplitude, or a defect in the color killer. If, on the other hand, removing the killer has no effect on the picture, a defect in the apc system is indicated.

Some of the oscillator output is applied directly to the "I" demodulator; the rest of this output is sent through a *quadrature amplifier* that shifts the phase of the oscillator signal 90 degrees, then passes it on to the "Q" demodulator.

"I" and "Q" Demodulators

The purpose of the two demodulators is to convert the subcarrier sidebands back to the original color signals. This demodulation is accomplished by beating the subcarrier sideband signals against the properly-phased local subcarrier oscillator signal. The sideband signals must get to the demodulators, of course; they travel from the video detector to this rendezvous, through the bandpass amplifier. The sideband signals must be properly prepared for application to the demodulators; the bandpass amplifier "does the honors" in this respect. Let's consider just what the bandpass amplifier is called upon to do.

In order to get best results from the "I" and "Q" color demodulators, it is necessary to strip away the unnecessary information associated with the color subcarrier sidebands. The unwanted information in this case consists, in part, of the low video frequencies. These are removed by a filter which allows only frequencies from 2 to 5 mc to get through the bandpass amplifier. The other unwanted signal is the burst. It is removed by keying; a negative keying pulse is applied to the band-

pass amplifier causing the latter to become inoperative during the time of the burst.

The bandpass amplifier forms the signal path for the color information between the 1st video amplifier and the demodulators. The bandpass amplifier is cut off by the color killer when a black-and-white signal is received.

A defective bandpass amplifier will result in a black-and-white picture alone being seen; snow but no confetti will be visible in such a case. The symptoms are the same as when the 3.58 mc oscillator is defective. When substitution of bandpass amplifier and oscillator tubes does not remove the symptoms, appropriate scope and/or voltage tests should reveal which of the two stages is the source of the trouble.

The output of the bandpass amplifier is fed to both demodulators. Each demodulator receives two signals: the subcarrier sidebands containing the color information, and the properly-phased 3.58 mc local oscillator signal.

The output of the "Q" demodulator consists of the "Q" color signal (which extends from 0 to 0.5 mc) and many other frequencies, such as the original input signals and their sums. A low-pass filter allows the "Q" signal to go on to the phase-splitter and removes all the unwanted higher frequencies. This filter, like any other filter, causes a time delay; that is, the signal comes out of the filter later than it came in. The delay is the longest for the filter with the lowest cutoff frequency—i.e., the "Q" filter.

In the case of black-and-white receivers, such time delays are not important, since only one video signal is processed in these sets. In

the color receiver, however, *three* separate signals must be combined to obtain the proper color. These signals must reach their final destination at the same time, if the color they produce is to be correct. If one signal is delayed, the others must be delayed the same amount. Since the filter acting on the "Q" signal delays the latter, a comparable delay must be provided in the "Y" and "I" signal channels as well. Fig. 1 shows the relative location of these delay networks.

A defective "Q" channel will be evidenced by the absence in the picture of the colors that make up the "Q" information—i.e., green and magenta (purple).

The "I" demodulator output is made up of the "I" signal, which extends in frequency from 0 to 1.5 mc,

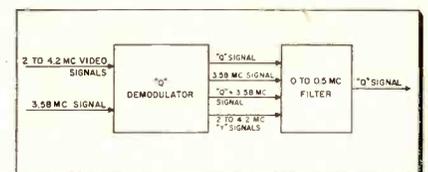


Fig. 4—Input and output of "Q" demodulator and its associated filter. Similar input and output signals appear in the demodulator and filter circuits of the "I" channel.

and unwanted signals above this frequency range. A combination filter and delay system rejects the unwanted signals and permits the "I" signal to arrive at the crt at the same time as the "Q" signal. A defective "I" channel will result in the absence of the "I" colors; that is, no cyan or orange will appear in the picture.

Going back to the first video amplifier, we note that the last (last to be discussed) take-off point goes
(Continued on page 56)

Servicing Printed Chassis

Recommended Soldering Technique for "Etched-Metal" Radios

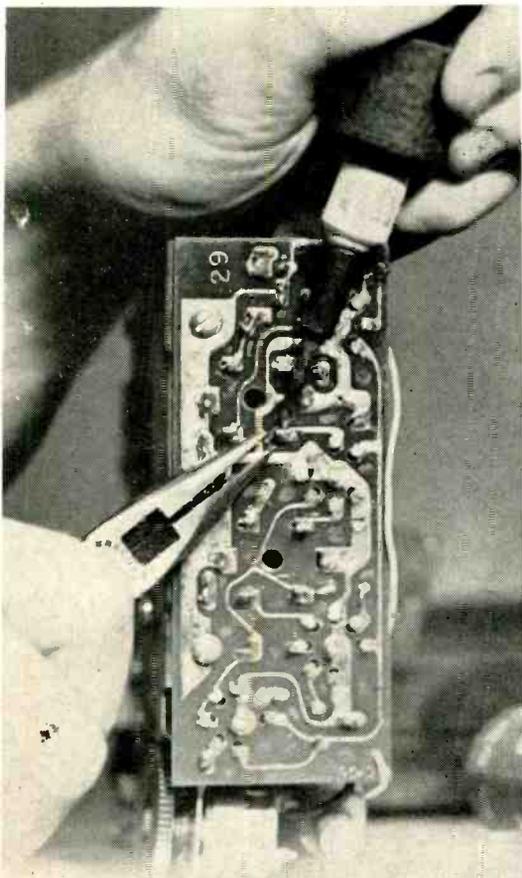
By JACK BAYHA

CHIEF ENGINEER, PHEN-O-TRON, INC.,
NEW ROCHELLE, N. Y.

• The rash of etched-metal radio sets appearing on the market, and the millions to come soon, have placed many servicemen in somewhat of a dilemma. Actually a blessing in disguise, the printed chassis seems like a Frankenstein monster to many technicians. Some of them, in fact, are even refusing to service sets of this type.

The etched-metal, or as some call it, *printed-circuit* radio, is actually easier to service than a conventional set, once you know the tricks of the trade, and can put them into practice. There is no great secret to successful etched-metal service work. Follow the simple methods outlined here, and you will find servicing a pleasure.

Photo of unsoldering job in progress on a late-model Admiral printed-chassis radio.



Several types of etched-metal, embossed-circuit and printed-circuit sets exist. In the true printed-circuit receiver, the wiring is electroplated on a layer of conductive (metallized) ink, printed on a sheet of phenolic plastic material, and deposited by a printing or silk-screening process. The bond between the chassis and wiring is very delicate, and special care is therefore necessary during servicing.

The embossed circuit is made by stamping metal or metallic powder into the surface of the plastic; the bond to the base material is quite strong.

The most popular form, the etched-metal panel, is made by etching away from a solid sheet of copper, which is bonded to the plastic, those areas where wiring is not wanted, leaving solid copper wiring. Bond strength is excellent.

The following tools and accessories are needed to service any of the three receiver types just mentioned:

1. A good pair of long-nose pliers.
2. 60-40 low-temperature solder with rosin core.
3. A glue brush (app. cost, five cents) purchasable at the local hardware store.
4. A 25-watt soldering iron. A higher-wattage will *not* do.
5. Tinned wire, such as resistor or capacitor pigtail clippings.
6. Carbon tetrachloride.

Solder Removal

As you probably know, etched-metal sets are assembled by either automatic or dip soldering in a matter of seconds; getting them apart, however, is not as speedily achieved, as you may well have found out. Maybe you are one of the servicemen who have turned the air blue in your immediate area with words not meant for tender ears, as you smashed tubes and speaker, and broke chassis boards, trying to extract a particularly stubborn i-f can from the death grip in which the chassis held it. The answer to the problem lies in getting the solder away from the joint between the etched conductor and the component.

Removing the solder from a joint

is readily accomplished with the glue brush and the low-wattage iron. Heat the joint cautiously; if the set manufacturer has bent the prongs of some unit in forty directions, as sometimes happens, straighten them with your long-nose pliers. By heating the joint again and rapidly brushing it, you can brush off the still molten solder. Since the solder present in the set has a very low melting point, and a low-wattage soldering iron is being used, the conductor will not generally be lifted from the base plate during this operation.

Component Installation

After eliminating all the solder by brushing, remove the component carefully, using your iron to smooth out the solder left on the pattern. Be sure to leave the component holes open for insertion of a replacement. Clean the chassis area around the repair zone with carbon tetrachloride, before installing the replacement part.

Install the new component with care, so as to not lift the pattern; then solder it in place with the special low-temperature solder. Leave coating of rosin in place, to act as a protective layer.

Successful removal and replacement of a component without damage to the conductors is not always possible, and occasionally a conductor section will break off. Repairs are readily made in such a case by soldering a short piece of tinned wire to the damaged conductor. Resistor or condenser pigtails are ideal for this purpose.

At all times use only a low-wattage soldering iron, always brush all joints free from solder, use only 60-40 solder, and be just a little careful—and etched-metal radio servicing will be a cinch. You will soon find the excellent accessibility, and absence of conventional wires, more than makes up for the extra care needed to service these sets.

By all means learn to service these units—you'll be getting plenty of this type of work soon, as almost every major manufacturer is currently putting such sets on the market, or will do so in the near future.

Ringling Problems in TV Sets

By JAMES McROBERTS

• Ringing circuits embrace all networks which oscillate or ring due to shock excitation. Television receivers employ the ringing circuits in some horizontal oscillator circuits (multivibrators and blocking oscillators) under several aliases: oscillator coil, stabilizer, phasing coil, etc.

Signal excitation usually causes rings in the peaking coils of video amplifiers. The resonant circuit of the peaking coils includes parasitic circuit capacitance (not shown on schematic) and interelectrode tube capacitances; hence, peaking coil circuits might also be classified as parasitic oscillatory circuits. Other television circuits, such as those in which the horizontal deflection coils lie, may also be placed in this category, due to their ability to resonate with their self-capacitance and produce excessive amounts of ringing.

The technician is concerned with how such circuits oscillate, practical means for increasing or decreasing the intensity of the ring or oscillation, and ways of suppressing the ring completely.

Simple Ringing Circuit. The simple series-resistance ringing circuit of Fig. 2 is derived from the multivibrator circuit shown in Fig. 1. The reader will recall that multivibrator and blocking oscillator tubes act like switches, that is, these tubes change

very rapidly from no conduction (open-circuit condition resembling an open switch) to full conduction (closed switch condition). The tube's plate-to-cathode resistance is in series with the switch (Fig. 2B). The plate load resistor is in series with the plate resistance and the switch, and we are therefore justified in adding these together to form resistance R_x in Fig. 2A.

We may liken the incoming sync pulses shown in Fig. 1 to a mechanical arm attached to switch SW of Fig. 2A. The analogy may also be thought of with respect to Fig. 2B. The internal resistance of coil L in Fig. 1 becomes series resistance R in Fig. 2A. Capacitance C in Fig. 2A comprises shunting capacitor C-1 shown in Fig. 1, plus the self-capacitance (not shown) of coil L.

Analysis of Series Ringing Circuit. Having simplified the circuit of Fig. 1 to the one shown in Fig. 2A, we may proceed to analyze its operation. For the benefit of those readers who are not familiar with the subject of ringing, we will further simplify Fig. 2A by considering that R is absent (R can never be eliminated in actual practice, it should be noted). We assume at the outset that switch SW is closed, permitting battery B to send a current through the coil L, and to charge condenser C.

Opening the switch causes this passage of current through coil L to cease. The current that previously

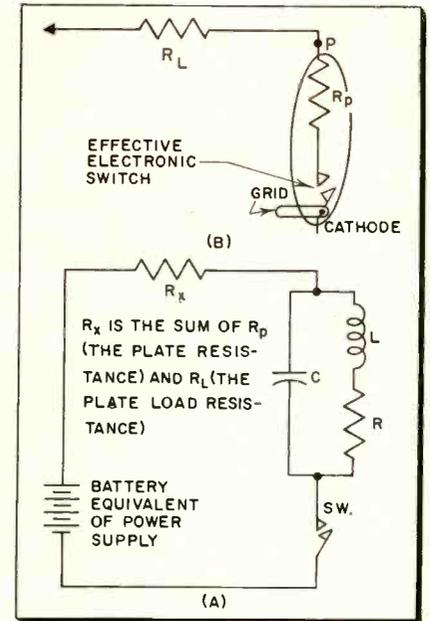


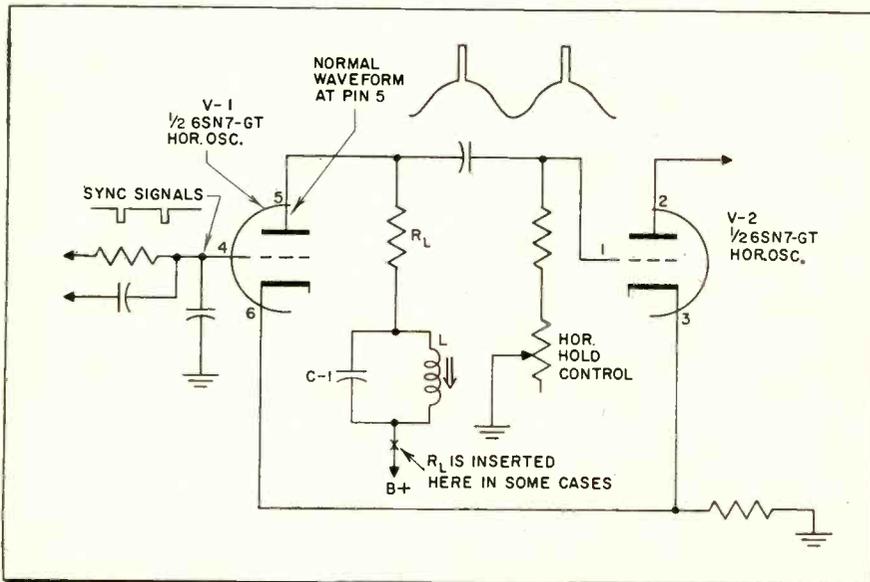
Fig. 2A—Simple ringing network (L, C, R) and associated circuit. R is made up chiefly of the resistance of the coil winding. B—Equivalent circuit of triode-switch tube. Grid-cathode voltage acts like a mechanical switching arm that opens or closes the switch.

passed through coil L stored up energy in the coil in the form of a magnetic field around it. This magnetic field now tries to dissipate itself, or collapse. In so doing, it sends a current through the circuit in a direction *opposite* to the one which originally flowed there. This new current charges C in the opposite direction.

When the coil has transferred its energy to C (storing a charge on C), the condenser will discharge, sending a current through L in the same direction as that of the original current. This recreates the field that originally appeared around coil L, and causes C to acquire a charge whose polarity is the same as the initial charge developed across it. One cycle of oscillation is thus completed. This cycle repeats itself (see Fig. 3A).

Since R (Fig. 2A) is assumed to be absent, and no energy is dissipated in the coil or condenser in this hypothetical case, each succeeding cycle is an exact duplicate of the first one. We call this the undamped case, due to the fact that no resistance is present to damp out the oscillatory energy. This theoretical case is approached in practice only in some extremely high "Q" circuits

Fig. 1—Section of horizontal multivibrator circuit. L and C-1 make up the ringing circuit.



(such as the lightly-damped networks associated with quartz crystals that are used to "ring" in some radar applications).

We now proceed to the case where series resistance R (Fig. 2A) is relatively small. The passage of current through the resistor causes a dissipation of energy (I^2R loss) that manifests itself as heat in the resistor. Not all of the energy is now transferred from the inductance (coil L) to the capacitance (condenser C) or vice versa. In each succeeding cycle the oscillatory peak amplitude consequently becomes progressively smaller (Fig. 3B).

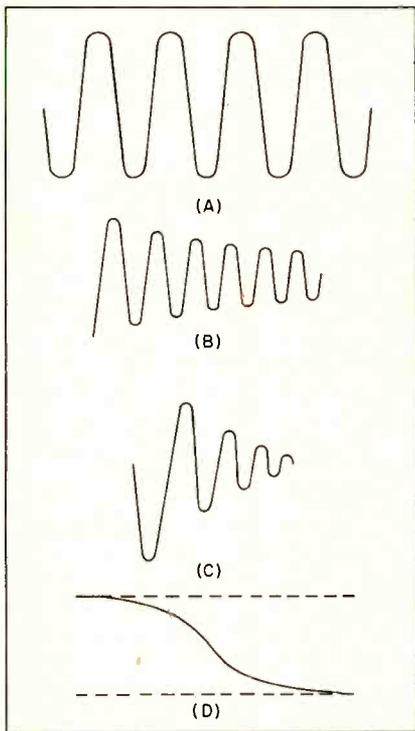


Fig. 3—Waveform of a ringing circuit when the latter is (A) undamped, (B) slightly damped, (C) heavily damped, (D) over-damped.

If series resistance R is increased further in value, more energy will be dissipated per cycle, or every half cycle, and the waveform now produced will resemble the one shown in Fig. 3C. Note the rapid decay of the oscillation in this case.

Increasing series resistance R beyond a certain critical value will cause the waveform shown in Fig. 3D to be produced. In this case, no oscillation whatsoever is present, and the current simply decays to zero without reversing. This "over-damping," as it is called, serves as a means for eliminating parasitic oscillation, such as the ring sometimes encountered when the horizontal output tube is overdriven. (To permit greater drive without ringing, antiparasitic damping resistors are

What the Technician Should Know about the Theory and Servicing of Ringing Circuits

inserted in horizontal output stages.)

We turn now to the parallel resistance case shown in Fig. 4, typical of video peaking coils and their shunting resistors. We are considering a simple instance here. When resistance is in *parallel* with an "excited" coil, the ringing that takes place will vary in *direct proportion* with the value of the parallel resistance (whereas ringing varies *inversely* with the resistance present, when the latter is in *series* with the coil). The absence of shunting resistance (we assume the absence of series resistance as well) produces the undamped wave of Fig. 3A; when parallel resistance is inserted in decreasing amounts, damping increases, and the ringing present goes through the changes shown in Figs. 3B, C and D.

Let's now apply the information we have developed to practical problems.

The Stabilized Multivibrator. The purpose of a ringing coil (regardless of its alias) in the plate circuit of the stabilized multivibrator, is to provide a means for triggering the retrace tube (2nd half of multivibrator) when incoming sync pulses have been lost, or are weak. Its further purpose is to prevent such retrace tube triggering at times other than at the end of exactly one horizontal line.

The circuit is appropriately resonated by adjusting the slug of coil L (Fig. 1) to produce one cycle of oscillation for every horizontal line. This one-cycle ring is very lightly damped, as indicated by the waveform (see Fig. 1) at pin 5 (plate) of V-1, carried over, also, to the grid of V-2, the 2nd tube section. We note further that the retrace spike occurs on or near the crest of the sine-wave ring; this spike, incidentally, starts the ring.

If the circuit is heavily damped for any reason, the waveform will resemble the one shown in Fig. 5. Note that the peak amplitude of the composite waveform is now considerably smaller. The stabilizing action becomes as ineffective under such conditions as if the stabilizer were not tuned, or could not be tuned (due to change or improper values of L or C) to produce a single-cycle ring. When any of the troubles just mentioned are present, symptoms of

instability and exceedingly critical horizontal hold will be produced.

The source of the trouble may be identified in each case with the aid of scope waveform checks. Too much damping will produce the waveform of Fig. 5, in which the spike starts from the sine wave valley; the absence of the sine wave or similar waveform, on the other hand, indicates either improper coil adjustment or improper component values (you can distinguish between these causes of trouble by trying to tune the slug). When a component's value is improper, its replacement is obviously indicated.

The author ran into a case where overdamping was due to water absorption by the stabilizing coil. A cold solder joint, which increased the resistance in series with this coil, was responsible for another overdamping condition.

Pulse Width Stabilizer Coil. The stabilizing coil used in a blocking oscillator pulse-width controlled circuit is similar in function to the stabilizing unit employed in the multivibrator. Only the waveform is different (see Fig. 6). The same troubles and symptoms occur in this as in the preceding case, and we will therefore not treat it further.

Parasitic Oscillation Providing Horizontal Retrace. The self-capacitance of the horizontal deflection coils resonates with their inductance

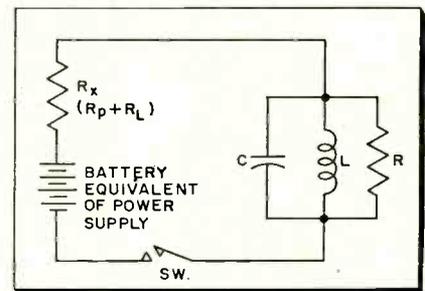
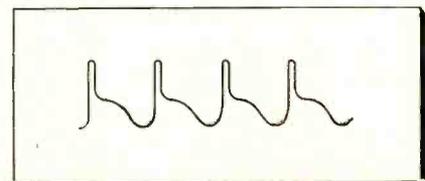


Fig. 4—Ringing circuit with shunt resistance.

Fig. 5—Waveform at first plate of multivibrator with excessive resistance in ringing circuit (compare with pin 5 waveform, Fig. 1).



to form an oscillatory circuit whose frequency is about 95 kc; the frequency is such that one half-cycle of oscillation occupies an interval approximately 5-6 microseconds long (retrace time duration). The energy stored in these coils tends to dissipate itself as an oscillation when the horizontal amplifier plate current stops flowing at the end of the trace interval. The absence of (excessive) damping allows the oscillation to start and go through one half-cycle; the oscillation is normally stopped at this time by the conduction of the damper tube, which acts as a parallel damping resistance.

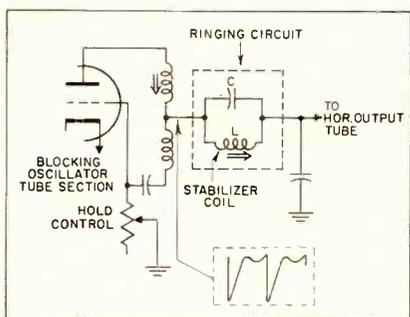
The waveform produced in the absence of damping is shown at Fig. 7B. With proper damping, the waveform will resemble the one shown in Fig. 7C (a very slight amount of oscillation is present in this case). The essential damper circuit is illustrated in Fig. 7A. Note the two (parasitic) self-capacitances.

One group of troubles in this circuit develops because of an increase in self-capacitance; the resonant frequency is lowered as a result of this increase, thereby increasing retrace time. If the retrace time becomes excessive, foldover will result. Troubleshooting is simple: try another yoke.

Tubes are frequent sources of trouble. Old or even new damper tubes may have a high plate resistance, causing damping to be insufficient. The capacitor from damper cathode to ground may develop a high resistance, increasing the effective impedance in shunt with the horizontal coils during retrace, and thus producing insufficient damping. Try replacing the capacitor, to check for this condition.

The rings produced by the troubles just cited (vertical lines at left of screen, most intense line at extreme left, with each successive line progressively weaker) may arise from other causes, such as parasitic oscillation in the screen or plate circuit of the horizontal output tube(s).

Fig. 6—Section of blocking-oscillator pulse-width circuit showing ringing network used.



Localization of, and remedies for, this type of fault have been considered in a previous article. Barkhausen-Kurtz oscillations may also produce similar symptoms. A magnet moved about the horizontal output tube will eliminate, and thus serve as a check for, this source of trouble.

Pronounced changes in the series resistance of the deflection circuit (including the flyback secondary) will result in too rapid a decay of the half-cycle oscillation or ring. Since the oscillation is rectified by the damper and converted into a dc boost voltage, the reduction in amplitude produced by its too-rapid decay will lower the B boost voltage

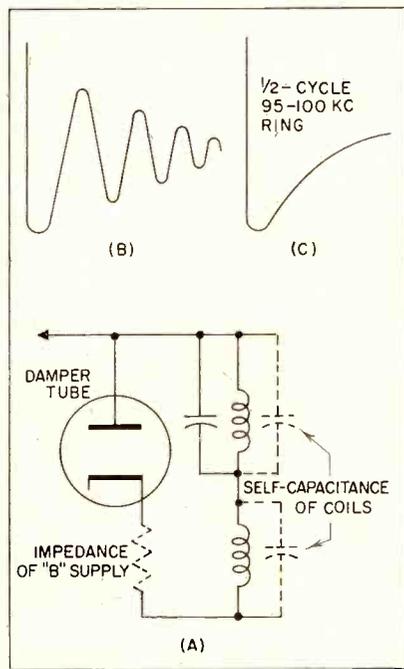


Fig. 7A—Section of damper circuit. B—Ringing waveform if damper tube were not used. C—Ringing waveform with damper present.

and decrease the width and high voltage; the need for increased drive in such a case may also cause the parasitic previously mentioned to be produced.

Ringing in Vertical Deflection Coil. Fig. 8 illustrates part of a conventional vertical coil circuit. Parallel damping is provided by the shunt resistors, whose customary value is 560 ohms each. From our previous discussion, we know that an appreciable increase in the value of these resistors will result in increased ring intensity; this often happens in practice.

The ring appears as a bar, similar to a sound bar but stationary, at the upper edge of the picture screen; it is followed by lower bars of successively-diminishing intensity. These symptoms give the appear-

ance of a wrinkle to a picture or test pattern; the condition is often referred to as a wrinkle in consequence. (Wrinkles are distortions of lines that are normally straight; the lines assume a sine-wave shape.) The remedy is, of course, replacement of the resistor at fault with one of the correct (lower) value, to decrease the ringing intensity.

Trouble may develop due to excessive capacitance across the vertical coils; this is, however, apt to be less pronounced than in the case of the horizontal circuit. Extreme cases of excessive capacitance will cause foldover, due to integration of the sweep signal; milder cases will produce (vertical) non-linearity.

Substitution of a new yoke is the proper test procedure, although this is not recommended until other circuit tests have been tried without success.

Trouble in the 56 mmfd (anti-wrinkle) condenser shunting half of the horizontal winding may cause wrinkle symptoms similar to those resulting from an increase in the value of the resistors shunting the vertical deflection coils. Check for such a defect by condenser substitution, making sure to connect the replacement across the same half winding.

Peaking Coils as Ringing Circuits.

Another ring that frequently manifests itself is the one following an abrupt change in picture content—i.e., when a predominantly dark scene becomes very light, or vice-versa. Ringing in this case may be caused by the peaking coils of the video amplifier (see Fig. 9A). Symptoms include ghosts of lines in the picture.

A ghost due to a ringing peaking coil is very similar to a reflection caused by an improperly-oriented antenna, except that the spacing of the direct and ghost signals remains the same at all channel settings, when a peaking coil is the source of the trouble; this spacing generally varies, on the other hand, when improper antenna orientation is causing the symptoms.

Several ghosts may be seen following an object in the picture, when a peaking coil ring is present, with each ghost less intense than the one immediately preceding it.

Some ringing is usually permitted in video peaking circuits. Certain customers may, however, object to the ringing intensity. The technician can alter the damping provided by the shunting (parallel) damping resistor in such cases.

The serviceman should check all

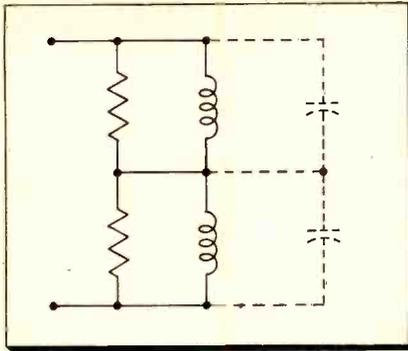


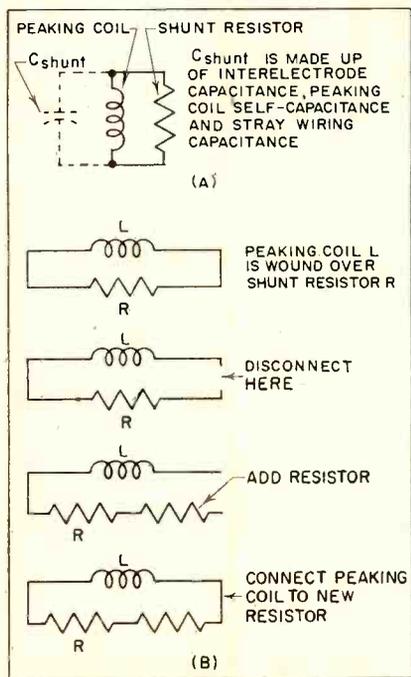
Fig. 8—Sketch showing resistance and capacitance associated with deflection coil circuit.

the individual peaking coils, using a bridging resistor in a manner similar to the bridging condenser used in checking for open condensers. This bridging resistor should have a value about eight times as great as the resistance in shunt with the peaking coil; a resistor ten times as large may not always produce enough of a change. Note that conventional resistors have a tolerance of about 20 per cent.

The bridging check just described will determine whether or not some coil circuit is not sufficiently damped, and is primarily responsible for the ringing. In cases where bridging any coil produces about the same decrease of ringing intensity as when the others are so tested, it is advisable to reduce all the damping resistors by about the same value—do not excessively over-damp one coil circuit alone, in order to get by with only one resistor.

Conversely, in some areas of low

Fig. 9A—Sketch showing resistance and capacitance associated with peaking coil circuit. B—Increasing resistance in shunt with coil.



signal strength, an increase in ring intensity may be desired, to improve the picture contrast; the procedure in such a case would be to increase the value of the parallel damping resistors, preferably raising all of them the same amount. A practical way of doing this is to disconnect the peaking coil lead from the pigtail of the resistor around which it is wound; attach the resistor to be added to the freed resistor pigtail; then connect the free end of the peaking coil lead to the pigtail of the new resistor (see Fig. 9B).

It should be noted that ringing may arise in the video i-f amplifier; this receiver section should be checked for proper alignment, if resistor bridging tests similar to the ones just described yield negative results.

Summary. Some important points relative to ringing circuits are enumerated below for the convenience of the reader:

1. A circuit must possess inductance and capacitance in order to be able to ring, regardless of whether or not such parameters are shown on the schematic.
2. The frequency of the ring is determined by the inductance and capacitance of the (resonant) circuit.
3. Ringing circuits are excited by a change in the current flowing through them; a change of voltage across such a circuit will obviously cause such a change in current.
4. Proper frequency adjustment of a ringing circuit permits it to ring in phase with the shock producing the ring.
5. Since ringing circuits do not amplify, the initial half cycle is the maximum half cycle or alternation. Succeeding alternations must decay relative to this first alternation, due to voltage dissipation across the resistive element present.
6. The rate of decay of a ringing circuit—i.e., its damping effectiveness—is determined by the ratio of resistance to the inductance and capacitance present in the circuit.
7. Damping—decay rate—is increased by increasing the series resistance, or by decreasing the parallel resistance. Both shunt and series resistance, when present in the same circuit, may be altered to produce the desired damping rate.
8. A circuit which possesses resistance, inductance and capacity cannot ring or oscillate if the damping exceeds a certain critical value; a condition known as *overdamping* is present in this case,

An acre of performance is worth the whole world of promise.—Howell

Printed-Circuit Confusion

In recent months it has become more and more evident that there is considerable confusion in the industry on the subject of printed circuits. In technical literature for example, we find general technical statements on "printed circuits"; the statement involved, however, is frequently not applicable to all types of printed circuits. The book "Printed Circuit Techniques" (1947), available through the Superintendent of Documents in Washington, D. C., defines "printed circuits" as circuits produced on an insulated surface by any means. Painting, spraying, chemical deposition, vacuum processing, die stamping and dusting are listed as the methods now in use. Obviously, it is difficult to make any general statement on printed circuits because characteristics differ so from type to type.

Case in Point

As a case in point, in the article titled "Servicing Printed Circuits and Chassis" appearing in the December 1953 issue of *TECHNICIAN*, under the sub-heading "Replacement Techniques" the author, in discussing the replacement of printed circuit networks and/or components thereof, has laid down general principles for soldering which are not applicable in all cases. Low-heat soldering is, of course, desirable when working on etched circuits because a high temperature iron might tend to loosen the binder between the circuit material and the backing insulation. This in turn could cause possible tearing of the circuit material in the event the latter lifts off on the iron. Obviously this is not a restriction in the case of ceramic networks such as Centralab's "Couplates," "Filpacks" and "Filplates." These units are designed to be handled in the same way that conventional paper capacitors or composition resistors might be handled.

While it may not be practical to eliminate the term printed circuits in general discussions, the editors of *TECHNICIAN* will also refer, in the future, to the type of circuit under discussion, such as etched, sprayed, stamped circuits, etc., and unless otherwise indicated, the technical data presented will be concerned with only that type circuit. It is hoped that standardization in this relatively new industry will occur soon, to clarify the uncertain definitions both for the reader and for the editor.

First Printed TV Chassis

Kaye-Halbert "Etched-Circuit" Television Set Has Been Scheduled for Mass Production

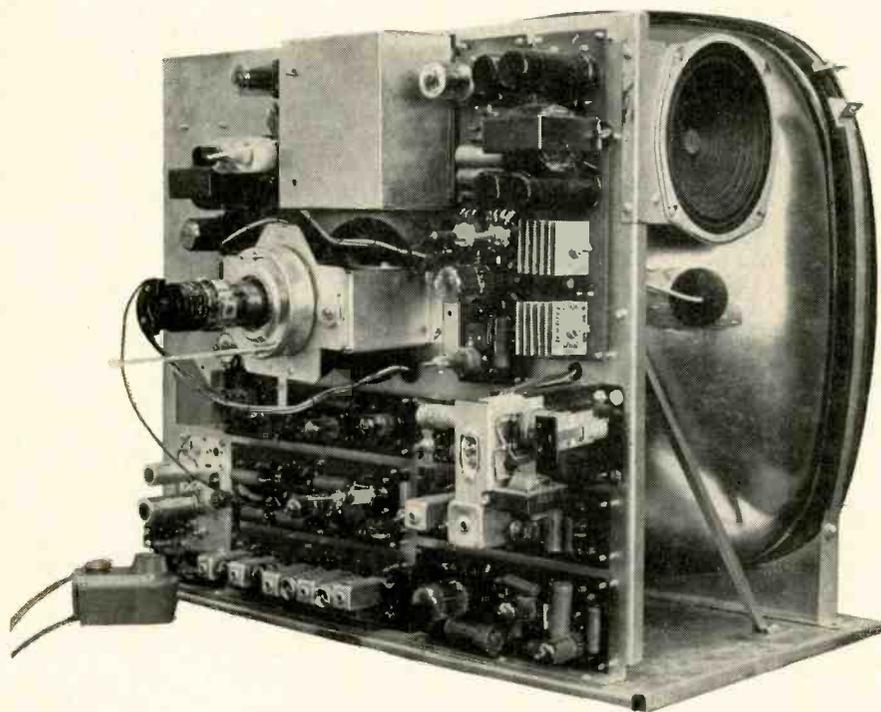


Fig. 1—Camera view of the new Kaye-Halbert all "printed-circuit" television receiver chassis. Note concealment of high-voltage circuit and the "Robot" remote control (extreme bottom, left). The remote control unit turns the receiver on and off, adjusts volume and changes channels.

• The first mass-produced all-printed-circuit chassis for television receivers will soon be manufactured by the Kaye-Halbert Corporation of Culver City, California. Production on this newly-designed chassis is scheduled to begin sometime within the next 90 days. The chassis (Fig. 1) was recently previewed in Chicago during Market Week and retail prices for the new set are now being worked out by company officials.

The printed-circuit chassis is the culmination of a year's development work, and utilizes the silk screen-etched method. The chassis, instead of being constructed as one complete printed circuit, has been divided into nine major sections. One such section is illustrated in Fig. 2.

Each of the major sections is separately silk screened and etched on copper phenolic plates. These plates are then punched and proper components and tubes are placed in them. The entire plate is then dip-soldered. When all nine printed circuit sections have been sub-assembled and dip-soldered, they are

snapped into a large phenolic frame which acts as the chassis holder. The sections are then connected with each other through a few conventional wire attachments.

The printed circuit chassis is mounted vertically back of the picture tube. The backs of Kaye-Halbert cabinets will be hinged, so that servicemen will merely have to drop the back of the cabinet, to look directly into the vertical chassis.

Because the printed circuit arrangement is in nine sections, the servicing problem becomes much simpler. A service manual is being prepared that will advise technicians to remove such-and-such a section, when certain listed symptoms of trouble appear. All sections will be coded in the manual.

By breaking down the chassis into nine major sections and designing a snap-in arrangement for these sections, it will be possible, according to estimates, to perform about 95 percent of all future servicing on Kaye-Halbert sets in the home.

The new chassis will contain 27 tubes, instead of the 23 now operating in current K-H chassis. In addition, the printed-circuit set will contain two selenium rectifiers and two germanium crystals. The new chassis will have four stages of i-f; it is designed to provide better interlace, and will have a better video response.

Since the human error in production will have been almost entirely eliminated, mechanical failure in the new Kaye-Halbert printed-circuit television set will, it is expected, be limited to component breakdowns. One of the major improvements introduced by the p-c TV receiver, thus, will be the standardization of high-quality chassis assembly.

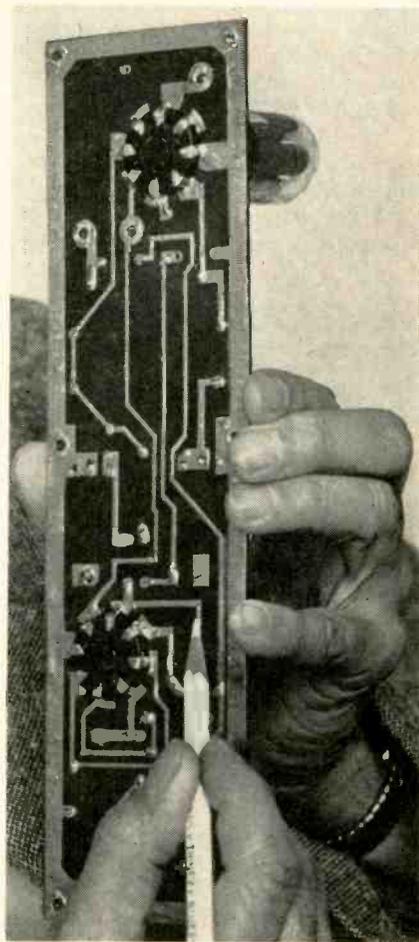


Fig. 2—Above photo is a sample of one of the printed-circuit sections. Section is etched to one of the copper phenolic plates. Glimpse is offered of component parts on reverse side.

Eliminating Sound TVI

Data From WASHINGTON TELEVISION INTERFERENCE COMMITTEE on Keeping R-F Out of Audio Stages.

• The grid circuit of the first audio stage of a television receiver usually requires from a fraction of a volt to a few volts of bias. Any r-f signal from a nearby radio station (taxi, police, military, amateur or other), strong enough to overcome this small bias, or large enough in amplitude to cause grid-current flow will, as a consequence of non-linear grid voltage-plate current relationship, be rectified, and, if amplitude-modulated, will appear as an audio signal passing through the audio amplifier, together with the audio signal of the station actually tuned to. An FM or

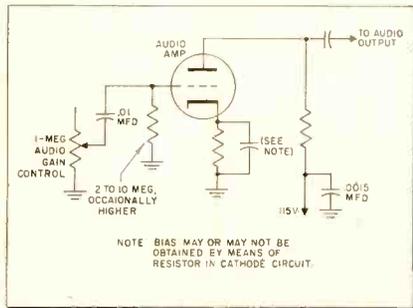


Fig. 1—Conventional first audio amplifier.

unmodulated carrier of moderate intensity may produce hum or distortion. A strong FM or unmodulated carrier will reduce the audio output level of the station to which the receiver is tuned. If the interfering signal is keyed, program reception with breaks in volume will be noted. This type of interference will be evident on all television channels, regardless of receiver tuning adjustments.

Identifying Rectification Effects.

To identify the interference described, momentarily short the output of the last i-f amplifier through a condenser to ground. If the interfering signal *persists*, it is most probably due to pickup in the first audio amplifier; the procedures outlined in the paragraphs following will be found effective in such a case. If the interference *stops*, it is not due to pickup in the audio stages, but is probably being caused by inter-modulation in the r-f or i-f stages.

These same effects can also occur in AM and FM receivers, phono and

public-address amplifiers, hearing aids, and other high-gain audio devices.

Receiver Modifications. Effectively eliminating this type of interference depends entirely on preventing the r-f from being rectified; once rectification occurs, it is impossible to separate or filter the interference from the desired signal.

Fig. 1 is a simplified schematic of a conventional first audio amplifier, and indicates typical values of associated components.

In Figs. 2A, B, changes made in the circuit of Fig. 1 to eliminate the undesired signals are indicated. When the original grid resistor is large, it may be necessary to reduce its value to as little as 1 megohm. This will not appreciably affect the gain of the desired audio. However, care should be taken in choice of values for bypass condenser and series resistor or inductance to maintain the grid circuit pre-eminently resistive to audio frequencies (i.e., use a relatively large capacitance, and a small inductance).

Choke or resistor and condenser should be mounted directly at the grid pin of the tube socket, with the shortest possible lead length between grid and cathode. For grid-cap type tubes, the grid lead should be shielded, and the bypass condenser connected as close to the grid-cap as practicable.

The bypass condenser added as a shunt across the tube input provides such a low impedance at r-f that it

practically shorts out any such signals at this point; the series choke, or resistor, helps prevent r-f from reaching the grid. The choke gives the best results, but the carbon resistor is almost as effective.

Bypassing and Filtering Suggestions. As in ac-dc standard broadcast receivers, bypassing the heater of a combined detector-first-audio stage to ground with a 0.01 mfd condenser, will often prove helpful. Be certain screen and suppressor grid bypassing is adequate.

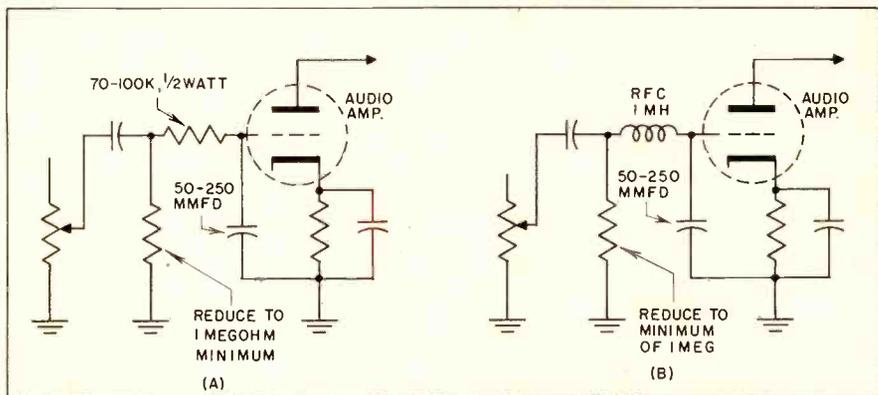
In extremely strong signal fields, it may be necessary to filter the second audio amplifier, or output amplifier, in the same manner. Where the interference is strong enough to be feeding into stages after the first audio amplifier, care should be taken that no phase inverter stage is affected by any filter installation.

Series heater strings should be well bypassed to prevent the undesired signal from entering the tube through the heater leads. Both sides of the ac line may be bypassed to chassis (in transformer-powered sets) with 0.01 to 0.1 mfd (value non-critical), 600-volt condensers.

Tube shields, if used, should be checked for positive ground connection. If an audio tube is unshielded, it may be necessary to install a shield. Lead dress should be carefully checked. R-f pickup may occur on long volume control leads running to the front of the chassis. Receiver wiring may represent an

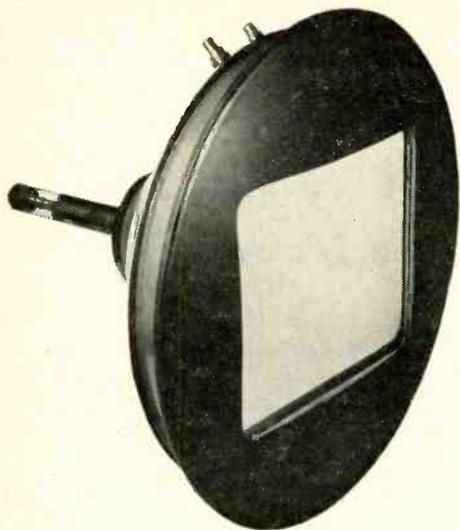
(Continued on page 52)

Fig. 2—Circuit changes for keeping r-f out of the audio stages. Observe cautions described in text.



The Chromatron:

How This CRT Works. Comparison



By SIDNEY C. SILVER

Associate Editor, TECHNICIAN

The existence of a single-gun structure, the Lawrence gun, has been known for some time. Use of this structure in the *Chromatron*, designed by Chromatic Television Laboratories, is not a development of the last few weeks or months; recent events, however, make it worth while to call attention to this tube and to its possible impact on set design. In the first place, two or more important manufacturers of black-and-white crt's have been licensed to produce the tube. In addition, at least two manufacturers of nationally-sold name-brand receivers are making plans to use the *Chromatron*, and are working on associated circuit design.

As discussed in earlier articles, color phosphors in three-gun shadow-mask tubes are deposited in dots on the inside surface of the tube's viewing screen. The dots are arranged in triangles of three each, one for each of the primary colors. The electron beams from the tube's cathodes are so directed that, in passing through apertures in the mask, the beam from each gun can only strike dots of the correct color phosphor—or strike no dots at all. Electrons that are not propelled directly onto the desired dots are blocked by the mask altogether. As a result, such tubes are highly inefficient devices; it is estimated that only 15 per cent of the electrons that leave the three cathodes actually strike the picture-tube screen. With an aperture mask, then, three guns are needed to insure enough total electron emission, if for no other reason. Also, because of the low efficiency, higher second-anode voltages are required than are common

in black-and-white receivers, and overall brightness of the picture is reduced.

The *Chromatron*, which uses no aperture mask, is said to permit 85 per cent of all electrons beamed from the single gun to strike the phosphor-coated screen. Elimination of the mask is made possible by a dynamic *lensing* or *beam-bending* system. When information of any particular color is to be displayed in the picture, a varying voltage applied to elements inside the crt bends the beam coming from the single cathode so that it strikes phosphors of that color only.

To see how this is done, a look inside the tube is necessary. The manner in which the color phosphors are placed on the inside surface of the tube's viewing screen differs from the triad-dot arrangement common to three-gun types. The ar-

range in the latter is shown on one segment of the tube's inner surface in Fig. 1A. In Fig. 1B, which is a comparable segment of the surface in the *Chromatron*, these phosphors are deposited in adjacent horizontal strips extending across the faceplate.

It will be noted that there are twice as many strips of green phosphor (G) as there are of blue (B) or red (R). Such an arrangement is used because most of the luminance information is associated with the green signal. This design feature does not upset color balance. See explanation in caption for Fig. 3.

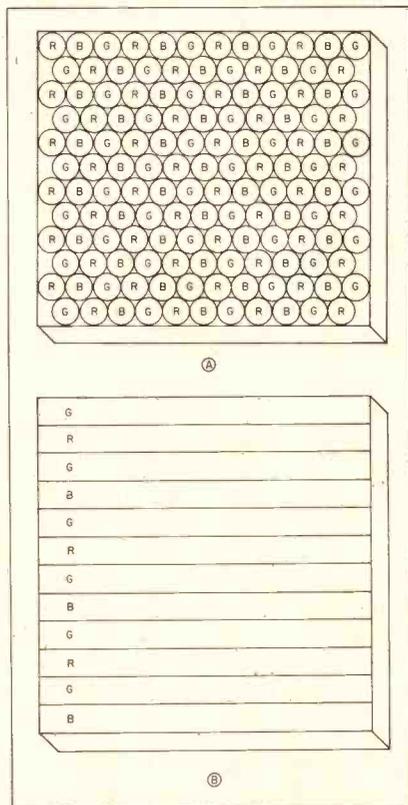
Grid Wires Act As Lenses

Between the gun assembly and the phosphor-coated screen, but closer to the screen, is an assembly of horizontal grid wires, as shown in Fig. 2. Alternate horizontal wires are connected together and brought out as two fundamental connections, marked red and blue.

In Fig. 3A, a cross section view shows the electron beam passing between one red and one blue wire when there is no potential difference between them; that is, when the voltages applied to the connections marked red and blue in Fig. 2 are equal. The like positive charges on the grid wires have only one effect, in this instance: they tend to focus the beam sharply onto the green phosphor strip. When the structure of red grid wires is made *positive* with respect to the blue assembly, the electron beam is deflected *upward*, as shown in Fig. 3B, and the beam strikes the red phosphor strip. In like manner, when the potential between adjacent wires is reversed, only the blue strip is struck (Fig. 3C). Note that, even when there is no voltage difference between the red and green wires, the potential on both sets of wires still has a lensing effect on electrons propelled toward the screen.

A keying or switching arrangement is used inside the receiver to develop the varying potential that is applied to the grid wires. In this

Fig. 1A—Phosphors for three primary colors are deposited in dot-triangle arrangement in 3-gun tubes. B—Horizontal phosphor strips are used in *Chromatron*.



A Single-Gun Color Tube

with 3-Gun Types. Associated Receiver Considerations

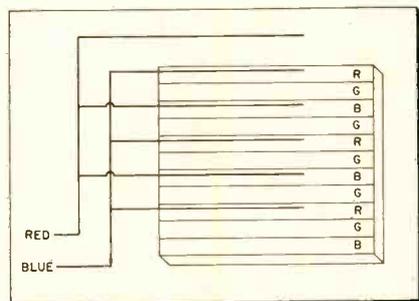


Fig. 2—Instead of an aperture mask, a screen of horizontal wires is placed behind the phosphor-coated faceplate. This lensing structure directs electrons to the proper color strips.

way, beam lensing is constantly switched from one color to another. Obviously some means must exist, controlled by color information, for varying the emission from the gun's cathode as the beam is being lensed or bent to the various color strips.

More than one circuit has been devised to accomplish this. The most elaborate one makes use of a color section in the receiver that is comparable in size to the specialized color sections already developed for receivers using three-gun tubes, although it operates in an entirely different fashion. On the other hand, one laboratory talks of incorporating the entire color-processing section into a single stage. This single-tube section will work in conjunction with the color tube; actual decoding of color information will take place in the latter. Such circuits will be discussed in future issues of *TECHNICIAN*, as and when they become available. Evaluation of the possibilities introduced by Lawrence-gun tubes, however, need not wait for such information.

Since many of the tube's possibilities depend on its physical characteristics and some electrical characteristics not yet mentioned, this data is presented here. Maximum diameter of the tube in its present form is about 22 in. The diagonal of the rectangular viewing screen is about 18 in. Overall tube length is about 22 in. Length is comparable to that of 19-in. black-and-white crt's; the Chromatron is considerably shorter than a three-gun color tube providing a comparable picture size would

be (in the present state of design).

The 22-in. overall length is made possible by the use of a 72-degree deflection angle. Still wider deflection angles are said to be possible. Magnetic deflection and magnetic focus are accomplished with standard yoke and focus assemblies. The larger and more expensive yokes required for three-gun tubes are thus eliminated.

The Chromatron requires 18 kv of second-anode voltage in its present size. This is only slightly higher than the value required for black-and-white tubes that produce pictures of the same dimensions. The three-gun tube, on the other hand, needs 20,000 v to produce a picture with a diameter of app. 12 in.

Regulation of the hv section in a receiver using a Chromatron is not highly critical. The same statement may be applied to the normal B+ supply, for that matter. In three-gun tubes, we are dealing, in one sense, with three tubes that happen to use a common shell and phosphor screen. For proper functioning (particularly with respect to convergence), the three guns and their associated external circuits must be critically adjusted with respect to each other. Voltage changes beyond certain narrow limits upset this delicate balance.

Non-critical Tolerances

In the Chromatron, the relationship between the voltages on the single cathode, the wire-grid structure, the second anode, and other tube elements remains essentially unchanged over a fairly wide range of overall increase or decrease in the low and high dc supplies. Receiver tolerances in general are comparable to existing tolerances in b & w sets. This means that conventional fly-back transformers may be used in familiar horizontal-output circuits. Low-voltage supplies will also tend to resemble those now in use.

With the use of a single electron beam, the problem of convergence is eliminated as it exists in shadow-mask tubes. There will simply be no convergence controls. There will

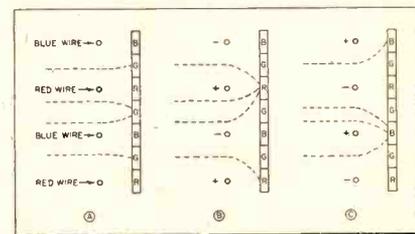
also be no need for critical balancing adjustments to match the outputs of three guns. These factors are particularly important when the receiver is required to reproduce a black-and-white picture, free of color fringing (color "ghosts") on the one hand, and of overall color tinting on the other.

Limitations of Chromatron

A sober estimate of this color tube's potential indicates some disadvantages. In the current version of its associated receiver, a 25-watt oscillator is used at the frequency of the color subcarrier (3.58 mc). Interference radiation from this stage is a possibility. Measurements with a field-strength meter at 100 ft. indicate radiation of 5 microvolts per meter in the present state of circuit design. In addition, the limited number of phosphor strips now used (450 for green, half that number for red or for blue) make for coarse definition of blue or red detail, although subjective reaction to this phenomenon varies.

It is impossible to say at this time that the Chromatron, or any other color crt, enjoys a clear advantage over its rivals. Changes in all tube types, as well as in the design of associated circuits, will determine whether one tube will obsolete the others, or whether more than one type will come into general use for an indefinite period.

Fig. 3—The potential difference between adjacent grid wires bends the electron beam. The paths of four electrons in the beam are shown when (A) green, (B) red and (C) blue phosphor strips are being activated. Despite the fact that fewer strips are struck in the last two cases than in the first, note that the same number of electrons are activating phosphors in all three cases. Uniform saturation is thereby maintained for the three primary colors.



to Lighten Farmer's Chores

Technicians Located Near Farm Areas Will Be Interested in the Profit Possibilities Provided by This New Receiver

This new Tractor Radio is an 8-tube (including rectifier) superheterodyne, designed to operate from the 6-volt storage battery of a tractor. It is equipped with a self-contained telescopic antenna, and features single unit weatherproof construction and shock-proof mounting. The radio covers the frequency range 538 to 1620 KC. Three operating controls are provided.

The receiver has been designed with a tuned RF stage and a 3-gang tuning condenser. The unit is easily installed and requires no electrical adjustment after installation.

This Tractor Radio is enclosed in a rugged weatherproof case. Open the front cover by raising the thumb catches at the sides of the case, swing the cover all the way back so

that it lies flat, and rotate the catches to lock over the sides of the case. Extend the antenna to the lowest position necessary for good reception. The cover should be closed and locked when the radio is not in use. Collapse the antenna and turn the radio off before closing the cover.

The Tractor Radio has been designed so that it may be easily installed in any convenient location. The specially designed shock-proof mounting base is made to accommodate a standard one-inch pipe. *Never* attempt to mount your Tractor Radio without its shock-proof base. A one foot length of pipe and a floor flange are supplied with the radio. Some installations require additional lengths of pipe, lumber and hardware which are readily obtainable

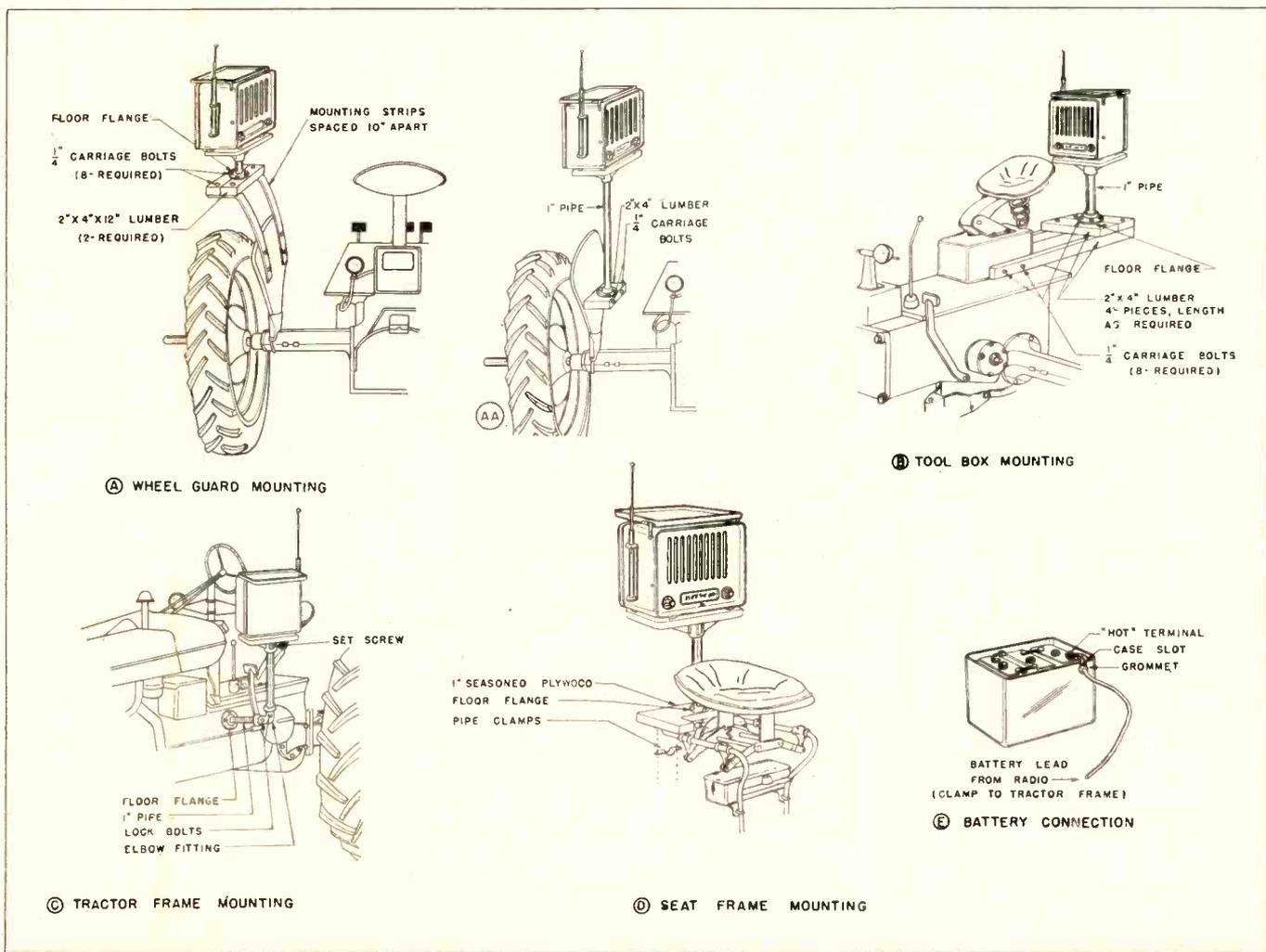
locally. The best method of mounting will depend upon the tractor on which the radio is to be installed. Four suggested methods are shown in the sketch below.

Electrical Specifications

Power Supply 6.3 Volts DC
 Current 5.5 Amp. Avg.
 Frequency Range 538-1620 KC
 Speaker 6" x 9" PM
 Power Output 5 w., undistorted
 6 w., maximum

Sensitivity 2-3 microvolts avg. for 1 watt output
 Selectivity 40 KC broad at 1000 times signal, at 1000 KC

This receiver contains the following:
 1 - 6BA6 - RF Amplifier, 1 - 6BE6 - Converter, 1 - 6BA6 - I.F. Amplifier, 1 - 6AV6 - Detector - AVC - 1st Audio, 1 - 6AV6 - Phase Inverter, 2 - 6AQ5 - Power Output, 1 - 6X4 - Rectifier.

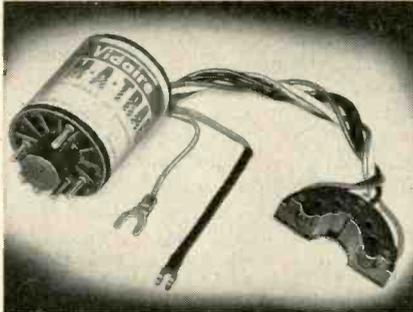


Products and Parts

TV Receiver Accessories, Replacement Components,

Vidaire RETRACE KILLER

Elim-A-Trace, a vertical retrace line eliminator, may be installed without removing chassis or crt from cabinet. No cutting or splicing of leads required. Installation is said



to take a few minutes. Permits high setting of brightness control without bringing up annoying vertical retrace lines. Vidaire Electronics Corp., Lynbrook, N. Y.—TECHNICIAN

Stancor FLYBACKS

Exact replacement flybacks, A-8227, A-8228, A-8229, are said to cover almost 90% of all Sylvania production up to 1953. They are supplied as coil and core only, because mounting bracket for these Sylvania flybacks is a permanent part of the chassis. New filament leads are packed with each transformer.

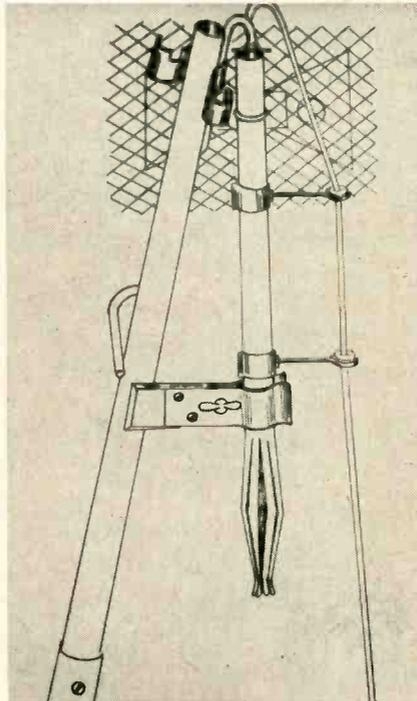
Three flyback transformers—A-8230, A-8231, A-8232—are exact physical and electrical replacements covering 88 chassis and 194 models in the following brands: Air King, CBS-Columbia, Emerson, Firestone, Silvertone. List of applicable models and chassis available from the manufacturer: Standard Transformer Corp., Standard Div., Addison and Elston, Chicago 18, Ill.—TECHNICIAN

IRC PRECISION RESISTORS

Molded boron-carbon precision $\frac{1}{2}$ -watt resistors, type MBC, are available in values from 100 ohms to .51 megohms, in tolerances from $\pm 1\%$ to $\pm 5\%$. These small-size components are stable under changes in humidity, temperature and voltage. Bulletin available from International Resistance Co., 401 N. Broad St., Philadelphia 8, Penna.—TECHNICIAN

Broth ANTENNA INSTALLER

Tenna-Tool is designed to permit the addition of a UHF or other antenna to an existing installation without the need of climbing. From a point at the base of the existing mast, the installer can raise the additional unit and attach it at any height up to 28 ft. The new antenna can be installed in either of 2 ways: with a slotted extension mast (as shown) for top mounting, or with



a clamp for side mounting. For further information, contact Broth Television Co., 602 Penn Ave., West Reading, Penna.—TECHNICIAN

North Hills VARIABLE COILS

Series 120 variable-inductance coils cover the range from 2 microhenries to 2 millihenries in 11 coils, 120-A through 120-K. Useful for replacing video peaking chokes or coils in r-f and i-f circuits, where various units in the 120 series may be adjusted to the exact values required. Made with low-loss adjustable cores, the units are moisture- and fungus-proof. Minimum order of 10 units, 95 cents each. North Hills Electric Co., P. O. Box 427, Great Neck, N. Y.—TECHNICIAN

Sandor TV SCREEN CLEANER

Skreen Kleen, a silicone treated cleaning cloth, cleans and protects the surface of TV picture tubes or safety glass. Continued use is said to create surface resistance to dust and fingerprints. List price, \$1.00. Sandor Products, Inc., 21333 Woodward Ave., Ferndale 20, Mich.—TECHNICIAN

Controla-Tone REMOTE UNIT

This auxiliary volume control rheostat provides remote sound adjustment of sound level on any conventional radio or TV receiver. Connecting wire from remote unit attaches to one of speaker leads. Installation is said to be a matter of a few minutes. Directions with each unit. Retail price, \$5.95. Controla-Tone Co., Tacoma, Washington.—TECHNICIAN

Airserco TV VENTILATOR

The T-Ventilator, easily attached to the back of a TV receiver, discharges hot air inside the cabinet and draws in cool air, thus reducing operating temperatures. With overheating thus prevented, deterioration of set performance due to change in component values or breakdown is said to be reduced



substantially. The unit operates only when receiver is on, and is designed for quiet performance. Price, \$14.75. Airserco Mfg. Co., 435 Melwood St., Pittsburgh 13, Penna.—TECHNICIAN

for Sales and Service

Servicing Aids, Audio Units

Fenton GUY WIRE

Tuf-Guy Ten Spot guy wire, available in a flat pack, is spot-marked every 10 ft. for easy measuring. Wire is unwound from the center, through a 7-in. perforated



circle in the top of the box. Pack is designed for more convenient use than reel-wound wire. Fenton Co., 15 Moore St., New York 4, N. Y.—TECHNICIAN

C-D MIDGET ELECTROLYTICS

Type TAN sub-miniature tantalum electrolytic capacitors are $\frac{1}{16}$ in. long and $\frac{3}{16}$ in. in diameter. Thirty-five units available from 0.01 mfd to 8 mfd, 3 v-dc to 150 v-dc. Said to have the following special features: wide range of operating temperatures, low leakage current, long shelf life, long service life, superior frequency characteristics. Cornell-Dubilier Electric Corp., South Plainfield, N. J.—TECHNICIAN

MASCO 2-WAY INTERCOM

The "Small Talk" is a complete 2-way intercom system designed for use in home, office or other applications requiring a low-cost system. The system includes 50 feet of cable. Master unit features an on-off switch with volume control, pilot light and press-to-talk switch. Remote unit can originate or answer calls with separate press-to-talk switch. List price, \$29.95. Mark Simpson Mfg. Co., Long Island City 3, N.Y.—TECHNICIAN

AMCO BATTERY TAPE RECORDERS

The series of Magnemite portable tape recorders, battery-powered and with regulated spring-wind motors, make field recording possible at points far from regular external and with regulated spring-wind motor power sources. Models in the 610 lbs., provide tape speeds from 15/16 to 15 in. per sec.; response on best model is 50-15,000 cps. Series 310 recorders (8 lbs.) use electric motors. Net price ranges from \$195 to \$435. Amplifier Corporation of America, 398 Broadway, New York 13, N.Y.—TECHNICIAN

Telectrosonic TAPE RECORDER

Portable recorder model 880 is designed to fill the demand for a low-priced, simple-to-operate tape machine for home use. Features: dual-track recording, fast forward and rewind, built-in amplifier and speaker, level indicator and high impedance input for mike, radio, record player and other devices. May be operated with the cover closed. One hour recording at $3\frac{3}{4}$ in. per sec. Telectrosonic Corp., 35-18 37th St., Long Island City 1, New York.—TECHNICIAN

Sylvania FLASHLIGHT-TOOL

The See-Well is a 3-way tool with a built-in flashlight. Bulb and batteries, contained in handle, light up work area. Three heads that fit into handle are: philips screw driver, alignment tool and flat-head screw driver. Unit comes in plastic carrying case. Available for 16 Sylvania premium tokens up to March 31. Sylvania Electric Products, 1100 Main St., Buffalo 9, N. Y.—TECHNICIAN

Merit REPLACEMENT FLYBACK

Flyback unit HVO-13 is an exact replacement for 4 units used in Sylvania receivers; the HVO-13 covers 39 chassis and over 160 models, almost 90% of Sylvania's production up to 1953. Since the original transformer's mounting bracket, which is an integral part of the chassis, must be used, the unit is supplied as core and coil only. List price, \$8.25. Also available, horizontal scan choke C-2980, to replace Sylvania

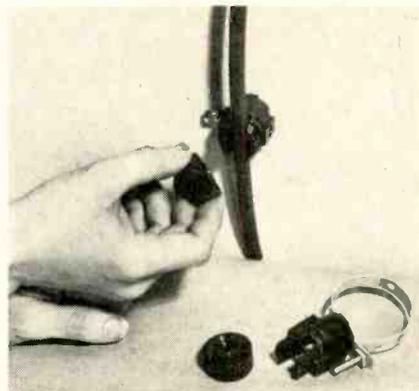
part 241-0002. List price, \$3.50. Merit Coil & Transformer Corp., 4427 N. Clark St., Chicago 40, Ill.—TECHNICIAN

Imperial TRANSMISSION LINE

Spongee, a low-loss sponge polyethylene twin-lead antenna wire, is suitable for UHF and VHF applications. Each lead is made of 7 strands of pure 28 copper (20 gauge wire). Suitable for all climates and weather conditions, this wire is available on 1,000-ft. reels. Sample on request. Heavy steel ground rods, $\frac{3}{8}$ -in. in diameter, are also being produced. Available in 4- or 6-ft. lengths, the rods are double-plated and finished with hand-rubbed oil coating. Turned-down point is used to facilitate driving into any type soil. Imperial Radar & Wire Corp., 820 E. 233 St., New York 66, N. Y.—TECHNICIAN

RCA LIGHTNING ARRESTORS

Two quick-service UHF lightning arrestors are designed for installation without the need of splicing wires, stripping insulation or soldering. May be used with most types of 300-ohm transmission line without affecting electrical properties. During installation, a screw cap forces antenna line against staple contacts which pierce the insulation and make contact with conduc-

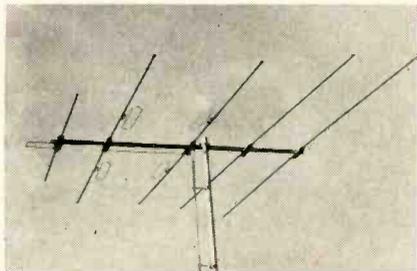


tors. Arrestors available in screw-in type (234A1) for direct mounting to baseboards or windowsills; also in strap type (235A1) for mounting to masts and water pipes. Both listed by Underwriters Labs. Radio Corp. of America, RCA Victor Division, Harrison, N. J.—TECHNICIAN

New Antennas and UHF and VHF Types Designed for Outdoor and

TACO VHF ANTENNA

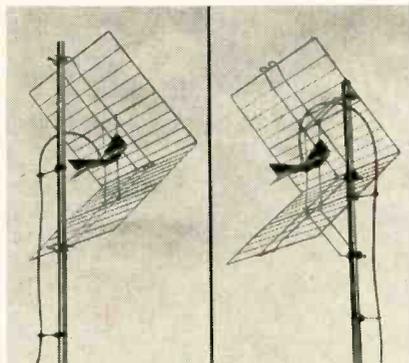
Designed for high-gain all-channel VHF use, the Trapper, cat. no. 1880, is similar to a broadband twin-driven yagi on the low band. Phase-reversing radiators, in the



form of folded dipoles, are spaced along two of the antenna elements to provide full in-phase pickup with minimum loss on the high band. Gain up to 7 db for a single-bay model on the low band, up to 11 db on the high band. Other features: high front-to-back ratio, sharp directivity, 300-ohm impedance, easy assembly. Designed for ultra-fringe use. List price, \$19.75 for each bay, \$1.75 for 2-bay stacking line. Technical Appliance Corp., Sherburne, N. Y.—TECHNICIAN

Channel Master UHF ANTENNAS

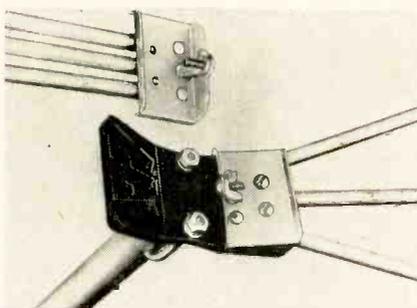
Model 409 UHF corner reflector can be mounted either in front of or behind the antenna mast, depending on installation conditions, with no difference in performance. For quick assembly, screen swings open and dipole snaps into place. For all-channel UHF use, with gain up to 12½ db and sharp directivity.



UHF 16-element yagis (Sweet Sixteen, model 420) are also available, with coverage up to 21 different channels available on some sizes, for use in fringe areas. Elements are

welded in place on these pre-assembled yagis. Channel Master Corp., Ellenville, N. Y.—TECHNICIAN.

Trio VHF ANTENNA



The Colorite is a VHF conical whose elements cannot weaken and fall out because they are riveted to the head. The use of non-hygroscopic head material provides good weather resistance as well as mechanical strength. Assembly is accomplished by tightening 4 wing nuts. List price for single-bay model: \$7.85. Also available in two-bay model with stacking harness. Trio Manufacturing Co., Griggsville, Ill.—TECHNICIAN.

Vee-D-X YAGI

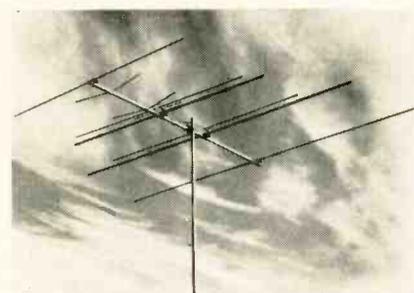
The Vee-D-Xtra Special, model SP-II, is a broadband VHF yagi that incorporates basic yagi performance in an all-channel VHF design. The forward high-channel section is matched to the rear low-



channel section, both being coupled for 300-ohm termination. A sharp horizontal pattern with superior front-to-back ratio minimize ghosts and interference. Reinforced con-

struction uses drawn aluminum elements with crimped ends. LaPointe Electronics Inc., Rockville, Conn.—TECHNICIAN.

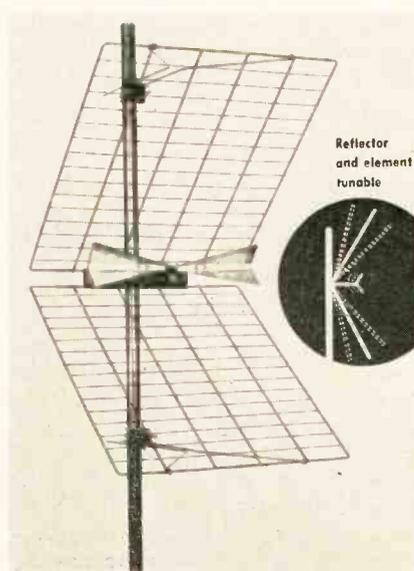
Welco VHF ANTENNA



The Challenger, a high-gain antenna for all-channel VHF use, features sharp directivity, high signal-to-noise ratio and 300-ohm impedance match. It is light, rigid and quickly assembled. Welco Mfg. Co., Burlington, Iowa.—TECHNICIAN

Tele-Matic UHF ANTENNA

The Tuner Tenna, model 715, is an adjustable corner reflector for UHF that may be tuned for optimum reception on any channel. It is also said to be adjustable for optimum lobe pattern and for impedance match to any type of transmission line. Completely pre-assembled. Also available as a one-piece side-



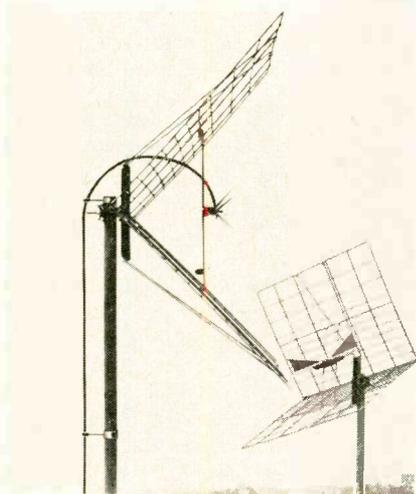
by-side version for greater gain (model 715-2X). Tele-Matic Industries, 1 Joralemon St., Brooklyn, N. Y.—TECHNICIAN

Related Products

Indoor use. Self-Supporting and Telescoping Towers

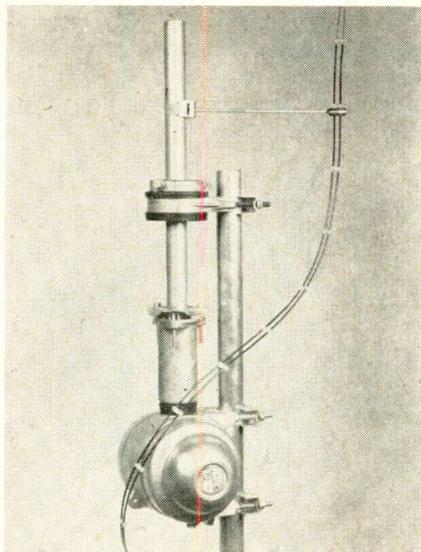
JFD UHF ANTENNA

The Golden Rig bowtie with corner reflector, model UHF415, is designed for fringe reception on Channels 14 to 83. Four-way bracing



eliminates ghost-producing vibration. Pre-assembled construction is said to make installation possible in less than one minute. Gold color is due to anti-corrosion plating. List price, \$9.05. JFD Manufacturing Co., Inc., 6101 Sixteenth Ave, Brooklyn 4, N.Y.—TECHNICIAN

Buchan ROTOR LINK

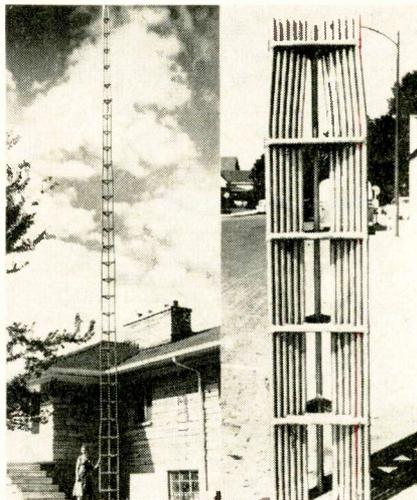


The problem of connecting open-wire or other rigid transmission lines to antenna rotators is solved by LL300, a 6-ft. length of open-wire 300-ohm line. Each conductor is in-

sulated with fiberglass tubing and fitted with solderless connectors. LL300 can be used in rotor installations without danger of shorting, while maintaining the low-loss long-life features of open-wire line. R. J. Buchan Co., P. O. Box 9, Bricelyn, Minn.—TECHNICIAN

Spaulding ANTENNA TOWER

One hundred feet of Strato-Tower steel tower sections nest together compactly to occupy a space less than 2½ ft. square. A complete tower can be hauled to an installa-



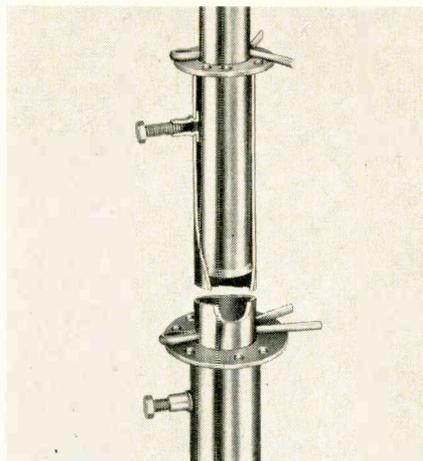
tion in a station wagon or on top of a car, in a package only 8 ft. long. The self-supporting tower features heavily coated galvanized steel, all-riveted bracing with no welds to rust, installation of rotators without additional accessories, assembly without wrenches and low cost. Spaulding Products Co., Tipton, Ind.—TECHNICIAN

Wamco ANTENNA TOWER

One person, who has to climb 27 ft. at the highest point, can erect this 60-ft. self-supporting steel antenna tower. No guy wires or house supports are needed; tower is balanced so that it can be lowered to ground with minimum exertion. A hinge near the middle enables antenna to be swung down for repair and swung back up for use. Walnut Machine Co., 1525 S. Walnut St., South Bend, Ind.—TECHNICIAN

iE TELESCOPING TOWER

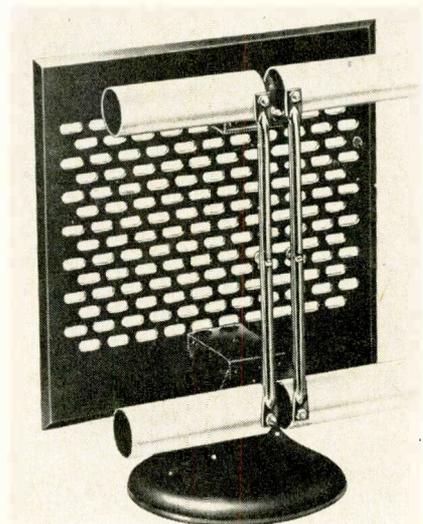
Nine-thread rivnut and hex bolt lock the tubes of this telescoping mast in any position to prevent swaying. A cotter pin resting se-



curely on the guy ring locks tubing into assembled position. Flared tube bottoms permit easy sliding, minimize scratching. Corrosion resistant construction is used throughout. iE Mfg., 325 N. Hoyne, Chicago 12, Ill.—TECHNICIAN

Ward INDOOR UHF ANTENNA

The indoor Can-Can, model TV-215, is designed for high gain on the UHF band. Finished in simulated wrought iron and bronze, it is said to be decorative as well as func-



tional. List price, \$10.95. Ward Products Corp., Div. of the Gabriel Co., 1148 Euclid Ave., Cleveland 15, Ohio.—TECHNICIAN.

Electronic-TV Technician

Test Instruments and Shop Accessories

Seco GRID CIRCUIT TESTER

Positive isolation of age tube malfunctions is one of the features claimed for model GCT-1, a grid circuit tester. Designed to supplement the average tube checker, this



tester uses an electronic eye to reveal control-grid emission, also to indicate high resistance grid-cathode or cathode-heater shorts. Maker recommends it for checking tubes in the audio, i-f, and sync sections, where trial-and-error, wait-and-see substitutions are normally used. List price, \$24.95. Available in kit form as model GCT-2, \$19.95. Seco Mfg. Co., 5015 Penn Ave. S., Minneapolis, Minn.—TECHNICIAN

EPL 12-VOLT ADAPTER KIT

To prevent obsolescence of models B and BJ 6-volt dc power supply units for servicing auto radios, a 12-volt modification kit has been developed. Change-over requires drilling 3 holes and installing 2 selenium rectifiers, 1 switch and 1 new dc meter (0-20 v). Kit is supplied complete with parts, instructions and diagrams. Net price, \$10.50. Electro Products Laboratories, 4501 Ravenswood Ave., Chicago 40, Ill.—TECHNICIAN

EMC INSTRUMENT STAND

Model IS, a safety instrument stand, will hold a vtvm or other meter at a convenient angle for reading with no danger of tipping over. The stand is rubber-covered to protect the instrument. Electronic Measurements Corp., 280 Lafayette St., New York 12, N. Y.—TECHNICIAN

EICO CRT CHECKER

Model 630 crt checker indicates shorted or open elements in electron guns with a neon lamp. Also provides bridge measurement of peak beam current (proportional to screen brightness). Calibrated in terms of tube condition. Test sockets are provided for pix tubes with duodecal or diheptal bases to cover practically all modern types. Octal socket is provided on panel so that adapters for tubes with other bases may be plugged in. Picture tubes may be tested without removal from set or carton. Oscilloscope tubes may also be checked. Model 630, factory wired, \$24.95. Model 630-K, kit form, \$17.95. Electronic Instrument Co., 84 Withers St., Brooklyn 11, N. Y.—TECHNICIAN

ITI UHF GENERATOR

The IT-130R UHF generator is useful as a demonstrator device as well as a laboratory instrument. It can take the signal from any VHF station and translate it to any UHF signal. Useful in new UHF areas for making adjustments and installations before the local transmitter is ready to operate on a full-time basis, it also can be used with existing VHF instruments (signal and sweep generators) to adapt them for UHF use. Service technician's price, \$149.50. Industrial Television, Inc., Clifton, N.J.—TECHNICIAN

Louchheim RESIST. DECADE

This decade resistance box has a range from 0 to 11 meg in 1000-ohm steps, 4 decades, with an accuracy of $\pm 1\%$. Stable deposited carbon resistors are used throughout. The compact unit is 10 in. long and is shielded. Useful for trial substitutions of resistance values during trouble-shooting or to determine the value of resistance needed for best circuit operation. List price, \$49.95. Stuart F. Lochheim Co., 1229 N. Broad St., Philadelphia 22, Penna.—TECHNICIAN

Hickok VHF-UHF MARKER

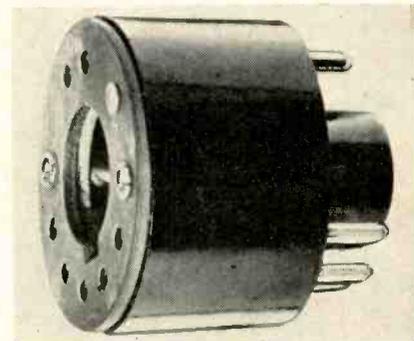
Model 690 TV marker generator covers frequencies from 4.25 to over 225 mc on fundamentals with 0.25 v r-f output, and provides dual markers for use with TV sweep generators. Output up to 900 mc, for UHF coverage, is available on harmonics. Accuracy of marker setting within .05% is said to be possible with the illuminated shadow-type non-parallax dial, which may be viewed from any angle without introducing error. Uses a self-contained crystal calibrator supplied with crystal. Hickok Electrical Instr. Co., 10523 Dupont Ave., Cleveland 8, Ohio.—TECHNICIAN

Raytheon SERVICE LAMP

Worn on the head, the Brow-Lite is designed so that the service technician can have both hands free for work at the same time that he is directing light to the desired area. An adjustable socket enables light to be directed at any angle. The pocket-size unit is constructed of durable plastic and uses standard parts. Raytheon Mfg. Co., Receiving Tube Div., 55 Chapel St., Newton 58, Mass.—TECHNICIAN

P-P BAR GENERATOR

The HBG horizontal bar generator is plugged on the picture tube to provide a sequence of equally-spaced horizontal lines. Lines are developed by a neon-tube relaxation



oscillator. Useful for adjusting vertical linearity, height and vertical centering; also for positioning yoke and focus coil or magnet. Small in size and self-contained. Perma-Power Co., 4727 N. Damen Ave., Chicago 25, Ill.—TECHNICIAN

Be Sure to See Page 73
CIRCUIT DIGESTS

COLOR

SHORTS

MORE TRAINING NEWS: Last month, CBS began 5-day, 35-hour seminars at its plant in Long Island City, N. Y., which are still continuing. Discussions and demonstrations cover color principles, the CBS Colortron, circuitry, components, installation and maintenance. RCA color service clinics also teed off during February in 15 major cities—New York, New Haven, Newark, Philadelphia, Pittsburgh, Washington, Cleveland, Cincinnati, Detroit, Chicago, St. Louis, Des Moines, Denver, San Francisco, and Los Angeles. Other major cities will be covered during the rest of the year.

RCA'S 19-INCH TRICOLOR TUBE, now in the development stage, is expected to be commercially available in limited quantities in the latter half of this year. Its pumpkin-faced viewing screen will reproduce pictures in about the size available from 16-in. round tubes. Directly below you see the 19-incher com-



pared with the company's 15-in. tube, which is now in production. Based on the earlier tube, the 19 incorporates some design changes: new gun assembly, improved phosphors, modification of the shadow mask and a wider deflection angle. The latter makes possible an overall length no greater than that of the 15-in. crt.

A **21-INCH TUBE** is also in the works at RCA. This rectangular color crt will incorporate fundamental design changes. The shadow mask will be replaced by a focus mask. Tube brightness will be stepped up. Commercial production is expected next year.

CONVERGENCE, FOCUS and high-voltage transformers, as well as deflection yokes, are color receiver components that are scheduled to be

available to manufacturers in mass production quantities at just about the time you read this item.

DU MONT TRAINING PLANS for color TV, now being developed, will include lectures, actual bench work, personal assistance in handling color receiver problems and a booklet on the subject similar to the one issued by this organization on UHF. Emphasis is being placed on developing a complete program rather than on getting it into operation immediately. Du Mont promises the program will be in effect in time for technicians to handle its color sets.

LUCKY OWNER of a color set tried this experiment during a color telecast: He placed his old b & w receiver beside the new one and tuned it to the same program. Except to make quick comparisons, none of the viewers present paid attention to the b & w version. This despite the fact that faulty transmission was throwing color balance way off. His conclusion: even bad color TV is better than none at all.

ANTENNA DESIGN has already felt the influence of color. While many antennas now in use will continue to be entirely satisfactory, sharply-tuned single-channel arrays, like yagis, may need replacement. This opinion was voiced by Ira Kamen, vice-president of Brach Manufacturing Co., in an engineer-

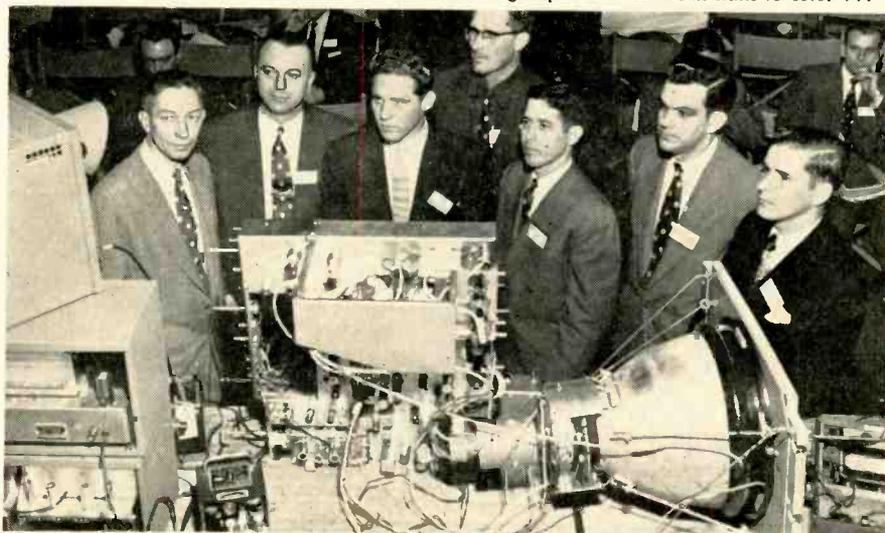
ing report. All antennas in the new Brach line are being designed with color in mind. Single-channel yagis are being broadbanded sufficiently to preclude dips and valleys; normal broadband designs are being engineered to reject FM signals and side-lobe pick-up on all types is being minimized.

THE COLOR SERVICE BONANZA will not be free of headaches even for the technician who gets to know his color receiver inside-out. Present high resistance to b & w service charges is expected to be much greater in the case of color TV maintenance, since the number of calls needed, as well as the charge per call, is bound to go up. Advance estimates for average number of service calls per year go as high as 11 per color set. Let your customers know about this NOW—save headaches later.

CHEERFUL NOTE on service: despite the increased complexity of the color set, picture symptoms will provide more clues to the actual trouble than is the case with b & w receivers.

GE'S RECENT SEMINAR on color TV, held at the GE Syracuse plant, was attended by 200 distributor and dealer service technicians. The week-long seminar (35 hours) covered all phases of color TV alignment and service.

W. L. Parkinson of G.E. (extreme left) introduces a group of service technicians to color TV.



Prevent Paperwork Losses

Profits Pour Down Drain When Record-Keeping is Sketchy

• Poor record-keeping is a sieve through which huge sums of money are lost forever to TV-radio service departments throughout the country.

Such losses are caused by failure to charge out *all time* spent on jobs, both in repairing and delivering, as well as in neglecting to charge *all* tubes and components to respective repair jobs.

There are various reasons why dealers fall into slipshod habits which permit good money to go down the drain. The Number One reason is that they do not have an air-tight record-keeping system. Number Two, they are lax in policing what may otherwise be an efficient system. In cases where an intrinsically satisfactory system is in use, yet fails to work, no one person may be responsible for seeing that forms are filled out completely and without "rigging."

In addition to losing dough as a result of not charging out all time,

and all tubes and parts, sketchy record-keeping methods present the possibility that still more money may take wings and fly away due to inability of bookkeepers to interpret such records accurately. Under such conditions, customers are likely to be under-charged or over-charged.

To provide all relevant data for charging, billing and keeping track of time and parts, it isn't necessary to use a large or complicated form. Everybody knows that the typical technician hates to fill out forms, anyway, and the harder the boss makes it for him to do the paper work, the more likely that errors will creep in and corners will be cut.

On this page is a form especially designed by TECHNICIAN editors. Local printers can provide supplies on cheap paper, similar to that used on shipping tags. In ordering, make certain that the forms are numbered and perforated. Don't start with no. 1, because the customer receiving

this low number may think that you've just gone into business. Instead, make your first set of figures read 5500 or something similar.

In using the form when picking up a set, or in the over-counter transactions, it is only necessary to fill in the customer's name and address, the date, make of set, complaint, date promised, and the estimate (if it is your practice to make estimates). The form then stays with the receiver until the job is finished. Upon completion of the repair, the form is turned over to the bookkeeper, who transfers the information on it to the ledger or sales slip for billing. In addition to the foregoing routine, it is very desirable to transfer profit and loss data to a day book or journal, so that the owner can make an analysis of his service operation at any time.

The reader will notice that provision is made for repairs stretching
(Continued on page 67)

Below is a simplified repair form, designed by TECHNICIAN editors to provide all necessary information to keep repairs rolling out on time, control parts and tubes used, keep track of technicians' time and to furnish speedy means for billing. Additionally, the form will enable the service manager to see how he made out financially on each job. In cases where it is not shop policy to give estimates,

the estimated charge line on the customer's coupon can be left out. "Don't-Write-In-This-Space" section is for bookkeeper, who can make a complete billing from a single form. It is recommended that forms be filed alphabetically under customers' names, so that they can be consulted without delay in case of call-backs. Make form larger than this sample, to allow more fill-in space.

8467	Date _____	8467	Date taken in _____	Date promised _____	Completed _____	Delivered _____																
<u>Customer's Receipt</u>		Customer _____		Address _____		Tel. _____																
Name _____	Set Make and Chassis No. _____		Approx. Age of Set _____		Complaint _____																	
Address _____	Date Started _____	Time: from _____ to _____	Tot. Hrs. _____	Completed? _____																		
Set Make _____	Date Resumed _____	Time: from _____ to _____	Tot. Hrs. _____	Completed? _____																		
Chassis No. _____	Date Resumed _____	Time: from _____ to _____	Tot. Hrs. _____	Completed? _____																		
Approx. del. date _____	Nature of Repairs Made _____																					
Estimated Charge \$ _____	<table border="1"> <thead> <tr> <th>Tubes Used</th> <th>Parts Used</th> <th>Date</th> <th>Service's Initials</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table>						Tubes Used	Parts Used	Date	Service's Initials												
Tubes Used	Parts Used	Date	Service's Initials																			
XYZ Television Co., 426 No. Main St., Dover. Tel: DO-76544-2	Date of pickup _____	Time consumed in pickup: _____ Hrs., _____ Min.		Date of return _____																		
	Date of return _____	Time consumed in return: _____ Hrs., _____ Min.		Was Job Estimated? _____																		
	Am't. Estimated \$ _____		Who Estimated? _____																			
DON'T WRITE IN THIS SPACE																						
Charges to Customer:	Time \$ _____	Parts \$ _____	Tubes \$ _____	Total \$ _____																		
Cost to Shop:	Time \$ _____	Parts \$ _____	Tubes \$ _____	Total \$ _____																		

\$5000

IN PRIZES

... easy to win

503

PRIZES!

\$2000 - 1st prize

\$500 - 2nd prize,

\$100 - 3rd prize

100 - \$10 prizes,

400 - \$5 prizes

HOW TO WIN

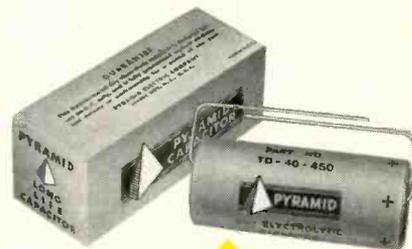
To win one of these 503 prizes all you have to do is complete in 25 words or less "I like Pyramid capacitors because _____" You fill in this statement on a Pyramid contest entry blank which can be obtained from any electronic parts jobber selling Pyramid capacitors. You have this entry blank countersigned by your jobber or one of his salesmen and forward it to us attached to a Pyramid Dry Electrolytic Capacitor box top—the top being the part which carries the description of the item. There is no limit to the number of entries which you may make in this contest but each entry must be accompanied by a box top. Full rules for the contest appear on the entry blank.

It's so easy. Here is the kind of statement that might win:

"I like Pyramid capacitors because they always check out perfectly and don't deteriorate and so I know I won't have to call back at my expense."

"I like Pyramid capacitors because the line is so complete that I can always get what I need and don't have to worry about an off-brand capacitor."

PYRAMID



PYRAMID FEATURES:

- 1 Only one quality—the best at no premium. All Pyramid capacitors are made of materials commanded by rigid military specifications.
- 2 All Pyramid capacitors are non-hygroscopic.
- 3 Highest quality insulator material used in all production results in low leakage factor.
- 4 Exclusive non-contamination technique guarantees close tolerances and no deterioration. Peak performances for life.
- 5 Pyramid capacitors operate unchanged at ambient temperature of 85° centigrade.
- 6 Designed by service technicians across the country for their requirements.
- 7 Individually packaged for protection.
- 8 Permanently legible, high visibility ratings on each item.
- 9 100% absolute electronic inspection before shipment.

Pyramid is in its 10th year as a leading manufacturer of high-quality capacitors.

PYRAMID ELECTRIC COMPANY
1445 HUDSON BOULEVARD
NORTH BERGEN, N. J.

Shop Hints to Speed Servicing

Tips for Home and Bench Service Contributed by Readers

New Flyback Upsets Sync

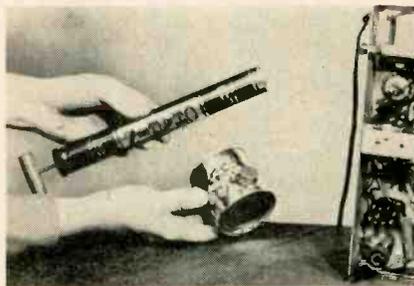
In two instances after horizontal output transformers had been replaced in sets using a 6AL5 horizontal sync discriminator with only one horizontal circuit control (horizontal frequency slug), the following symptom resulted: The slug would lock the picture only at a position that placed the entire horizontal blanking bar at one side of the picture. This caused critical horizontal hold and made horizontal retrace lines visible at the opposite side of the raster.

Good horizontal hold was obtained by changing the components in the circuit that feeds back pulses from the horizontal output transformer to the sync discriminator. One effective procedure for making this change is to temporarily replace the series resistor in the feedback loop with a potentiometer. The potentiometer and the frequency adjustment slug are then both varied for the best hold, with approximately equal blanking on both sides of the picture. That part of the potentiometer's resistance which is in the circuit is then measured. Finally, a fixed resistor of this measured value is then used in the feedback network.—R. R. Ondrovic, San Diego, California.

Chassis Blower-Cleaner

An inexpensive garden plant duster may be changed easily to provide a source of air for blowing dust from radio, TV and other chassis. It is only necessary to re-

move that section of the duster which ordinarily holds some form of insecticide. It may also be necessary to solder up the small hole to which



Garden sprayer altered to air-clean chassis.

this container section was attached; the full force of the expelled air will now be directed from the front opening.—H. Leeper, Canton, Ohio.

6BY5 Substitution

We have often found it difficult to purchase a 6BY5-GT tube, used mostly in Philco receivers. We have therefore been rewiring the damper circuit that uses this type to accommodate a 6W4-GT. The simple changes necessary can be made in a few minutes. There are six steps:

1. Leave plate connections as is on pins 5 and 4.
2. Disconnect wires tying pins 1, 7 and 8 together.
3. Remove horizontal linearity lead from pin 8 and connect it to pin 3.
4. Disconnect filament lead from pin 2 and connect it to pin 8.
5. Connect pin 1 to pin 3.

6. Disconnect the horizontal amplifier's screen resistor (about 18 k) from pin 7 and connect it to pin 3.

There is another advantage to be gained from this procedure. The 6W4-GT costs less than the 6BY5-GT.—Joseph F. Valenti, Bronx, N. Y.

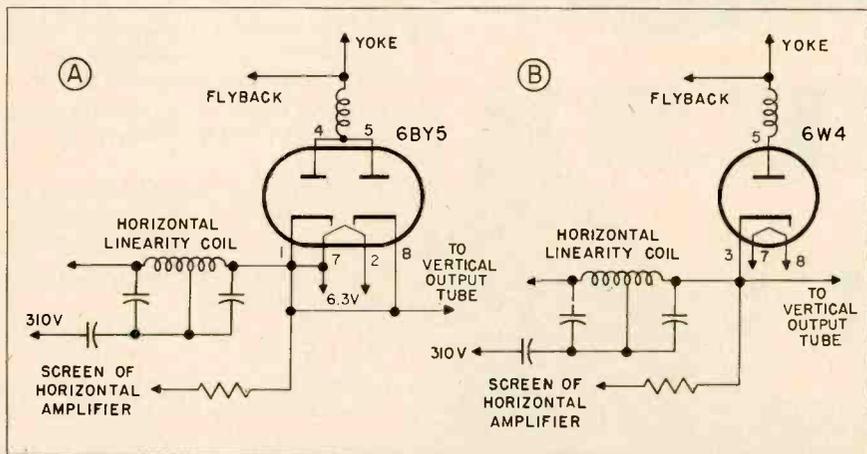
HV Condenser Check

To find leaking condensers of the 500-mmfd, 20kv type rapidly and easily in the high-voltage power supplies of some TV sets, I use the following procedure: Take a wooden stick, rod or rule about 20 or 30 in. long and fasten a small square of cardboard at one end. This end is used as an earphone. Then apply the other end near the suspected condensers. The clearest noisy clicks will be heard when the stick is closest to the bad condenser. The trouble appears as black pips or streaks on one side of the screen at the same time that the clicks are heard. The wooden rod used must be very dry, to act as a good insulator and also to pick up the sounds better.—J. G. C. Hernandez, El Paso, Texas.

Dial Stringing Shortcut

To replace hard-to-get-at dial strings, tie the new cable to one broken end of the old string; then pull the other end of the old cable through and out of the assembly. The new string will thread through, following the old one. This time saver can be used on many sets.—J. V. Cicero, Carson City, Nevada.

A—Damper tube wiring for 6BY5. B—Wiring changes to permit 6W4-GT to be substituted.



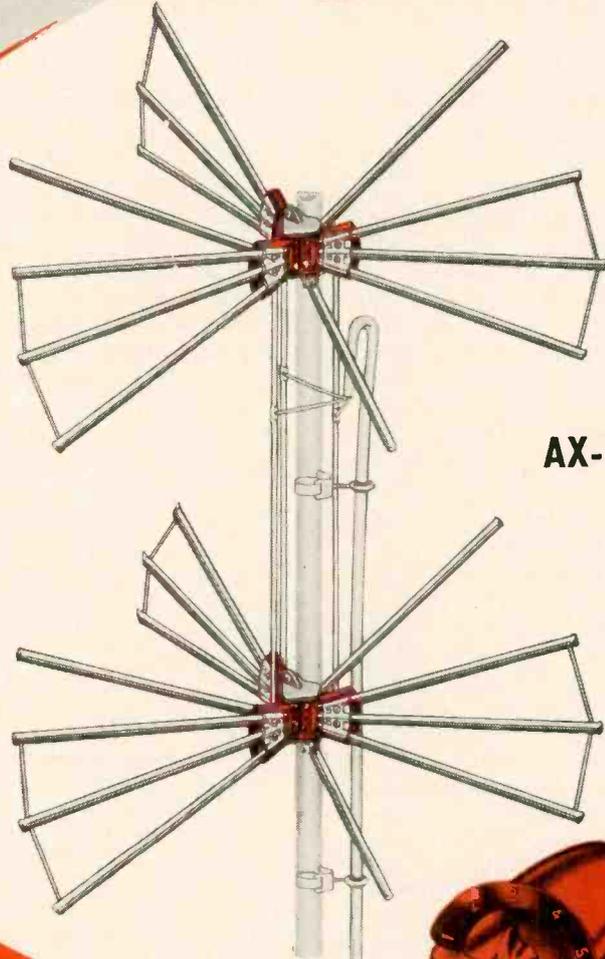
SHOP HINTS WANTED

TECHNICIAN will pay \$5 for acceptable shop hints. We are particularly interested in hints that tell how a technician located a hard-to-find trouble in a TV set, radio, record-changer or similar unit; or how he traced a conventional defect to its source more rapidly than usual by using a short-cut. Unacceptable items will be returned to the contributor. Send your ideas to "Shop Hints Editor, TECHNICIAN, Caldwell-Clements, Inc., 480 Lexington Ave., New York 17, New York."

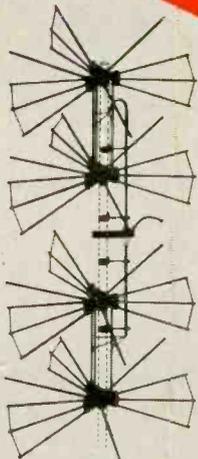
Snyder
PHILADELPHIA

DIRECTronics
build SALES

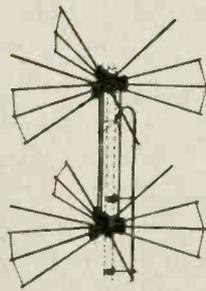
Fringe Area VHF/UHF
SUPER Directronic®
TV ANTENNA SYSTEM



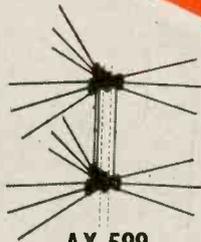
AX-524



AX-548
ULTRA-FRINGER



AX-524
FRINGE-AREA



AX-599
FRINGE-AREA



AX-56
METROPOLITAN



Directronic®
6-Position BEAM SELECTOR

SNYDER

SNYDER MFG. CO., PHILADELPHIA 40, U.S.A. • BELLEVUE TUBE MILL, INC., PHILADELPHIA 40, U.S.A.
SNYDER ANTENN-GINEERS LTD., TORONTO, CANADA • WORLD EXPORT: ROBURN AGENCIES, INC., N.Y.

NEW

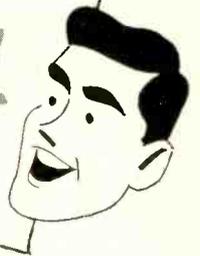


TIGHTEST SEAL

LOCKS IN PERFORMANCE

TOUGHEST SHELL

LOCKS OUT TROUBLE



ATTRACTIVE YELLOW MOLDED PLASTIC SHELL

Non-inflammable. Will not burn or melt under soldering iron or flame.

BONDED SEAL

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

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



ASTRON BLUE-POINT[†]

MOLDED PLASTIC PAPER

Capacitors

THE NEWEST ADDITION
TO THE **SM**[†] LINE

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

BLUE-POINT is suitable for continuous operation at 85°C. The bonded seal uses a special thermo-setting, heat-resistant, non-inflammable bonding agent—*positive* protection. For complete performance characteristics, specifications and listings, write to Department T for Bulletin AB-20A.

against moisture. Solder leads as close to the capacitor as you like—they *won't* pull out! Every BLUE-POINT is clearly marked with voltage and capacitance, bears outside foil identification. Every BLUE-POINT is *tested* and *guaranteed*. Look for the ASTRON BLUE-POINT when you buy capacitors from your jobber, or if he doesn't carry it, send us his name. Insist on ASTRON BLUE-POINT, the capacitor you *know* you can depend on. Order a supply today.

DEPEND ON—INSIST ON



Visit

THE ASTRON EXHIBIT
Booth 368

I.R.E. Radio Engineering Show
March 22-25

ASTRON CORPORATION

255 Grant Avenue, East Newark, New Jersey

In Canada: Charles W. Pointon, 6 Alcina Avenue, Toronto 10 Ont.



Patent Pending

[†]Trade Mark

* Safety Margin

Eliminating Sound TVI

(Continued from page 35)

appreciable portion of a wavelength at the higher frequencies and therefore pick up considerable r-f energy.

In isolated instances, a volume control with an ungrounded shaft may be found. Pickup on the shaft, especially when the hand is placed on the gain control, as in adjusting volume, is considerable. The cure in this case is to install a control having a shaft insulated from the terminals, so that

the shaft may be grounded to the chassis.

Dual and triple-purpose tubes, when performing several functions, such as detector, first audio and avc, present a special problem because of inter-electrode capacitance, and a common cathode which feeds from one circuit to another.

Where the usual remedies for preventing r-f rectification on the grid of a triple-purpose tube do not cure the condition, the audio section of the multiple circuitry may be removed and incorporated with a separate tube, preferably mounted on a small sub-assembly bracket under the

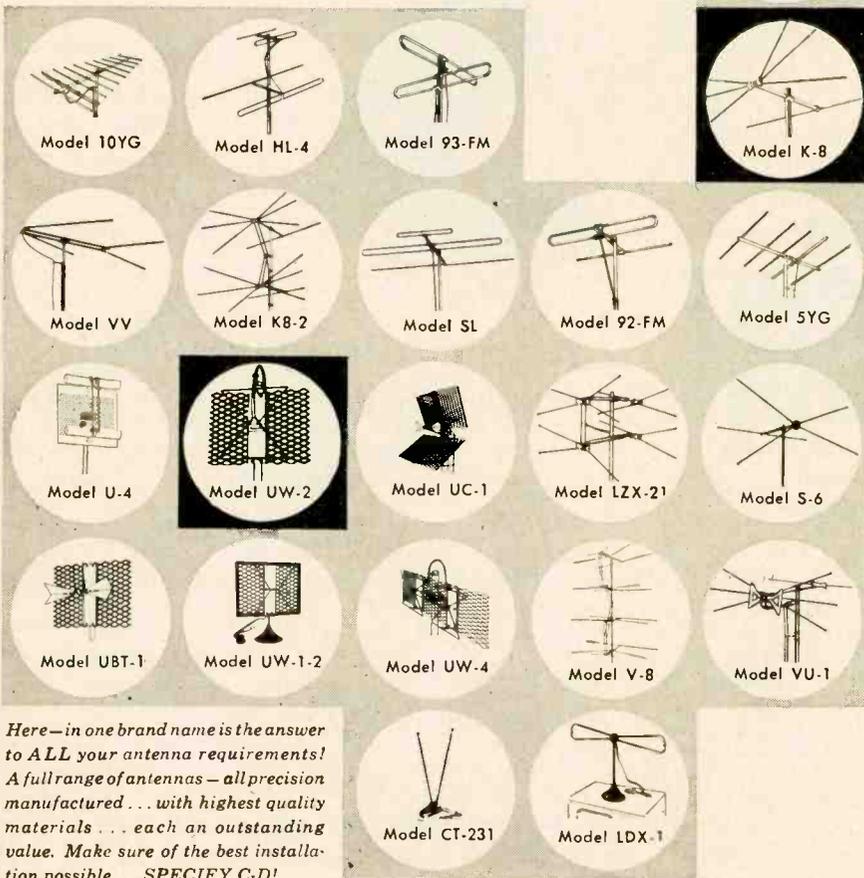
chassis. The resistor or choke, bypass condenser and lower-value grid leak may then be added as modifications in circuitry to the (standard) first audio circuit in the new sub-assembly.

"An Ounce of Prevention". An unwanted r-f signal may get into the receiver as a result of direct pickup, because of inadequate tube or tube input shielding; more commonly, however, the undesired signal will be introduced through power line coupling, or through the antenna and transmission line. Any measures taken to prevent or attenuate r-f energy, other than the desired signal, from entering the set at the antenna or other paths are helpful.

Much can be accomplished in stubborn cases when the interfering signal is introduced through the power source, by installing the necessary

An outstanding design for EVERY application

CORNELL-DUBILIER UHF AND VHF TV ANTENNAS



Here—in one brand name is the answer to ALL your antenna requirements! A full range of antennas—all precision manufactured... with highest quality materials... each an outstanding value. Make sure of the best installation possible... SPECIFY C-D!



CONSISTENTLY DEPENDABLE
CORNELL-DUBILIER
SOUTH PLAINFIELD, NEW JERSEY



ROTORS • CAPACITORS • VIBRATORS • ANTENNAS • CONVERTERS

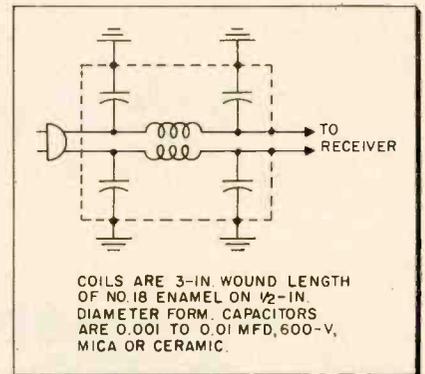


Fig. 3—Elements of typical power line filter.

power line filter. Commercial plug-in line filters are available for this purpose, and are particularly suitable in cases where space is limited, as in compact ac-dc receivers. Bypass condensers for r-f installed across the line may also be effective.

Fig. 3 shows the basic elements of a filter. An appropriate filter may be installed as close as possible to the receiver antenna input transformer, if the interference is entering by that path.

It is important that these filters be enclosed in a metallic shield to prevent direct pickup of signal. The entire equipment should be carefully constructed electrically, with wire size appropriate to the load. The unit should be effectively grounded either directly, or through a 0.01 mfd, 600-volt condenser in the case of ac-dc sets. A water-pipe or similar plumbing fixture is usually an effective ground.

Essentially the same cures outlined here also apply to audio systems other than those associated with standard broadcast and television receivers.

**YOUR TICKET TO
THE GREATEST
"SHOW" ON EARTH!
...G-C SERVICE AIDS**

**FREE! New G-C Catalog
... get it today.**



**G-C AMD MINIATURE
TUBE PULLER**
Prevents tube breakage,
burned fingers.
For 7-pin tubes
No. 5093—List \$1.80
For 9-pin tubes
No. 8106—List \$1.80

Successful servicing of the greatest "show" on earth—television—calls for fast, economical, customer-pleasing performance. The G-C Service Aids shown here are typical of the almost four thousand items now available to help you do a better job ... with greater volume, greater profits.



**G-C MINIATURE
TUBE PIN
STRAIGHTENER**
For 7-pin tubes
No. 5191, List \$1.25
For 9-pin tubes
No. 8105, List \$1.25



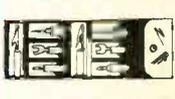
**G-C DUPLEX TUBE
PIN STRAIGHTENER**
Precision dies
straighten both 7- &
9-pin tubes.
No. 8655, List \$2.50



**G-C ALLEN-BRIST
WRENCH KIT**
Twelve wrenches for
both hex and spline
screws.
No. 5028, List \$1.80



**G-C CABINET
REPAIR KIT**
Complete, in metal
box, full instruc-
tions.
No. 901, List \$7.50



**G-C TEST LEAD PLUG
INTERCHANGE KIT**
Interchanges alliga-
tor clips, banana
plugs, etc.
No. 7743, List \$3.25



**G-C DIAL CABLE
TOOL**
Aids in replacing
worn cables, dial
springs.
No. 5096, List \$0.85



**G-C TV & RADIO
DIAL CABLES**
Extra thin Nylon
.025" dia. Chemi-
cally treated. 25-ft.
spool. No. 75A-25,
List \$1.40.



**G-C 14-L
PHONO DRIVE**
Specially molded for
RCA 45-RPM, com-
plete.
No. 14-L, List \$1.00



**G-C 195 RCA TV
TUNER BELT**
For RCA series 8T,
8TC, 8TK, 9TC, etc.
No. 195, List \$0.50



**G-C NE-O-LITE
TESTER**
Handy for 60 v AC
to 550 v AC-DC.
No. 5100, List \$0.60



**G-C HIGH FIDELITY
RECORDING WIRE**
Finest quality stain-
less steel, with
leaders. 1-hr. spool.
No. 5171, List \$5.00



**G-C MASTER-TONE
RECORDING TAPE**
Plastic base, high
frequency response.
1270-ft. reel.
No. 5180, List \$5.50



**G-C NEW TV
SAF-T-RACK**
Holds any TV chas-
sis safely.
No. 8045, List \$5.45



**G-C SPEEDEX
WIRE STRIPPER**
New, fully automat-
ic, delayed action.
12 models.
No. 766, List \$8.25



**G-C TUBE & PARTS
EXTRACTOR**
Same as Signal
Corps TL-201.
No. 5092, List \$1.65



**G-C "TUX"
TOOL KIT**
Handy, flexible,
roomy.
No. 8943, List \$3.95



**G-C GENERAL
SKRATCH STIK**
Handy, fast on wal-
nut, mahogany, oak
cabinets.
No. 909, List \$0.50



G-C SILVER PRINT
Pure silver, for
touching up printed
circuits. 1 Troy oz.
No. 21-2, List \$7.75



**G-C RUF-KOAT
WRINKLE VARNISH**
Air dries; black,
gray or brown col-
or. 2 oz.; specify
color.
No. 60-2, List \$0.65



television
service

GENERAL CEMENT MFG. CO.

902 Taylor Avenue Rockford, Illinois

**Here it is! DRAMATIC DEVELOPMENT IN TV INSTALLATIONS! LESS METAL
...LOWEST LOSS IN AN ALL-PURPOSE STAND-OFF INSULATOR**



PAL*
Stand-off
Insulator

*Pivot-Action-Lock

PAL* stand-off insulator is the serviceman's PAL for all UHF and VHF installations—takes tubular, open and flat transmission lines more quickly and simply.

No metal surrounds the PAL insulator. PAL eliminates standing waves and voltage losses on UHF or VHF. Produces sharper, clearer pictures.

The PAL* positive lock—pressure button exerts extra locking tension when insulator is in closed position.

PAL* is easy to work with—even in the open position PAL* is always in one piece because of the exclusive JFD hinge design. No threading of insert. No crimping.

PAL* is plated to a special military spec which safeguards against rust. Exclusive BRONZIDITE plating.

PAL* cam type latch is for quicker, easier, better installations.

Write for PAL Brochure No. 243
JFD MANUFACTURING CO., INC.
Brooklyn 4, N. Y.

World's largest manufacturers of TV Antennas and Accessories

AVAILABLE IN ALL TYPES AND SIZES

Wood Screw Stand-Offs

PAL 213.....	3 1/2"
PAL 215.....	5 1/2"
PAL 217.....	7 1/2"
PAL 2112.....	12 1/2"

Wood Screw Inline Stand-Offs

PAL 2177.....	7 1/2"
---------------	--------

"NUT" Universal Stand-Offs
(with electro-galvanized straps)

PAL 323.....	3 1/2"
PAL 325.....	5 1/2"
PAL 327.....	7 1/2"
PAL 3212.....	12 1/2"

Inline "NUT" Screw Eye Stand-Off

PAL 3277.....	7 1/2"
---------------	--------

"NUT" Universal Stand-Offs
(with stainless steel straps)

PAL 433.....	3 1/2"
PAL 435.....	5 1/2"
PAL 437.....	7 1/2"
PAL 4312.....	12 1/2"
PAL 4377.....	7 1/2"

(with stainless steel strap)

Clip-On Stand-Offs (7 1/2")

PAL 100.....	1" od
PAL 116.....	1" e.m.t. od
PAL 125.....	1 1/4" od

Inline Clip-On Stand-Off

PAL 1255.....	7 1/2"
---------------	--------

Machine Screw PAL

PAL 713.....	3 1/2"
PAL 715.....	5 1/2"
PAL 717.....	7 1/2"
PAL 7112.....	12 1/2"

Inline Machine Screw PAL

PAL 7177.....	7 1/2"
---------------	--------

Drive-In Stand-Off

PAL 500.....	4 1/2"
PAL 517.....	7 1/2"

Double Drive-In Stand-Off

PAL 510.....	4 1/2"
PAL 517.....	7 1/2"

Gutter Stand-Offs

PAL 547.....	7 1/2"
--------------	--------

Inline Gutter Stand-Offs

PAL 5477.....	7 1/2"
---------------	--------

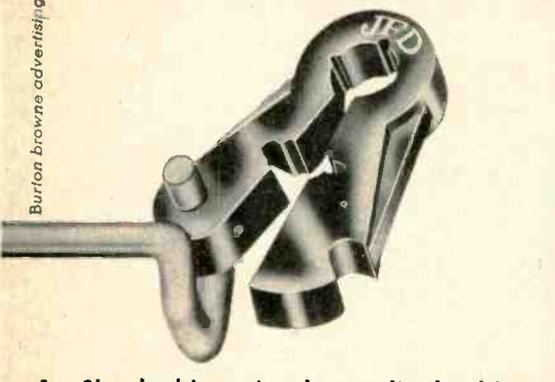
Hot Nail Stand-Off

PAL 600.....	3 1/2"
--------------	--------

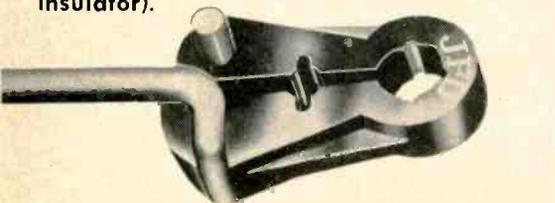
PAL Insulator (only)

PAL 800.....	
--------------	--

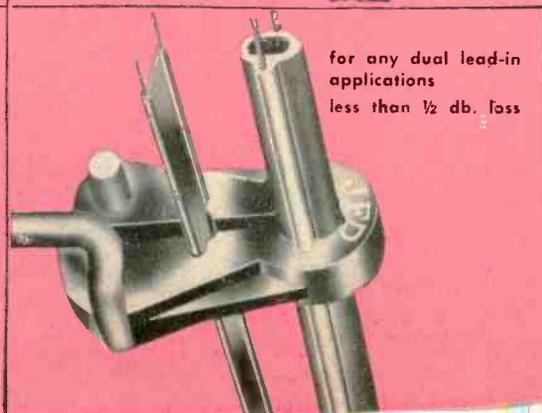
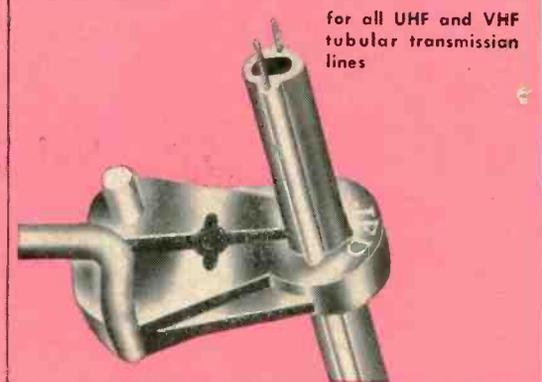
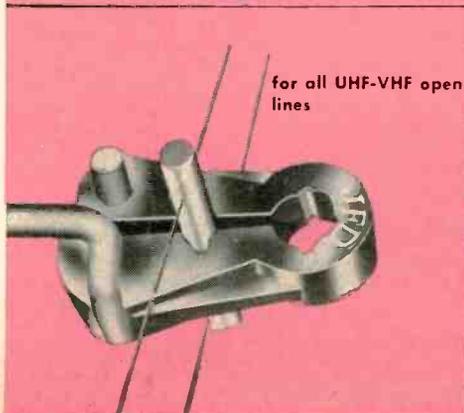
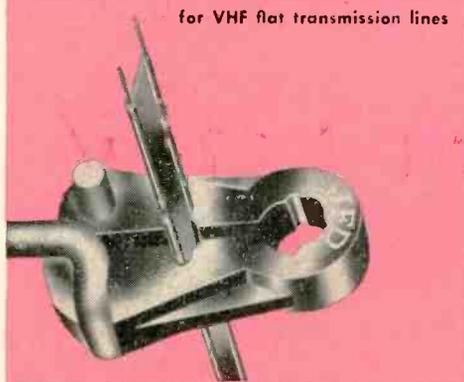
Burton Browne Advertising



1. Simply hinge insulator—slip lead-in into place—(any type fits tightly inside insulator).



2. Swing polyethylene insulator into place—click that's it.



SARATA Elects Officers

New officers elected at the annual meeting of the San Antonio Radio and Television Association are: Albert R. Niehaus, pres., 1131 Nolan St.; Elmo Bohmann, vice pres.; Ora G. Fretz, secretary; Thomas F. Boyd, treasurer; H. M. Willmann, director; Esteban Z. Viera, director. This organization is affiliated with the Texas Electronics Association. After operating expenses and contribution to the state association, SARATA's funds are used for cooperative advertising.

LIETA Planning Co-op Ads

Members of the Long Island Electronic Technicians Association, Inc., 88 Fourth Street, Oceanside, N. Y., have approved a plan for cooperative advertising, in which the organization guarantees all repairs made by its members. LIETA urges all members to use this information in their individual advertising. Affiliated technicians are also urged to use their membership cards when buying from distributors, to identify themselves as LIETA technicians.

ETSC Annual Conference

The Eastern Television Service Conference, composed of service associations on the eastern seaboard, will hold its annual session in the Bellevue-Stratford Hotel, Philadelphia, April 2-4, in connection with the color symposium to be held at

SERVICE ASS'N REPORTS

the same time in the same place. All persons connected with the service industry, whether affiliated with associations or not, are welcome to attend. Business sessions will cover the problems of managing a service business, public relations, methods of increasing business, reduction of expenses and operations of service associations. The conference chairman is Harold B. Rhodes, of Paterson, N. J., president of the Radio and TV Servicemen of New Jersey and eastern secretary of NATESA. In addition to the two just mentioned, participating groups are NETSDA, ARTSNY, Philadelphia Radio Servicemen's Assoc., Federation of Radio Service Associations of Penna., Council of Radio and TV Service of Phila., Mid-State Radio Servicemen's Assoc., of Harrisburg (Penna.), Allied TV Technicians of N. J., Long Island TRT Guild, Empire State Federation of Electronic Technicians, Radio Technicians Guild of New England, TV Service Dealers of Phila., TV Service Dealers Assoc. of Delaware County (Penna.), and Radio and TV Servicemen's Assoc. of Pittsburgh.

CRTSA Color Symposium

The Council of Radio and Television Service Associations, in cooperation with local parts distributors, will sponsor a color symposium featuring technical papers and demonstrations. The program is scheduled at the Bellevue-Stratford Hotel, Philadelphia, April 2-4. Subjects to be covered besides color include: VHF-UHF TV, hi-fi, tape recorders, record-changers, transistors, and business management. Eight member associations are participating: Allied TV Technicians' Service Assoc. of South Jersey, Northeast TV Service Dealers Assoc., Phila. Radio Service Men's Assoc., TV Service Dealers Assoc. of Delaware County, TV Contractors' Assoc., and TV Service Dealers Assoc. of Phila. For further infor-

mation on the symposium, contact show committee chairman Dave Krantz, 1917 W. 74th Avenue, Phila. 38, Penna.

NATESA Annual Award

First annual award of the President's Cup of the National Alliance of Television-Electronics Service Associations went to Fred Colton, chairman of the board of the Associated Radio & Television Service Dealers of Columbus, Ohio. The cup



Fred Colton (left) receives NATESA annual cup from organization's president, Frank J. Moch.

was presented by Frank J. Moch, NATESA, at a luncheon in Colton's honor. Colton, who is eastern central v. p. of NATESA, received the award for his work in behalf of the organization.

LITRTG Color Lecture

The Long Island Television and Radio Technicians Guild, P. O. Box 87, Bethpage, N. Y., recently held a color-TV forum that was attended by approximately 250 persons. Henry Wawryck, president, discussed the traditional independence of the service technician. He noted the emergence of a new type of technician, better educated, more interested in his work and his customers, and more interested in the exchange of ideas with his fellow technicians through service organizations.

Calendar of Coming Events

- Mar. 22-25: Institute of Radio Engineers National Convention, Waldorf-Astoria Hotel, New York. Exhibits, Kingsbridge Armory, Bronx, New York.
- May 17-20: Electronic Parts Show, sponsored by Association of Electronic Parts & Equipment Manufacturers; West Coast Electronic Manufacturers Association; Radio-Electronic-Television Manufacturers Association and National Electronic Distributors Association and Sales Managers Club (Eastern Group), Conrad Hilton Hotel, Chicago, Ill.
- June 15-17: Radio-Electronic-Television Manufacturers Association Convention, Palmer House, Chicago, Ill.
- July 12-15: National Association of Music Merchants Trade Show, Palmer House, Chicago, Ill.
- Sept. 30-Oct. 2: High Fidelity Show, International Sight and Sound Exposition, Palmer House, Chicago, Ill.
- Oct. 13-16: The Audio Fair, Hotel New Yorker, New York.

WILL YOU HELP US?

... By giving us the name of the technical association to which you belong? We'd like this information as part of an editorial survey which we're conducting.

Service Association:

Address

Manager or Recording Secretary's Name:

Phone:

Your Name:

Your Address:

Mail to: Associations Editor, TECHNICIAN, 480 Lexington Avenue, N.Y.C. 17, N.Y.

Serviceman's Analysis of Color Stages

(Continued from page 28)

through a delay line to the "Y" or luminance amplifier. The purpose of the delay line is to assure the arrival of the "Y" signal at the picture tube at the same time as the "Q" and "I" signals. The "Y" amplifier is similar to a video amplifier in a black-and-white set except that a trap, tuned to the color subcarrier frequency, is usually present, to reduce interference.

A defective "Y" section will, first of all, cause a complete loss of detail. This is so because picture detail information is all contained in the "Y" signal. Secondly, there will be no brightness information. The brightest colors—yellow, cyan, and green—will appear too dark, whereas the dark colors—blue, red and magenta—will appear bright by comparison.

The outputs of the color demodulators are amplified (in the phase-splitter blocks) and fed to the matrix section. The matrix determines the proportion and polarity the "Y," "Q" and "I" information should have, when combined in the adder stage, to produce red, blue and green color signals. These signals are separately amplified in individual amplifiers, before being applied to the crt guns. Since both positive and negative "I" and "Q" signals are required in the matrix, phase splitters or inverters are necessary.

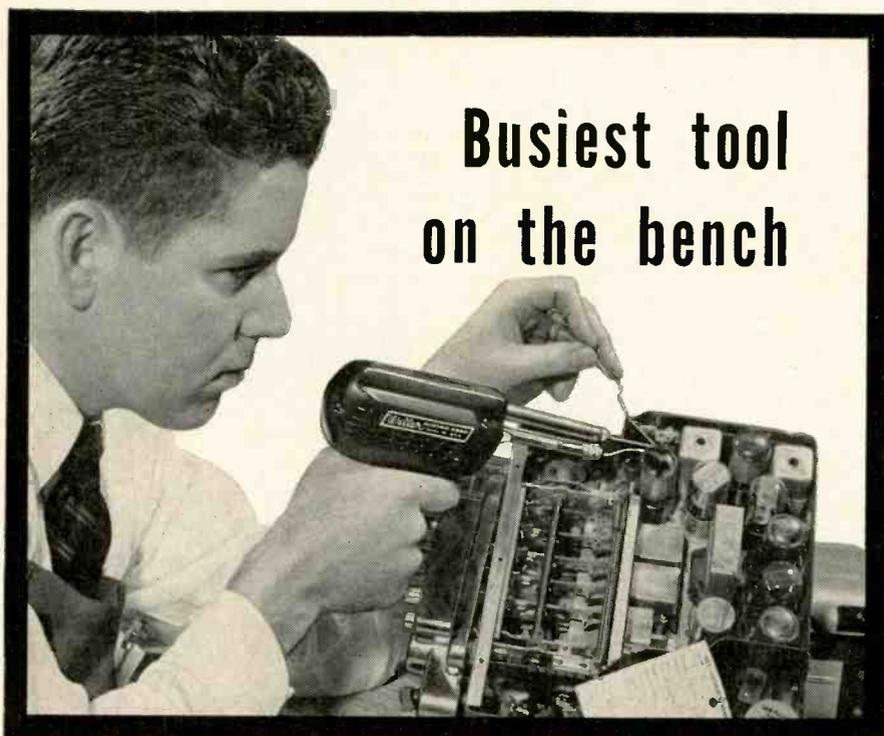
There are two controls in the color section that the set owner will operate. One of these is the *chroma control*. This adjustment regulates the amount of signal fed to the band-pass amplifier, and thus determines the amount of "I" and "Q" signal that will be available. When it is set fully *counter-clockwise*, there will be no color at all in the picture. As the control is turned *clockwise*, the saturation of the colors will be increased—that is, the colors will go from pastel to more and more vivid shades. With the control fully up, the picture will usually have an excessively vivid, supersaturated appearance.

Hue Control Adjustment

The other control the set owner will manipulate is the *hue control*, also called the *color phase control*. This adjustment regulates the phase of the 3.58 mc oscillator, with respect to the incoming burst signal. In an ideal system, such a control would not be necessary, since this phase relation should be fixed. In practice, however, it is found that some phase shift may be introduced anywhere in the system—antenna, the lead-in wire, video i-f section, etc. Incorrect shading tends to be produced in consequence; the hue control is used to counteract this tendency.

On a live program, the best way to adjust the hue control is to set it to the position where the most pleasing flesh tones are produced. As the hue control is rotated, flesh color will be seen to vary from green or greenish yellow to orange, then to normal flesh color and finally to red. If a color bar pattern is on (this consists of a series of vertical bars in the following order: green, yellow, red, magenta, blue, cyan, green), optimum adjustment can usually be obtained by setting the hue control for the best yellow.

Service (rather than customer) adjustments will be discussed when individual circuits are described in detail.



Busiest tool on the bench

The new Weller Soldering Gun—the tool that finishes the job before ordinary soldering tools warm up!

Weller's newest models —

Go anywhere inside circuit-jammed chassis of smallest portables and table models. Slim streamlining and longer reach makes tight spots a cinch—in a fraction of the normal time.

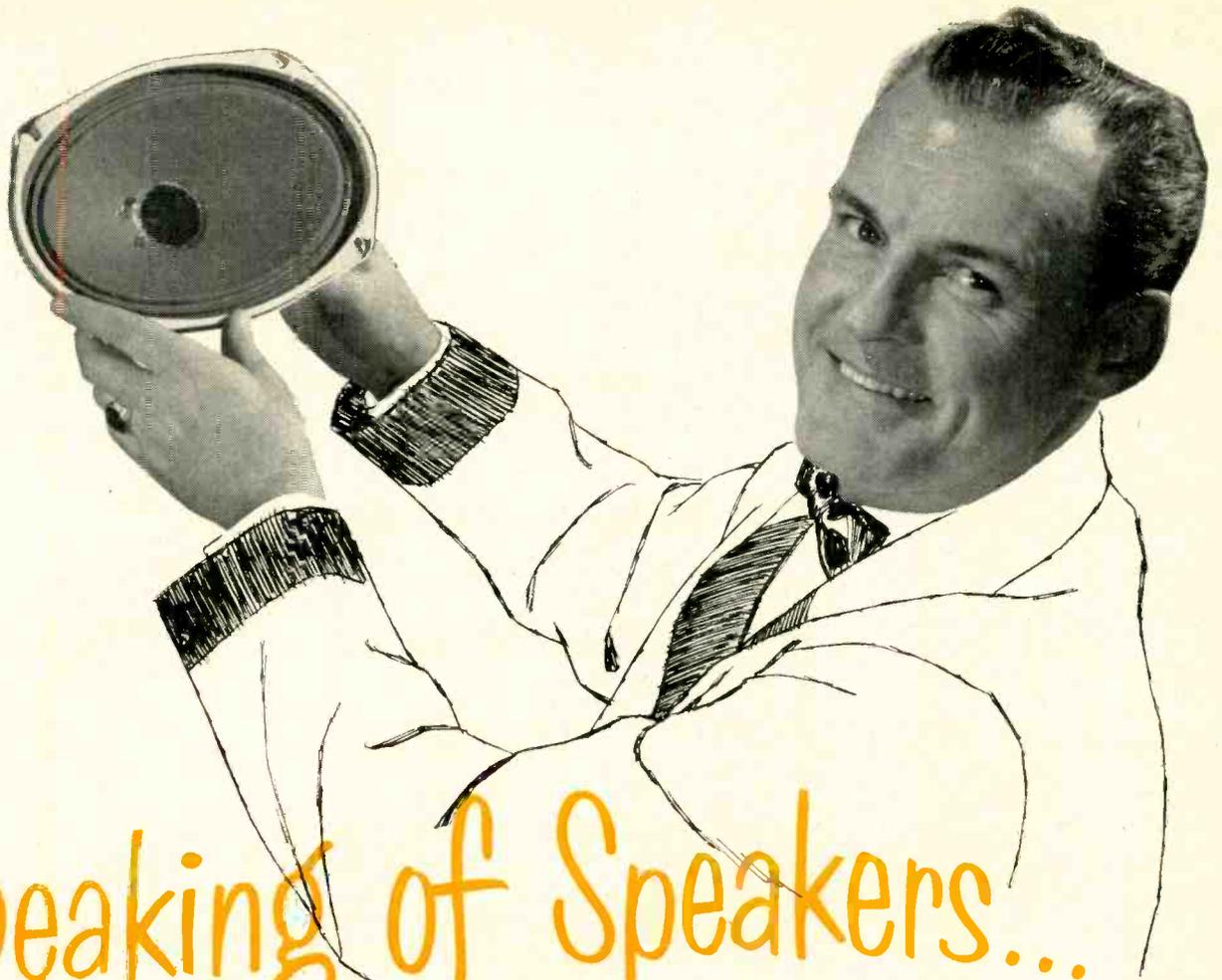
Get hot instantly with click of trigger. Another click and—power is instantly boosted—up to 275 watts!

Give wide selection of power for every job—100, 135, 200, 250, and now—275 watts! Light and heavy duty models, either single or dual heats.

You'll like the perfect balance and slim lines, too—on all latest Weller models. Ask your distributor for a demonstration, or write direct for bulletin.

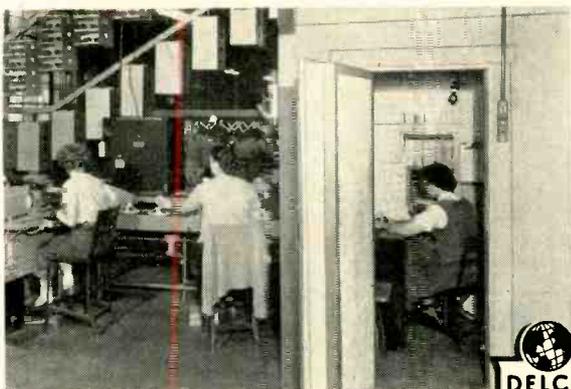
Weller

Better from Grip to Tip
SOLDERING GUNS
805 Packer Street, Easton, Pa.



Speaking of Speakers...

DELCO RADIO CAREFULLY CONTROLS THE MANUFACTURING OF ITS SPEAKERS TO ASSURE HIGHEST POSSIBLE QUALITY



In the audio test booth, the speaker is checked for its ability to deliver good listening. In the background you can see a small section of the speaker production line.



High quality in the final product can be had only through rigid quality control. Take speakers, for example. Speaker baskets are formed in our stamping department. Special machines wind the voice coils. On the assembly line the cones are secured to the voice coils and then assembled with the basket. All along the line inspectors have been checking and rechecking. Then, the speaker is magnetized and goes into a specially designed sound booth for a final check.

This continuing quality control is one important reason why Delco Radio replacement parts assure customer satisfaction. Made by the world's largest manufacturer of auto radios, they are available from your UMS Delco Electronic Parts Distributor.

**DISTRIBUTED BY
ELECTRONICS
WHOLESALE
EVERYWHERE**

DELCO RADIO

DIVISION OF GENERAL MOTORS CORPORATION, KOKOMO, INDIANA

A GENERAL MOTORS PRODUCT   A UNITED MOTORS LINE

KESTER

Since the most important single step in Radio-Television Servicing is soldering... it's just plain good sense to use the best — KESTER SOLDER... Key Name in Solder for More Than 50 Years.

KESTER SOLDER COMPANY
4264 Wrightwood Avenue • Chicago 39, Illinois
Newark 5, New Jersey • Brantford, Canada

SOLDER

NEWS of the TRADE

Stewart-Warner Transceiver

The model 73 Portafone is said to be the only FCC-approved Class B telephone transmitter-receiver. Any citizen of the United States over 18 years of age can easily obtain an operational license from the FCC. The units are sold and operated in pairs or multiples.

Using a case only about 10½ in. long (17 in. with antenna), the unit



weighs less than 2 pounds. With carrying case and battery, weight is about 5½ pounds. Set to transmit on 465 mc, the Portafone is said to have unusual stability in the face of wide changes in temperature, humidity and operating voltages.

For listening, the device functions as a 2-tube super-regenerative receiver, which may be accurately adjusted with a tuning knob. A press-to-talk switch reconnects the circuit to act as a 2-tube transmitter. The circuit uses standard parts, easily replaced, which are operated well below their ratings. Despite compact size, the layout of the transmitter-receiver permits accessibility to components for servicing.

Receiver sensitivity is about 12 microvolts for a readable signal. Audio output is about 15 mw, with unit working into a 600-ohm earphone. The unit meets FCC and RETMA standards of good engineering practice.

Tung-Sol Appoints Rep.

J. D. Van der Veer, of Tung-Sol

THE ORIGINAL Cross-Bar Generator, Designed in 1951 and granted U. S. Design Patent No. 169,112.

Still the best buy because: It is the *only* Cross-Bar Generator selling for less than \$50, which includes its own built-in power supply. Connects direct to receiver Antenna Posts—No connection to chassis or any tube. This is a truly professional instrument—not an adapter!

-TV CROSS BAR GENERATOR-

THROWS AN ACTUAL BAR PATTERN ON ANY TV RECEIVER SCREEN!!

Two Simple Steps

1. Connect Bar Generator to Antenna Post of any TV Receiver.
2. Plug Line Cord into A.C. outlet and Throw Switch.

Result: A stable never-shifting vertical or horizontal pattern projected on the screen of the TV receiver under test.

FEATURES:

- Provides linear pattern to adjust VERTICAL linearity, height, centering.
- Provides linear pattern to adjust HORIZONTAL drive, width, peaking, linearity, centering.
- Provides vertical sweep signal for adjusting and synchronizing vertical oscillator discharge and output tubes.
- Provides horizontal sweep signal for adjusting and synchronizing horizontal oscillator A.F.C. and output tubes.
- Provides horizontal sweep signal to check H.V. section of fly-back and pulse operating power supplies.



TV BAR GENERATOR COMES COMPLETE WITH SHIELDED LEADS AND DETAILED OPERATING INSTRUCTIONS. ONLY

\$39.95
NET

**SHIPPED ON APPROVAL
NO MONEY WITH ORDER — NO C. O. D.**

Try it for 10 days before you buy. If completely satisfied send \$9.95 and pay balance at rate of \$5.00 per month for 6 months.—No Interest or Carrying Charges Added. If not completely satisfied, return to us, no explanation necessary.

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. D-16, 3849 Tenth Ave., New York 34, N. Y.

Please rush one TV Bar-Generator. I agree to pay \$9.95 within 10 days after receipt and \$5.00 per month thereafter.

Name

Address

City

Zone

State

Electric, Inc., has announced the appointment of John J. Corcoran as sales representative and commercial engineer on the west coast. Corcoran has been associated with the Tung-Sol sales force since 1950. His new headquarters will be in Culver City, California.

Raytheon Caravan Hits N. Y.

Manhattan Center in New York City was the scene of a recent Raytheon Service Saver meeting, one of many that have been held all over the country. Bill Ashby, Raytheon service engineer, explained operation of the plan at the well-attended lecture.

Under the system, the purchaser of a TV set gets a Service Saver booklet containing 40 numbered pictures illustrating common troubles that show up on a TV screen. The serviceman has a related version of the Service Saver booklet, which permits him to identify, via telephone, the faulty tube or circuit in the Raytheon receiver; he may even be able to pinpoint the defective component. Servicing time is thus reduced; the need for removing the set from the home is said to be eliminated frequently.

Bill Ashby was introduced by John F. Rider, publisher. At a press conference preceding the lecture, Raytheon's Carroll Hoshour said the plan would be even more significant with the advent of color TV.

The meeting was co-sponsored by local distributors H. L. Dalis, Inc., and Dorfman Distributing Co., also by the N. Y. C. Service Managers Group. Similar meetings were held in Reading and Wilkes-Barre (Penna.); also in Hagerstown (Md.).

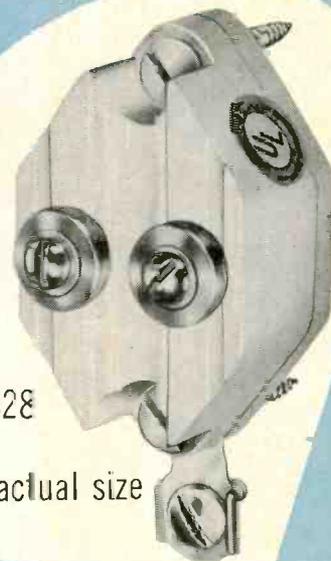
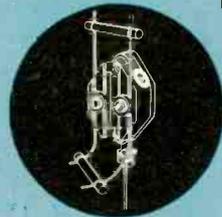
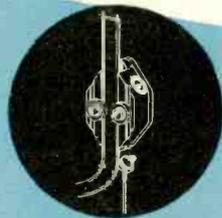
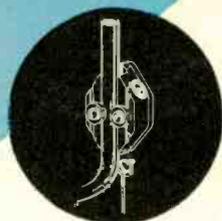
Crosley Pushes B & W Sets

Remember the pre-TV days when many homes had the big console radio in the living room, with one or more additional table-model receivers in other rooms? A new design approach by Crosley foreshadows a similar situation in TV, in which the b & w receiver may continue in use long after the large color set in the living room is a common fixture in the American home.

New Crosley receivers using 17-in. pix tubes are scarcely larger than the crt. Space is saved by mounting the chassis vertically, rather than horizontally, and placing it behind the pix tube. Controls are mounted on one side rather than in front. The streamlined circuit uses only 15 tubes and light-weight components. This is said to make the receiver portable. Suggested list price for the set (Super V) is \$139.95.

new! designed for UHF

AMPHENOL

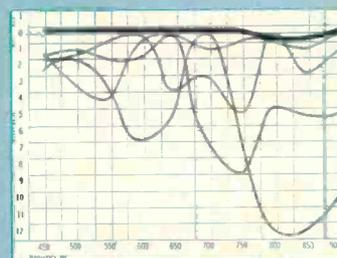


model 114-328

actual size

universal LOW-LOSS LIGHTNING ARRESTOR

Insertion Characteristics Chart



AMPHENOL
Competitor A
Competitor B
Competitor C
Competitor D

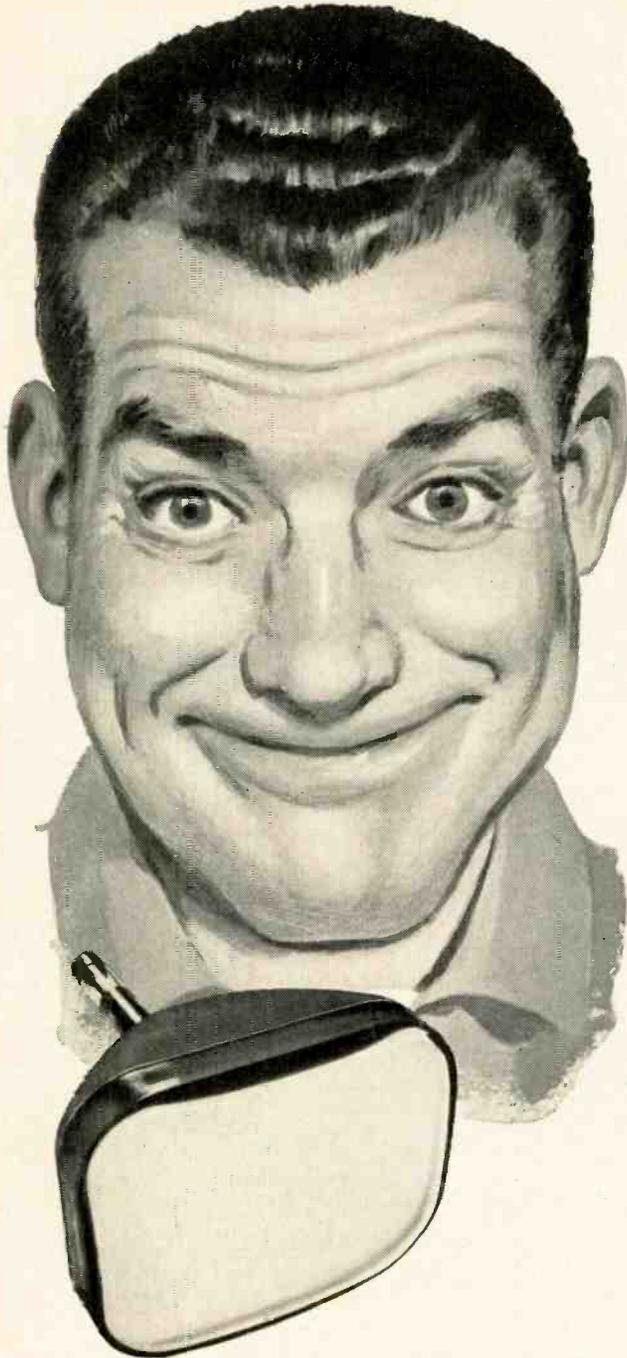
LOWEST LOSS—The chart above gives the characteristics of the AMPHENOL model 114-328 and four competitive lightning arrestors. The superiority of the AMPHENOL arrester is obvious—negligible losses over UHF frequencies. The same standard measurement procedures applied to four competitive lightning arrestors illustrate the high loss on UHF resulting in poor pictures at the receiver.

FROM THE LABORATORIES OF AMPHENOL comes a new concept in lightning arrestors, designed not only to protect the television receiver from the hazards of lightning but to give full protection to the signal strength as well. This is the new model 114-328 AMPHENOL Lightning Arrester, the result of long months of research by skilled engineers. This Arrester's low-loss performance means better picture quality—VHF or UHF. Its unique design assures easy installation—a sure-grip of flat, tubular or open-wire lead-in.

AMERICAN PHENOLIC CORPORATION
chicago 50, illinois

AMPHENOL

SERVICE MEN LIKE TO USE TUNG-SOL TUBES



Tung-Sol business practices are on the same high level with Tung-Sol Tube quality—and service men have always profited from both. It pays to use Tung-Sol Tubes.

TUNG-SOL[®]

dependable
PICTURE TUBES



TUNG-SOL ELECTRIC INC., Newark 4, N. J.
Sales Offices: Atlanta, Chicago, Columbus,
Culver City (Los Angeles), Dallas, Denver,
Detroit, Newark, Seattle.

DB Measurement

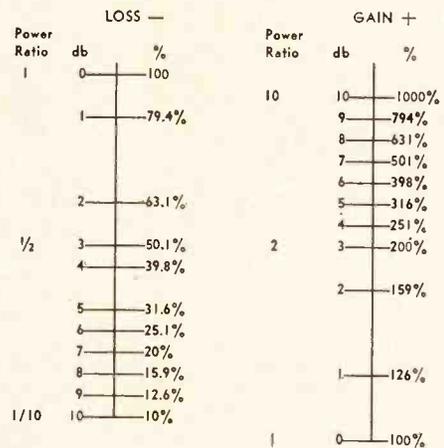
BY GEORGE P. KEARSE

Widespread contacts with numerous TV service engineers have revealed that many of these highly qualified and vitally important members of our family are greatly confused by the decibel values used to evaluate the performance data of antennas and transmission lines. Therefore, we believe that a short discussion of the use of the decibel as a measuring unit would help to clear up some of this confusion.

ORIGIN. The decibel is one tenth of a bel, named after Alexander Graham Bell, and was originally developed by telephone companies to measure power levels in communication circuits. It has been "borrowed" by other branches of electronics and today it is almost universally used in any application where it is necessary to compare two power levels, even when these levels are measured in different terms, such as voltage or current.

LOGICAL CHOICE FOR ANTENNA MEASUREMENTS. It is a natural choice, therefore, to select the decibel as a measuring unit when comparing the power sensitivity (signal pickup) of an antenna with that of a folded dipole, where pickup differences must be stated in relative units independent of the power level at which the measurements are made.

PECULIARITIES OF THE DECIBEL SCALE. Decibel values, being logarithmic quantities, can often become confusing and misleading unless one has been using these units regularly. For example, values of 10 db or 20 db correspond to a power ratio of 10 to 1 and 100 to 1, respectively, and values of 30 db, 50 db, and 100 db, while being relatively small numbers themselves, represent tremendous changes in power levels. Less confusion will result



if one will remember that a 2 to 1 (or 1 to 2) power ratio represents approximately a 3 db change, and that a 10 to 1 (or 1 to 10) power ratio represents a 10 db change. Points in between these two values may be "guesstimated" within a few per cent without too much trouble. The following table showing power ratios as db values compared to percentage changes vividly illustrates the difference between the two. It is based on a 1 to 1 ratio, or 0 db, as representing a 100% level.

EXAMPLES OF THE USE OF THE CHART

1. An antenna with a gain of 3 db over a folded dipole would collect 200% or 2 times the power collected by a folded dipole.
2. A lightning arrestor with an insertion loss of 1 db would permit 79.4% of the signal power to remain in the transmission line for reception purposes—20.6% being consumed by the unit itself.

The chart may be extended as needed, remembering that as the percentage values are multiplied or divided by 10, the decibel values add. For example:

A serviceman has the problem of determining how much gain a booster should have, to overcome the loss in a 1000-ft. run of coaxial line from a hilltop antenna to an installation in the valley below. At the operating frequency, the loss per hundred feet is 1.5 db. The total loss will be ten times 1.5 db. or 15 db. Therefore, the booster must raise the power level at the input to the cable 31.6 times or 3160%, to compensate for the long cable run. (Courtesy American Phenolic Corp.)

Mfrs. Service Tips

Excessive Heat in HV Cage

This symptom in the Packard-Bell 2040 chassis, along with the cure recommended by the manufacturer, suggests an approach that may be useful in handling the same problems in other sets. The condition may result in a drop in high voltage and loss of picture width. In this case the Q of the horizontal output transformer decreases due to heat. Therefore it has been found necessary to add a heat baffle in the high-voltage cage between the horizontal output tube, 6BQ6, and the horizontal output transformer. The baffle is easily installed and is held in place by the 6BQ6 plate-cap lead. The lead must be removed in order to install baffle, which is placed at right angles to cage. Baffle part number is 78113 and it is available through the nearest Packard-Bell service department.

Fuse Failure in Horizontal Circuit

The fuse now used in many RCA TV sets is a 0.3 ampere, 250 v type with wire leads, Stock No. 78214. The fuse has been found to be satisfactory in this application for all operating conditions normally encountered. Replacement should be made only with a fuse of the same rating.

In cases where an unexplained fuse failure occurs, examine the glass body interior to determine the mode of failure.

1. Failures where a small segment of the fuse has been melted are generally due to a malfunction of the horizontal scanning circuit. Horizontal output and damper tubes should be checked. An intermittent component, such as a capacitor in this circuit, may result in fuse blowing.

2. Failures where the fuse link has been vaporized against the fuse glass body can be due to an intermittently shorting 6AQ5 vertical output tube. In some cases, a momentary flashover occurs which clears itself. During flashover time, the B+ to the scanning circuit is shorted through the tube, resulting in a vaporized fuse link. In such cases, it is advisable to replace the tube. Where the same tube type is used in other positions, such as the audio output circuit, it may be possible to exchange tubes and obtain satisfactory operation.

CUSTOMERS LIKE SERVICE MEN WHO USE TUNG-SOL TUBES



Tung-Sol hi-performance tube quality is a dependable safeguard against call-backs that cut into service work profits. Keep that in mind and remember—it pays to use Tung-Sol Tubes.

TUNG-SOL[®] dependable TUBES—DIAL LAMPS

TUNG-SOL makes All-Glass Sealed Beam Lamps, Miniature Lamps, Signal Flashers, Picture Tubes, Radio, TV and Special Purpose Electron Tubes and Semiconductor Products.

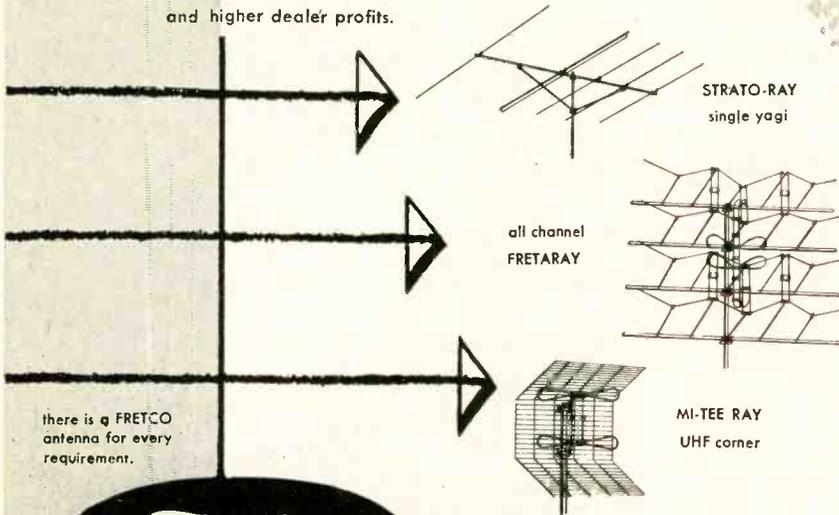


the versatile

FRETCO INC

family of TV antennas*

For proven customer satisfaction
and higher dealer profits.



there is a FRETCO antenna for every requirement.

Fretco

I N C Pittsburgh 13, Pennsylvania.

HICKOK

Model 209A



true VTVM
and
CAPACITANCE TESTER

- Large 9" meter.
- Measures wide ranges of capacitance, inductance, resistance, current, voltage, both AC and DC.
- Includes matched high frequency probe to make this laboratory instrument a TRUE VTVM.
- Write for technical details...

THE HICKOK ELECTRICAL INSTRUMENT CO.

10523 Dupont Ave., Cleveland 8, Ohio

AUDELS TV-RADIO SERVICE LIBRARY

HERE IS LATE INFORMATION IN A HANDY FORM FOR RADIO AND TELEVISION REPAIRMEN, SERVICEMEN AND STUDENTS



2 VOLS. \$6 COMPLETE \$1 A PAY ONLY 1 MO.
AUDELS T.V. RADIO SERVICE LIBRARY—Highly Endorsed—1001 Facts—Over 1552 Pages—625 Illustrations, Diagrams of Parts. Presents Important Subjects of Modern Radio, Television, Industrial Electronics, F.M., Public Address Systems, Auto, Marine & Aircraft Radio, Phonograph Pick-Ups, etc.

IT PAYS TO KNOW!

The Basic Principles—Construction—Installation—Operation—Repairs—Trouble Shooting. Shows How to get Sharp, Clear T.V. Pictures. Install Aerials—How to Test. Explains Color Systems, Methods of Conversion, Terms, etc. Includes Ultra High Frequency (U.H.F.)—Valuable for Quick Ready Reference & Home Study. Tells How to Solve T.V. & Radio Troubles—Answers Your Questions.

Get this Information for Yourself.
7 DAY TEST—ASK TO SEE IT!

MAIL ORDER

AUDELS, Publishers, 49 W. 23 St., N.Y. 10, N.Y.
Mail AUDELS T.V. RADIO SERVICE LIBRARY 2 Vols. \$6 on 7 days free trial. If O. K. I will remit \$1 in 7 days and \$1 monthly until \$6 is paid. Otherwise I will return them.

Name _____
Address _____
Occupation _____
Employed by _____ TC

NEW BOOKS

UHF TELEVISION ANTENNAS AND CONVERTERS. By Allan Lytel. Published by John F. Rider Publisher, Inc., 480 Canal Street, New York 13, New York. 118 pages; \$1.80, paper bound.

It is the purpose of this book to explain in simple terms the function and operation of the UHF conversion systems that are appearing on the market in ever increasing numbers. It is also meant to prepare the service shop owner and serviceman for the installation and maintenance of these units. Emphasis is placed not only on the converter systems but also on the antenna structures and transmission line systems. The level is meant to be direct and practical; every effort has been made to use circuits and descriptions that are useful. No involved mathematics have been included, although there are a few instances where simple formulas have been used.

PROTECTION AGAINST BURGLARY. By Richard L. Holcomb. Published by the Institute of Public Affairs of the State University of Iowa, Iowa City, Iowa. 54 pages; \$1.00, paper bound.

Professor Holcomb is Chief of the Bureau of Police Science of the State University of Iowa's Institute of Public Affairs. His first book in this series, *Armed Robbery*, was designed to point out to potential victims the things they might do to thwart hold-up men and to reduce their losses in the event they should be held up. The present volume attempts to achieve the same purposes regarding burglary.

Both of these books were prepared with two objectives in view: 1. to help individual citizens and business firms protect themselves against criminals and 2. to help law enforcement officers enlist public support and cooperation in their efforts to prevent crime and to apprehend and convict criminals.

After a brief introduction, this book is divided into two sections: preventing burglaries of business places, and preventing burglaries of homes. At the back of the book are two check lists; by surveying your place of business and your home with these check lists you can find out what burglary protection devices and practices you need to adopt and follow in order to make your property more secure.

Many humorous cartoons illustrate points made by the author.

It's no contest—



Take the jack-of-all-trades — Type PRS "Dandees." Exceptional choice of voltages, capacities, combinations, means the right fit for any electrolytic replacement need. Higher voltage listings, together with 85° C rating, meet the extra-severe-service conditions in today's radio and TV sets. For stay-put jobs that spell lasting profits for you: it's no contest—Aerovox is BEST.

GET THE FACTS!

Ask your Aerovox distributor for these handy "Dandees." Ask for latest catalog—or write us.



AEROVOX CORPORATION

NEW BEDFORD, MASS.

See your Aerovox distributor!

In Canada: AEROVOX CANADA LTD., Hamilton, Ont.

MFRS' Catalogs & Bulletins

THORDARSON REPLACEMENT GUIDE: Fly-backs, peaking coils, yokes, inductive controls, i-f assemblies and other types are covered in *TV Replacement Guide*, 32 pp. Available free from Thordarson-Meissner, Dept. C, Mt. Carmel, Ill.

JFD ANTENNA BROCHURE: Describes antenna package merchandising, antenna accessory kits. Discusses cutting installation time. Available to part jobbers and service dealers. Write for form no. 245. JFD Manufacturing Co., 6101 16 Ave., Brooklyn 4, N. Y.

SIMPSON TROUBLESHOOTING MONTHLY: Technician's *Timesaver* covers test equipment and troubleshooting technique, servicing shortcuts, in 4 pp. Illustrated. Available to service personnel. Simpson Electric Co., 5200 West Kinzie St., Chicago 44, Ill.

ALLIED CATALOG SUPPLEMENT: Supplement no. 137, 56 pp., to be used with 1954 catalog no. 135. Lists parts, equipment, chassis, and other units added to line since main catalog. Available free. Allied Radio, 100 N. Western Ave., Chicago 80, Ill.

HEATH SERVICE BUSINESS GUIDE: *Planning Your Service Business*, by John T. Frye, 8 pp. Illustrated data on selecting location, choosing equipment, bench layout, record keeping, advertising, and charging. Price, \$1.00. Heath Company, Benton Harbor, Michigan.

BLONDER-TONGUE SERVICE MANUAL: Complete service data, schematics and replacement lists for all B-T home and master TV units, 16 pp. Boosters and converters covered. Price, 25 cents. Blonder-Tongue Laboratories Inc., 526-536 North Ave., Westfield, N. J.

GEE-LAR KNOB CATALOG: *Catalog no. 56* lists complete line of plastic knobs for radio, TV, other equipment; 16 pp. List prices and descriptions included. Available free. Gee-Lar Mfg. Co., 1330 10th Ave., Rockford, Ill.

STANCOR HI-FI AMPLIFIER BULLETIN: *Bulletin 479*, 4 pp., describes Stancor-Williamson ultra-linear amplifier. Chassis drawings, schematics, parts list included. Available free from distributors or from Chicago Standard Transformer Co., Standard Div., Addison & Elston, Chicago 18, Ill.

MALLORY AUTO-RADIO REPLACEMENT CONTROLS: *The Auto Radio Replacement Control Manual* lists replacement controls for nearly 600 models made by 39 mfrs. of auto radios. 11 pp. Fully indexed. Available free from distributors or write to P. R. Mallory & Co., P. O. Box 1558, Indianapolis, Ind.

WESTINGHOUSE SERVICE MANUAL: All Westinghouse TV receivers from 1947 through 1954 are covered by schematics and service data in 127 oversize pages. Manual designed to lie flat on service bench while in use. Price, \$1.75. Westinghouse Electric Corp., 401 Liberty Ave., Box 2278, Pittsburgh 30, Penna.

Built for SERVICE

RCA REPLACEMENT SPEAKERS



Quality engineered for superior speaker performance

- High sensitivity
- Alnico V magnets in all PM types
- Rugged mechanical construction with welded housing assembly
- Moisture-resistant cone and voice-coil suspension assures high efficiency and dependability
- Dust-sealed and rust-resistant
- Rim mountings designed to RET-MA standards

RCA replacement speakers are available through your local RCA Distributor. You'll find PM and field-coil types for virtually all your replacement needs . . . at popular prices!



RADIO CORPORATION of AMERICA
ELECTRONIC COMPONENTS CAMDEN, N. J.

150 **FREE!** Just For Examining **COYNE'S** New 6-Volume Set **APPLIED PRACTICAL RADIO-TELEVISION**

Get this new book FREE—150 Radio-Television Picture Patterns and Diagrams Explained! Gives complete 11 x 22" Schematic Diagrams on leading Radio and TV sets. Explains how to trouble-shoot with picture tube patterns.

GET MONEY-MAKING "KNOW-HOW"

FREE book your gift for examining Coyne's new 6-volume set, Applied Practical Radio-Television. Complete reference set covers everything on Radio and TV including Color TV, UHF, Transistors, Convertors, Adaptors . . . helps you get ahead. Over 2500 easy pages; 1200 illustrations; "breakdown" photos. Tells how to install, service, trouble-shoot, align all sets. Extra! New 762-page quick-reference TV Servicing Cyclo-pedia included.



FREE ON 7 DAYS TRIAL

MAIL COUPON—SEND NO MONEY! Get this 6-volume set and FREE Book. Use the set 7 days. If you want to keep it, pay \$2 after 7 days and \$2 a month until \$22.50 plus postage is paid. (Cash price \$20.95.) If not 100% satisfied with set, send it back and owe us nothing. EITHER WAY TV-RADIO DIAGRAMS BOOK IS YOURS FREE. Coupon is just a request to see set and get FREE Book. Send it today!

MAIL COUPON NOW!

COYNE ELECTRICAL & TELEVISION-RADIO SCHOOL
500 S. Paulina St., Dept. 34-A1, Chicago 12, Ill.
Rush 6-Volume "APPLIED PRACTICAL RADIO-TELEVISION" on 7 days' FREE TRIAL, per offer above. Include FREE Book.

Name Age

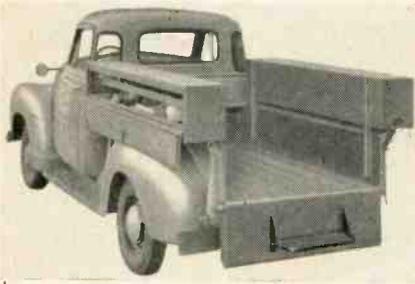
Address

City Zone State

Where Employed

Check here if you want set sent C.O.D. You pay postman \$20.95 plus C.O.D. postage. Same money-back guarantee of satisfaction.

You'll earn more profits with KARYALL COMPARTMENTS



KEEP YOUR TOOLS ORGANIZED AND SAVE TIME ON YOUR SERVICE CALLS

- Karyall Compartments convert any 1/2, 3/4 or 1 ton pick-up truck into a handy mobile service unit.
- Made in sizes to fit full length of truck bed: 78"—88"—96"—108"
- Complete with brackets for easy installation.
- Immediate delivery from our complete stock.

Mail this coupon today for specifications and prices

Name

Company

Address

City State

KARYALL BODY, INC.
8221 Clinton Road Cleveland 9, Ohio
Department T

Du Mont Fix-Faster

A Du Mont troubleshooting chart, the *Fix-Faster*, is designed to assist non-technical set dealers and salesmen in outlying TV areas where qualified technicians are miles away. Consisting of a series of faulty picture tube patterns, the guide indicates only external adjustments that may need re-setting, and possible defective tubes.

The user is cautioned not to attempt such other repairs as require technical knowledge. *Fix-Faster* may also be useful to service technicians in narrowing down more serious circuit faults.

RCA Atomic Battery

The combination of a radioactive source with semi-conductor techniques, similar to those used in transistor operation, has resulted in an experimental atomic battery. The thimble-sized unit, which converts atomic energy directly into usable electricity, is seen as a major breakthrough toward the eventual RCA goal: a tiny battery capable of operating for at least 20 years.

RETMA Training Course

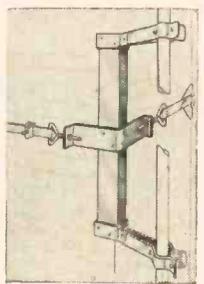
Graduation exercises for TV technicians who completed the RETMA study course at the N. Y. Trade School were held on the evening of Feb. 1. The pilot course, designed to upgrade the experienced technician both in the business and technical sense, had an enrollment of 60 selected servicers in the N.Y. area.

The course was the first in a series intended to provide basic information for developing an industry-recommended training program. The final program will be offered to trade and vocational schools throughout the country. RETMA member companies donated over \$80,000 in money, test equipment, sets, and parts to make this one of the best-equipped courses of its kind in the entire country.

On another front, the RETMA Service Committee announced approval of a standardized parts tag for use on all components returned to the set manufacturer under warranty. Use of this standard form will simplify procedure for technician-dealers and servicemen. Many RETMA member-companies are now distributing the return tags to their distributors throughout the country.

Editors, **TECHNICIAN**:
You have a wonderful journal for the serviceman. I like it better all the time.
E. F. HARMON
Strand Electric Co.,
Strand, Okla.

South River
NEWS



Chimney Uni-Mount Model UM-1

Riveted, heavy-gauge, galv. steel with wide, flared-lip, snap-in mast holders. 18" spacing between mast holders for firm support. Available with one heavy-gauge stainless steel strap, Kwik-Klip banding closure and Chimney Corner Guards.

Model UM-2 . . . same as UM-1 with 2 heavy-gauge stainless steel straps.

Write for catalog.
In Canada—A.T.R. Armstrong Ltd., Toronto

SOUTH RIVER METAL PRODUCTS CO., INC.
SOUTH RIVER, N. J.
PIONEER AND OUTSTANDING PRODUCER OF FINEST LINE OF ANTENNA MOUNTS

LOCALIZE YOUR SELLING

—by supplementing your free editorial listing in the Manufacturers' Alphabetical Index in the **TECHNICIAN BUYERS DIRECTORY** to be published in the May issue of **TECHNICIAN**.

Space may be purchased by the inch, immediately under your firm name, for the listing of:

- Local representatives
- Branch or regional offices
- Territories covered
- Types of products
- Brand names
- Executive and sales personnel

Localizer Listings result in quicker evaluation of inquiries; save time and money; cut red tape and get you to the buyer faster.

Write for details

TECHNICIAN

480 Lexington Ave., New York 17



C-D's new Cub

outlasts other
molded tubulars
in humidity tests!



- Government humidity tests show C-D's to be 3 to 6 times better!
- A better all-around tubular designed specifically for radio and TV service replacement needs!
- Compare its new sleek looks!
- -- and be sure to ask about the new "Cub-Kit".

This time try C-D's NEW CUB! For your nearest C-D distributor see the Yellow Pages of your Telephone Directory. Write for catalog to Dept. RT34 Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey.

CONSISTENTLY DEPENDABLE

CORNELL-DUBILIER CAPACITORS



There are more
C-D capacitors in
use today than any
other make.

PLANTS IN: SO. PLAINFIELD, N. J.; NEW BEDFORD, WORCESTER AND CAMBRIDGE, MASS.; PROVIDENCE AND HOPE VALLEY, R. I.; INDIANAPOLIS, IND.; SANFORD AND FUGUY SPRINGS, N. C. SUBSIDIARY: RADIART CORP., CLEVELAND, OHIO

Silicon Transistors

The use of silicon in place of germanium for the manufacture of transistors may open up transistor applications not possible until now. Raytheon engineers have announced experimental silicon transistors that operate at temperatures of 350 degrees and higher. Since germanium cannot withstand much heat, transistors have not heretofore been practical in high-wattage or high-heat applications.

Pyramid Contest Continues

Closing date for entries in the cash-prize contest for servicemen conducted by Pyramid Electric Co. is April 30. More than 500 cash prizes totalling \$5,600 are being offered to service technicians who write the best 25-word statements beginning "I like Pyramid capacitors because . . ." Entries must be accompanied by capacitor box-tops. Contest details were reported in *TECHNICIAN* last month (February.)

Transvision Coin-Box TV

Model C-1 Coin-TV Set, designed for use in hotels, motels, hospitals and other points of assembly, provide half an hour of TV viewing for 25 cents. A "free viewer" device permits a teaser view of the program for a few minutes, shutting off unless a quarter is deposited.

Transvision, Inc. of New Rochelle, N. Y., manufacturer of the sets, claims these tamper-proof receivers are not simply regular sets with attachments. They are ruggedly designed for operation under more demanding conditions of use than those to which conventional home receivers are subjected.

Freed Appoints Sales Mgr.

Freed Electronics & Controls Corp., 200 Hudson St., New York 13, N. Y., announces appointment of W. Walter Jablon as sales manager of the Home Instruments Division. Associated with the industry since the early days of broadcasting, Jablon will promote the manufacturer's complete line of "Higher Fidelity" equipment for home use.

An old name in radio and audio, Freed produced FM receivers and wide-range sets before World War II, preceding the present hi-fi boom.

Correction

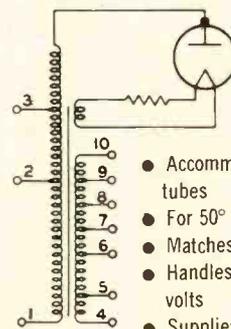
On page 29 of the December '53 issue of *TECHNICIAN*, two sketches closely based on Centralab drawings were published without a courtesy line. We wish to apologize for this omission.

Built for SERVICE

No Redesign Problems

with RCA

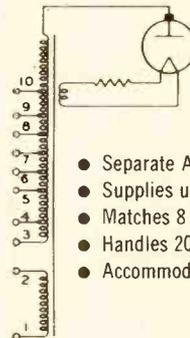
"Universal" HV Transformers 231T1 and 232T1



231T1

For replacement
use in isolated-
secondary type
circuits

- Accommodates all popular driver tubes
- For 50° to 70° kinescopes
- Matches 8 to 30 mh yokes
- Handles "B" supplies; 250 to 375 volts
- Supplies up to 15 kv



232T1

For replacement
use in auto-
transformer type
circuits

- Separate AGC/AFC winding
- Supplies up to 16 kv
- Matches 8 to 30 mh yokes
- Handles 200 to 375 volt "B" supplies.
- Accommodates all popular driver tubes

Why redesign, when mechanically and electrically, these two RCA "universal" horizontal-output and high-voltage transformers meet practically every mounting and circuit requirement.

Excellent for conversions. Comprehensive instruction booklet packed with each transformer.

Available through your local RCA Distributor.



RADIO CORPORATION of AMERICA
ELECTRONIC COMPONENTS CAMDEN, N. J.

"Greatest Show on Earth"

Yes, the industry's greatest TV-electronic parts show will be held in two places simultaneously.

—In CHICAGO, May 17-20, when parts, accessories and test equipment will have the spotlight at the Conrad Hilton.

—In TECHNICIAN, May issue, destined to be the Greatest TV-Electronic Show on Paper.

Why the Greatest Show on Paper? Because the many exclusive features planned for May will surpass anything done by O. H. Caldwell and M. Clements in 30 years.

Is TECHNICIAN THE GREATEST SERVICE PUBLICATION IN TV? ... Yes!

Substantiating the jet-like progress of TECHNICIAN, manufacturers are now polling 14 cities—asking servicemen what publication they prefer. First was an independent survey of 750 servicemen listed in Chicago's Classified Telephone Directory, made by a prominent agency with this result:

% OF TOTAL VOTES

Technician	32.0%
Radio TV News	17.0
Radio Electronics	13.0
Radio TV Service Dealer	12.5
Service	12.0
Sams Index	4.0
Electronics	3.0
Service Management	2.0
Miscellaneous	4.5

Note—TECHNICIAN led in 1st choice votes—and also in 2nd choice votes. In percentage of total votes, TECHNICIAN received more votes than the next two publications combined.

TECHNICIAN'S 50,000 circulation includes more professional servicemen and service managers (no consumers or experimenters) than any other radio-TV service publication—actually more than 45,000. And . . . TECHNICIAN'S PAID CIRCULATION NOW EXCEEDS 40,000!

Thus, media ratings of last Fall are already obsolete. It's time to again review your advertising schedule, and . . .

MAKE SURE YOU ADVERTISE IN THE TOP SERVICE PUBLICATION.



Caldwell-Clements, Inc., 480 Lexington Avenue, New York 17, N.Y.

Complete manufacturers' directory of products used by distributors and service men

Alphabetical listing of all manufacturers of radio-TV-electronic products

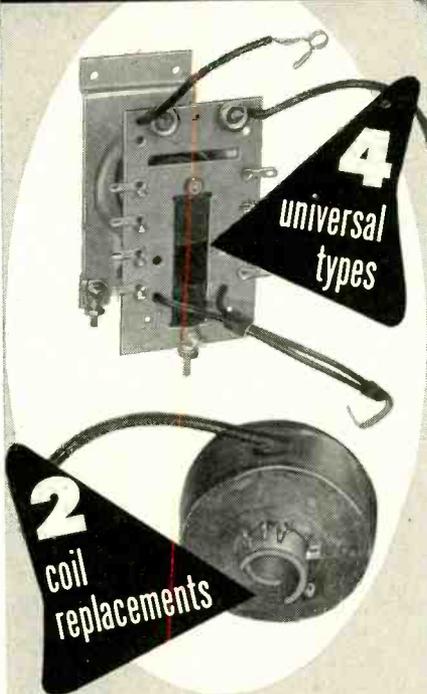
Exclusive annual distributors' directory

Complete Representatives directory

Complete list of service associations

Yes, TECHNICIAN's May Issue will be the GREATEST SHOW ON PAPER

6 NEW TRIAD FLYBACKS



As evidence of Triad's continuing efforts to meet your TV replacement needs — exactly and completely — 6 new flybacks have been added to the line. A total of 19 are now available, with more being added all the time. These flybacks are precisely engineered for specific replacements and carefully constructed of the finest materials. Their resulting high performance and long life insures satisfied customers and helps you build and hold your service business.

Type No.	List Price	Description
D-31	\$11.00	Universal type. Universal mounting. Replaces RCA 231-T1
D-32	11.00	Has AGC tapped winding. Matches all yokes.
D-33	11.00	Universal type. Universal mounting. Has AGC tapped winding similar to D-32, but low impedance secondaries.
D-35	11.00	Universal type. Universal mounting. Replaces RCA 223-T1, 224-T1, 230-T1 and 232-T1.
DA-36	5.50	Coil only. Replaces coil in Zenith Part No. S-18567.
DA-37	5.50	Coil only. Replaces coil in Zenith Part No. S-19032.

Available from stock. See your jobber for these — and all of your TV replacements.

Write for Catalogs TR-54K and TV-54K



Prevent Paperwork Losses

(Continued from page 46)

over a period of three days. (Additional days may be added.) This multi-day set-up is preferred because it can help plug up a very real source of losses. To illustrate:

Technician Joe starts work on Mrs. Smith's TV set on Monday, March 15th. Half-way through the job, he's sent on an outside call. It's a hurry-up affair; this home call, so he rushes out, planning to charge out the tubes and parts he's used on the Smith job, as well as his time, the next day. But things don't work out that way. The next morning Joe is asked to pick up a couple of sets on his way to work, and Fred takes over the Smith job.

Right off the bat, Fred loses time because he doesn't know how much or what kind of work Joe has done. Furthermore, Fred doesn't concern himself with the time Joe has spent on the job, or the parts he used. Fred, then, makes a fresh start, completes the job, and it goes through billed for only the time and parts used by the second man.

The foregoing is a typical example of how losses arise. There are many similar instances, too numerous to cite. Obviously, the first thing the owner should do after he's satisfied that the forms he uses are foolproof and complete is to insist that whenever a man leaves a repair job unfinished, he put down all time and all components used on the repair. Nothing should be left to memory.

TECHNICIAN editors hope that the accompanying form will be of help to shop owners and service managers; we will be pleased to receive samples of forms readers are successfully using in their own operations.

Bob Middleton, formerly with RCA and Precision Apparatus, has joined the sales-engineering division of Simpson Electric Company, Chicago. In his new position, Bob Middleton will conduct lectures for servicemen throughout the country. A novel twist will be his open invitation to all servicemen who attend the meetings to bring their "can't-fix-it" repair problems to the sponsoring jobber the following morning. Bob will personally tackle each repair.

Simpson's five plants manufacture electronic test equipment and panel instruments.

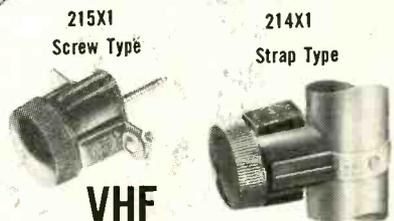
Built for SERVICE

Easy to Install



UHF LIGHTNING ARRESTERS

Accommodate Tubular, Oval, Foam and Jacketed UHF Lines. Low-capacitance design. Standing-wave ratio approximately 2:1 at 800 Mc. Low loss—approximately 1 db at 800 Mc. Listed by Underwriter Laboratories, Inc.



VHF LIGHTNING ARRESTERS

Weather-resistant . . . continually dissipate static charges . . . do not unbalance line . . . easy to install. Listed by Underwriter Laboratories, Inc.

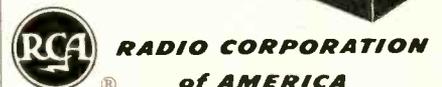


Type 240A1

TV SET COUPLERS

Permit operation of two or more TV sets from single antenna. Easy to install . . . no need to cut or splice twin lead.

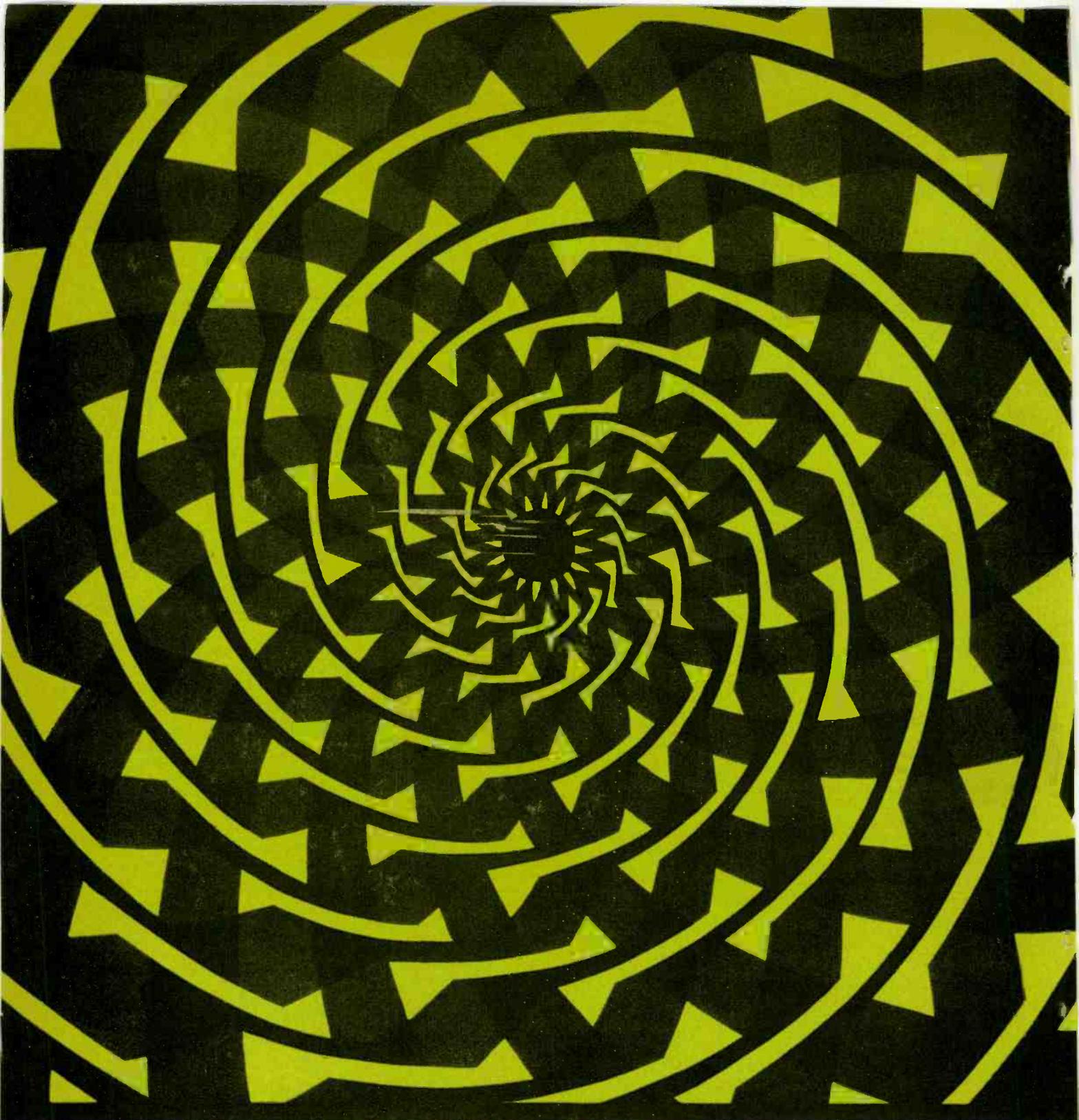
Individually packaged RCA UHF and VHF Arresters, and TV Set Couplers are available in handy display cartons containing 10 units. Get yours from your local RCA Distributor today.



ELECTRONIC COMPONENTS

CAMDEN, N. J.

Burton Browne advertising



THINGS ARE NOT AS THEY SEEM...

Things are not as they seem
These two fuses alike . . .
Until you look inside.



This is not a spiral. It is a series of concentric circles that do not join.

This fuse has a straight element—cannot be made more delicate than 1/16 amp. with normal blowing characteristics.



This fuse has a bridge construction (note short filament between electrodes). This type fuse may be rated as low as 1/500 amp. with precision blowing characteristics required for protection of extremely fine instruments. Without this construction pioneered by Littelfuse—the microscopically fine filament would break in shipment, in normal operating vibration or even from nearby footsteps.



LITTELFUSE

DES PLAINES, ILLINOIS

Littelfuse leads all other fuse manufacturers in design patents on fuses.

ALL "CIRCUIT DIGESTS" TO DATE

Including Current Issue. CIRCUIT DIGEST NOS. 116 to 120 will be found in this issue of TECHNICIAN

All Units Are TV Receivers
Unless Otherwise Noted

ADMIRAL	Circuit Digest No.
Chassis 2242: Models 520M15, 520M16, 520M17.	
Chassis 22A2A: Models 520M11, 520M12.	
Chassis 22M1: Models 121M10, 121M11A, 121M12A, 121M11, 121M12, 121K15A, 121K16A, 121K17A, 121K15, 121K16, 121K17, 221K45A, 221K46A, 221K47A, 221K45, 221K46, 221K47.	
Chassis 22Y1: Models 321M25A, 321M26A, 321M27A, 321M25, 321M26, 321M27, 421M15A, 421M16A, 421M15, 421M16, 421M35, 421M36, 421M37, 521M15A, 521M16A, 521M17A, 521M15, 521M16, 521M17	1
Chassis 19B1: Model 17DX10, 17DX11. Chassis 19C1: Model 121DX12, 121DX16, 221DX15, 221DX16, 221DX17, 221DX26, 221DX38. Chassis 19F1A: Model 121DX11. Chassis 19H1: Model 22DX15	15
Chassis 22A3, 22A3Z: Models 122DX12, 222DX-15B, 222DX16B, 222DX17B, 222UDX15, 222UDX16, 222UDX17, 222DX27B, 322DX16A, 322UDX16	101
Chassis 20A2, 20A2Z, 20D2	111
ANDREA	
Chassis VM21: Models T-VM21, C-VM21, 2C-VM21, CO-VM21	44
ARVIN	
Chassis TE331: Models 6175TM, 6179TM	13
Chassis 337-341: Models 7210, 7212, 7214, 7216, 7218, 7219	45
Tv Dual Tuner, used in Chassis TE 330, 332, 340, 341	75
Chassis TE 359: 9200 series	100
BENDIX	
Chassis T14: Models 21K3, 21KD, 21T3, 21X3, OAK3	20
Chassis T17: Models KS21C, TS21C, Chassis T17-1: Model TS17C	50
Chassis T14-3: Models FM27C, HB27C. Chassis T14-10: Models TM24DS, TB24DS. Chassis T14-11: Models TM24DU, TB24DU	116
CAPEHART	
Chassis CX-36, RF-IF chassis coded R-3, Deflection chassis coded D-4: Models 1T172M, 2C172M, 3C212M, 32212B, 4H212M, B, 5F212M, 6F212M, B, 7F212M, 8F212B, 9F212M, 12F272M, 10W212M, 11W212M	17
Chassis CX-37: Models 1T172MA, 1T172BA, 3C212MA, 3C212MG, 3C212BA, 4H212MA, 4H212BA, 5F212MA, 6F213B, 7F212MA, 8F212BA, 9F212MA, 11W212MA, 1C213M, 2F213F, 3C213M, 4T213M, 4T213B, 5H213M, 8F213B	37
CBS-COLUMBIA	
Chassis 817: Model 17T18, 17M18, 17C18.	
Chassis 820: Model 20T18, 20M18, 20M28	14
Chassis 1027: Models 27C11, 27C21	77
Chassis 750-3: Models 17M06, 22C06, 22C38	95
COLUMBIA RECORDS	
360 Phono Amplifier	43
CROSLEY	
Chassis 380: Models EU17COM, EU-17TOB, EU-117TOM. Chassis 381: Models EU-21CDB, EU-21CDM, EU-21CDN, EU-21COBa, EU-21-COMa	2
VHF Chassis 392: Models EU-COMUa, 21COBUa, 21CDMU, 21CDBU, 21CDNU (Chassis 392 is very similar to the 380—refer to Circuit Digest No. 2)	
Chassis 388: Models EU-30COMU, 30CORU	33
Chassis 393: Models EU-21TOLU, EU-21-TOLBU. Chassis 394: Models EU-21COLU, EU-21COLBU	46
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-17TOLBU; Chassis 403-1: Models F-21TOLU, F-21TOLBU; Chassis 404-1: Models F-21COLU, F-21COLBU, F-21CDLU, F-21CDLBU	82
Chassis 411: Models F-24COLH, F-24COLBH; Chassis 411-1: Models F-24COLU, F-24COLBU	96

Circuit Digest No.	
Chassis 412: Models F-24CDMH, F-24CDBH.	
Chassis 412-1: Models F-24CDMU, F-24CDBU.	
Chassis 416: Models F-27COMH, F-27COBH.	
Chassis 416-1: Models F-27COMU, F-27COBU.	
	106
DE WALD	
Models ET-14OR, DT-163R, DT-163A, ET-170, ET-171, ET-172, ET-191, DT-190D	69
DU MONT	
Chassis RA-164: Model Clinton. Chassis RA-165: Models Beverly, Ridgewood, Shelburne, Milford, Wakefield	3
Chassis RA-166/167, 170/171: Models 17T350, 21T327, 21T328, 21T329, 21T359, 21T366, 21T376, 21T377, 21T378	51
Chassis RA-306, 307: Models Summit RA-306A1 & RA-307A1, Warren RA-306A2 & RA-307A2, Hampton RA-306A3 & RA307A3, Bristol RA-306A4 & RA307A4, Newport RA-306A5 & RA-307A5, Rutland RA-306A6 & RA-307A6, Hartford RA-306A7 & RA307A7, Sheffield RA-306A8 & RA-307A8, Westbrook RA-306A9 & RA-307A9, Windsor RA-306A10 & RA-307A10, Bradford RA-306A11 & RA-307A11, Warwick RA-306A12 & RA307A12	107
Chassis RA-301, 302: Models RA-301-A1, RA-301-A2, RA301-A3, RA-302-A1, RA-302-A2, RA-302-A3	120
EMERSON	
Chassis 120166-D: Models 721D, 728D	10
Chassis 120168-D: Models 716F, 717F, 719F, 727D. Chassis 120169-B: Models 711F, 712F, 720D, 732B, 734B	31
Chassis 120174-B: Models 752A, 755A, 784A; Chassis 120198-D: Models 753F, 785C, 785E	91
ESPEY	
513-C AM-FM Tuner	70
FADA	
The "Imperial" Series: Models 17T6, 17T9, 17C2, 17C4	25
Models U2100C, U2150C, U2100T, UDL2100T, UH21T	83
GENERAL ELECTRIC	
"Stratopower" chassis: Models 17C125, 20C107, 21T1, 21C208, 21C204, 21C201, 21C202, 21C214, 21C206	4

HOW TO FIND MONTH in which any CIRCUIT DIGEST APPEARED

<i>Circuit Digest Numbers</i>	
1-8	Sept. 1952
9-16	Oct. 1952
17-24	Nov. 1952
25-30	Dec. 1952
31-36	Jan. 1953
37-43	Feb. 1953
44-49	Mar. 1953
50-58	Apr. 1953
59-64	May 1953
65-70	June 1953
71-76	July 1953
77-81	Aug. 1953
82-88	Sept. 1953
89-94	Oct. 1953
95-100	Nov. 1953
101-105	Dec. 1953
106-110	Jan. 1954
111-115	Feb. 1954
116-120	Mar. 1954

Note: Months prior to September, 1953, refer to issues of Television Retailing (predecessor of TECHNICIAN)

Circuit Digest No.	
UHF-TUNER Model UHF-103	52
"F" Chassis: Models 17C127, 21T14, 21C115, 21C116, 21C117, 21C119, 21C120, 21C121, 17T15, 21T10, 21T12, 21T4	84
UHF Tuner, Model S-UHF-80	104
Chassis "EE": Models 21T7, 21T8, 21T20, 21T21, 21C225, 21C226, 21C227, 21C228, 21C229, 21C230, 21C231, 21C232, 21C233	113
GRANCO	
UHF Converter Model CTU	74
HALLICRAFTERS	
Chassis A1200D, K1200D or W1200D: Models 1010P, 1012P. Chassis D1200D, L1200D or X1200D: Models 1021P, 1026P. Chassis F1200D: Model 1013C. Chassis G1200D: Models 1022C, 1027C. Chassis U1200D: Model 1056C. Chassis T1200D: Models 1051P, 1055C, 1056C, 1060C, 1061C. Chassis P1200D: Model 1052P. Chassis R1200D: Models 1053P, 1054P. Chassis Z1200D: Models 1057C, 1062C, 1063C. Chassis Z1200D: Model 1057U	21
Chassis A1300D: Model 1075	38
Model TW-1000 World-Wide 8-Band Portable Radio	49
Chassis A1400D: Models 21K201B, 21K211M, 21K221B, 21K231M	102
HOFFMAN	
Chassis 213: Models 21M903, 21B904, 21P905	32
Chassis 403-24: Models 24M725, 24B726, 24P727	92
JACKSON	
Chassis 317A, 320A, 321A, 324A: Models 277, 217, 221-T, 321-C, 217-T, 317-C, 221-C, 621	64
MAGNAVOX	
Model J, K-105 Series: CT331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349	23
UHF Converter Tuner Model 700359	53
107 Series: Chassis CT 358	65
UHF Converter Tuner 595461 (700359 Revised)	80
Chassis 108A series: Models CT, CU & CMU 401A: CT, CU & CMU 402A: CT, CU & CMU 403A: CT, CU & CMU 404A	112
MAJESTIC	
Chassis Series 110-111: Models 21T20, 21T21, 21C30, 21C31, 21D50, 21D51, 21P60, 21P61, 21P62, 21P63, 21P70, 21P71	26
Chassis 112: Models 17T38, 17T40, 17T41, 17C42, 17C43; Chassis 113: Models 21T40, 21T41, 21C42, 21C43	76
MALLORY	
TV-101 UHF Converter	58
MOTOROLA	
Chassis TS-292: Models 21C1, 21C1B, 21F2, 21F2B, 21F3, 21F3B, 21K4, 21K4A, 21K4B, 21K4W, 21K5, 21K5B, 21K6, 21K7. Chassis TS-324: Models 21T4A, 21T4EA, 21T5A, 21T5BA	9
Models TC-101, TC-101B UHF Converters	59
Auto Radio Mopar Models 610T	72
MUNTZ	
Chassis 17B1 or 17B2: Models 2053A, 2054-A, 2055-A, 2056-A. Chassis 17B2: Model 2055-B. Chassis 17B3 or 17B4: Models 2457-A, 2461-A. Chassis 17B5 or 17B6: Models 2158-A, 2159-A, 2162-A	39

(Continued on page 70)

Circuit Digest Index

(Continued from page 69)

Circuit Digest No.	
OLYMPIC	
Chassis TK: Models 17T40, 17T48, 17C44, 17K41, 17K42, 17K50. Chassis TL: Models 20T46, 20T47, 20C45, 20C52, 20C53, 20D49, 20K43, 20K51	30
Chassis TMTN: Models 17T56, 17C57, 17K55, 21T58, 21T69, 21T70, 21T74, 21C65, 21C68, 21C72, 21C73, 21D60, 21D64, 21K61, 21K62, 21K63	68
PACKARD-BELL	
Chassis 2720: Models 2721, 2722. Chassis 2710: Models 2723, 2724	60
Chassis 2740: Models 2742, 2743, 2744, 2842, 2843, 2844	117
PHILCO	
RF Chassis 91, Deflection chassis J-1 used in 1953 Code 126: Models 2269, 2270, 2271, 2273, 1853, 1853L, 2127, 2266, 2268, 2285, 2286, 2287	5
RF Chassis 81, Deflection Chassis H-1: Models 1824, 1825, 1826, 1852, 1852L, 2125, 2125L, 2152, 2152L, 2226, 2227, 2262, 2272, 2272L	22
R-F chassis 97, Deflection chassis J-7: Model 2750	47
All-Speed Record Changer: Model M-24	29
R-F Chassis R-201, Deflection Chassis D-201: Models 4308, 4110, 4108, 3104, 4008	89
R-F Chassis R-191, Deflection Chassis D-191, Code 140: Models 3002, 4002, 4004, 4102, 4106, 4109, 4150, 4302, 4304, 4306, 4307, 4005, 4007, 4107, 4112	118
RADIO CRAFTSMEN	
AM-FM Tuner C-800	28
RAYTHEON	
Chassis 17T1: Model M1733A, C1735A, C1736A. Chassis 17T2: Model M-1734A. Chassis 21T1: Model M-2107A, C-2108A, C-2110A, C-2111A. Chassis 21T2: Model C-2109A	16
UHF Tuner	54
Chassis 21T8: Models UM-2133, UM-2134, UM-2135, UM-2136, UM-2139, UM-2141, UM-2142, UM-2144, UM-2145	94
Chassis 21T11: Models M-2131A, C-2137A and C-2138A	114
RCA VICTOR	
Chassis KCS72: Models 17T200, 17T201, 17T202, 17T211, 17T220	6
UHF Selector Chassis KCS70: Model U70	42
Chassis KCS78 or KCS78B: Models 17-T-301, 17-T-301U, 17-T-302, 17-T-302U, 17-T-310, 17-T-310U	48
UHF Selector Model U2: Chassis KCS79	55

Circuit Digest No.	
Chassis KCS81: Models 21-D-305, 21-D-317, 21-D-326, 21-D-327, 21-D-328, 21-D-329, 21-D-330; Chassis KCS81B: Models 21-D-305U, 21-D-317U, 21-D-326U, 21-D-327U, 21-D-328U, 21-D-329U, 21-D-330U	67
Chassis KCS83C: Models 21-S-354, 21-S-362; Chassis KCS83D: Models 21-S-354U, 21-S-362U	90
Chassis KCS77D, KCS77H: Models 27-D-382U, 27-D-383U, 27-D-384U	103
Chassis KCS84C: Models 24-T-420, 24-T-435	119
Chassis KCS84E: Models 24-T-420U, 24-T-435U	119
REGENCY	
UHF Converter Model RC-600	73
SENTINEL	
Chassis 118: Models 454, 1U-454, 455, 1U-455, 456, 1U-456, 457, 1U-457	18
Models 1U-532, 1U-552, 1U-554	85
Models: 1U-581, 1U-582, 1U-584, 1U-585	108
SHERATON	
Chassis 250XL: Models T1750, T2150, T1755, T2120, T2155, C2125	81
SPARTON	
Chassis 25D213: Models 5342, 5343, 5382, 5383, 5384, 5386, 5390, 5391	24
Chassis 27D213: Models 5342A, 5343A, 5384A, 5386A, 5382A, 5383A, 10352, 10353	40
Chassis 29U213: Models 22312, 22313, 23322, 23323	71
Kingston UHF Converter	105
STANDARD COIL	
Tuner Models TV-1632, TV-2232	86
STEWART-WARNER	
Chassis 9210: Models 9210-C, 21T-9210A, 21C-9210C	34
Models: 24C-9370A, 24C-9370AB	109
STROMBERG-CARLSON	
Chassis 421 series: Models 421 TX, 421 CM, 421 CDM	19
521 Series: Models 521T, 521TO, 521CM, 521CDM, 521C5M, 521C50, 521C5Dec	66
Chassis 621A series	110
SYLVANIA	
Chassis 1-508-1, 1-508-2: Models 172K, KU, M & MU; 175B, BU, L, LU, M & MU; 176B, BU, L, LU, M & MU; 177B, BU, M & MU; 178B, BU, M & MU	12
Chassis 1-504-1, 1-504-2: Models 105B, 105BU, 105M, 105MU. Chassis 1-510-1, 1-510-2: Models 120B, 120BU, 120M, 120MU, 126B, 126BU, 126L, 126LU, 126M, 126MU	35

Circuit Digest No.	
Chassis 1-509-1, 1-509-2: Models 187B, BU, M, MU	41
UHF Converter Models C31M, C32M, C33M	87
Chassis 1-518-1, -2, -3: Models 175-18, 372, 373, 375, 376, 377	97
TRAV-LER	
Chassis 36A2: Models 217-32, 217-33, 220-35, 221-36	27
TRUETONE	
Model 2D1344A	61
Chassis 21T2A; Model 2D1326A	98
MONTGOMERY WARD	
Manual 4107A: Model 25WG-3056A	36
Auto Radio, Model 35BR-6796A	93
WEBSTER-CHICAGO	
Webcor Model 210 Tape Recorder	62
WESTINGHOUSE	
Chassis V-2207-1: Model H-706T16. Chassis V-2220-1: Model H-708T20	11
Model H-803 all channel UHF Tuner	56
Chassis V-2208-1: Model H-716T17	63
Chassis Assembly V-2233-4; Models H-746K21, H-747K21	78
Chassis V-2243-1: Models H-770T21, H-771T21, H-772K21, H-773K21, H-774K21, H-775K21, H-776T21	99
Chassis Assembly V-2250-1: Models H-815T24 and H-817K24	115
ZENITH	
Chassis 19K22: Models K1812E, K1812R. Chassis 19K20: Models K1815E, K1816R, K1820E, K1820R, K1846E, K1846R, K1850E, K1850R, K1880R. Chassis 19K23: Models K2229R, K2258R, K2286R, K2288E. Chassis 21K20: Models K2230E, K2230R, K2240R, K2240E, K2260R, K2263E, K2266, K2266R, K2267E, K2268R, K2270H, K2270R, K2287R, K2290R, K2291E	7
VHF-UHF Turret Tuner	57
Portable Radio Chassis 5L42: Model L507	79
Chassis 22L20: Models L2571R, L2572R, L2573E, L2574R, L2575E, L2592R, L2593H, L2876E, L2876R, L2878R, L2879E, L2894HU	88
BASIC ALIGNMENT DATA	8
Copyright 1954 by Caldwell-Clements, Inc.	

A New Exclusive Service for Television Technicians—

SINGLE SCHEMATICS, 25¢ Each

The publishers of **TECHNICIAN** are receiving so many requests for reprints or additional copies of its **Circuit Digests** that it is now making single schematics available at 25¢ each, post paid and the complete group, as published in any issue, for 50¢

postpaid. For overnight service, air mail special delivery, add 25¢. Schematics for all receivers indexed on these pages are in stock. Be sure to order by **Circuit Digest** number and give brand name and chassis number to prevent error.

Address Reader Service Dept., **TECHNICIAN**, 480 Lexington Ave., New York 17
 Currency or postage must accompany order.

CUT CALL BACKS

Install 1000 Volt Capacitors
at No Extra Cost



RMC DISCAPS . . . The Ceramic Capacitors TV Manufacturers Depend on

With RMC's expanded DISCAP line you can install 1000 V.D.C.W. ceramic capacitors at the same price as ordinary units.

DISCAPS provide added insurance against call backs and is your best protection of service profits.

RMC DISCAPS are supplied in handy, reusable molded plastic boxes. Contents and ratings are determined at a glance.

Ask your jobber for RMC DISCAPS . . . approved and used by leading manufacturers.

RADIO MATERIALS CORPORATION

Factories at Chicago, Ill. and Attica, Ind.

For the name of your nearest RMC jobber contact:

JOBBER SALES COMPANY

NATIONAL DISTRIBUTORS FOR RMC DISCAPS

146 BROADWAY

PATERSON 1, NEW JERSEY

ADVERTISERS INDEX

MARCH, 1954

Admiral Corp.	16
Aerovox Corp.	63
American Phenolic Corp.	59
Astatic Corp.	20
Astron Corp.	51
Audel, Publishers	62

Blonder-Tongue Laboratories	13
---------------------------------------	----

CBS-Hytron Div., Columbia Broad- casting System, Inc.	17
Caldwell-Clements, Inc.	66
Channel Master Corp.	8, 9
Cornell-Dubilier Electric Corp.	52, 65
Coyne Electrical & Television-Radio School	64
Crosley Div., Avco Manufacturing Corp.	2, 3

Delco Div., General Motors Corp.	57
--	----

Electro-Voice	71
-------------------------	----

Finney Co.	14
Fretco Inc.	62

General Cement Manufacturing Co.	53
General Electric Co.	19

Hickok Electrical Instrument Co.	62
--	----

International Resistance Co.	Cover 2
--------------------------------------	---------

JFD Manufacturing Co., Inc.	54
-------------------------------------	----

Karyall Body, Inc.	64
Kenwood Engineering Co., Inc.	71
Kester Solder Co.	58

Littelfuse, Inc.	68
--------------------------	----

Mallory & Co., Inc., P. R.	10
Moss Electronic Distributing Co., Inc.	58

National Radio Institute	72
------------------------------------	----

Philco Corp.	5
Pyramid Electric Co.	47

RCA Institutes, Inc.	21
Radiart Corp.	18
Radio Corp. of America	63, 65, 67, Cover 4

Radio Materials Corp.	71
Raytheon Manufacturing Co.	7
Regency Div., I.D.E.A., Inc.	4

Snyder Manufacturing Co.	49
Sonotone Corp.	12
South River Metal Prods. Co., Inc.	64
Sprague Products Co.	Cover 3
Sylvania Electric Products Inc.	15

Technical Appliance Corp.	11
Triad Transformer Corp.	67
Triplett Electrical Instrument Co.	6
Tung-Sol Electric Inc.	60, 61

Ward Products Corp.	22
Weller Electric Corp.	56

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.

Electro-Voice

CARTRIDGES

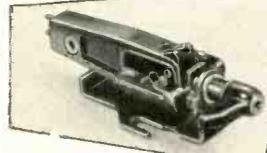
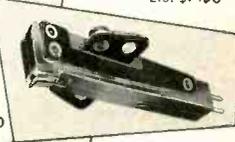
Guarantee

**FINER REPRODUCTION
LONGER RECORD LIFE
MORE NEEDLE PLAYS**



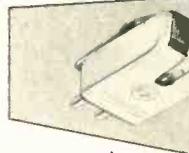
MODEL 43
Ceramic Cartridge.
Plays 78, 45, 33½
rpm with single
2.3-mil all-purpose
needle-tip. Output
.7 to 1.0 volt.
43. Osmium. List \$6.50
43-S. Sapphire. List \$7.50

MODEL 44
Ceramic Cartridge.
Plays 45 and 33½ rpm.
with 1-mil needle.
Impervious to heat and
humidity. Output .7 volt.
44. Osmium. List \$6.50
44-S. Sapphire. List \$7.50



MODEL 46-T
Ceramic Turnover.
Plays 78, 45, 33½
rpm with separate
3-mil Osmium and
1-mil Sapphire tip
needles. Output .7
volt. With turnover
mechanism.
46-T. List \$10.00
46. Without turn-
over mechanism.
List \$9.00

MODEL 16-TT
Crystal Twin Tilt.
Uses one piece twin tip
needle for 78, 45, 33½
rpm. Merely turn selector
handle for 1-mil Sapphire
or 3-mil Osmium tip.
Output 1 volt.
16-TT. List \$10.00
16. Same without tilt
mechanism. List \$9.00



MODEL 12
Crystal Cartridge.
Plays 78 rpm with 3-mil
needle. Light weight.
High compliance.
Tracks perfectly.
Output 2 volts.
With snap-in holder.
12. Osmium. List \$7.50
12-S. Sapphire.
List \$8.50

MODEL 60
Crystal Duo Volt.
Permits selection of
high or medium output
(2 or 4 volts on 33½-45,
and 3 or 6 volts on 78).
No soldering. Uses any
standard 3-mil, 1-mil or all-
purpose needle.
½" mounting hole centers.
60. Less needle. List \$4.95



6 BASIC TYPES make
over 92% of all replacements

With these preferred types, you can quickly make most replacements. By demonstrating the improvement in performance, you can make many more sales. Furthermore, the new E-V high output, high compliance, permanent Ceramic Cartridges are not affected by moisture or heat—and are directly interchangeable with silent-needle type crystal cartridges that do not use a thumb screw. E-V cartridges are widely used in original equipment and for replacement. Send now for **FREE** Phono-Cartridge Replacement Chart No. 170-A.

Crystal cartridges licensed under Brush patents.

Electro-Voice

BUCHANAN • MICHIGAN

KENCO KATE SAYS

**"NO
INSTALLATION
PROBLEMS
when you use
KENCO
MOUNTS"**

**KENCO
6"**

**ALUMINUM SNAP-IN
WALL BRACKET**

Made of heavy gauge high strength aluminum alloy. Snap-in feature eliminates holding of most while applying hardware. Carriage bolts through-out for easy installation. Full thread hex head lag screws permit use of ratchet or speed wrench.

MODEL
6W-AL (less tripod legs)
6W1-AL (1-tripod leg)
6W2-AL (2-tripod legs)

For information on the complete Kenco line write Dept. L.

KENWOOD ENGINEERING CO., INC.
Kenilworth, New Jersey

An Invitation . . .

To men who want to "go places" in TV SERVICING

Find out about this NEW,
ALL-PRACTICE WAY
of becoming a Professional
TV SERVICEMAN

If you have some Radio or Television experience, or if you know basic Radio-Television principles but lack experience—NRI's new Professional Television Servicing course can train you to go places in TV servicing. This advertisement is your personal invitation to get a free copy of our booklet describing this training in detail.

Learn-by-Doing "All the Way"

This is 100% learn-by-doing, practical training. We supply all components, all tubes, including a 17-inch picture tube, and comprehensive manuals covering a thorough program of practice. You learn how experts diagnose TV defects quickly. You see how various defects affect receiver performance—picture and sound; learn causes of defects, accurately, easily, and how to fix them. You do more than just build circuits. You get practice recognizing, isolating, and fixing innumerable troubles.

You get actual experience aligning TV receivers, diagnosing the causes of complaints from scope patterns, eliminating interference, using germanium crystals to rectify the TV picture signal, obtaining maximum brightness and definition by properly adjusting the ion trap and centering magnets, etc. There isn't room on this or even several pages of this magazine to list all the servicing experience you get.

UHF & COLOR TV Making New Boom

Installing front-end channel selector strips in modern UHF-VHF Television receivers and learning UHF servicing problems and their solution is part of the practice you get. To cash in on the coming color TV boom you'll need the kind of foundation in knowledge and experience this training gives.

Get Details of New Course Free

Once again—if you want to go places in TV servicing, we invite you to find out what you get, what you practice, what you learn from NRI's new course in Professional Television Servicing. See pictures of equipment supplied, read what you practice. Judge for yourself whether this training will further your ambition to reach the top in TV servicing. We believe it will. We believe many of tomorrow's top TV servicemen will be graduates of this training. Mailing the coupon involves no obligation.



Train at home easily, quickly, for TV's top servicing jobs. NRI's Professional Television Servicing course includes a 17-inch picture tube and all other tubes and components to build a complete TV Receiver, Oscilloscope, Signal Generator, H.F. Probe. Complete training, including all equipment, available now for a low introductory price—under \$200 on easy terms.



National Radio Institute, Dept. 4CUT
16th and U Sts., N.W., Washington 9, D. C.

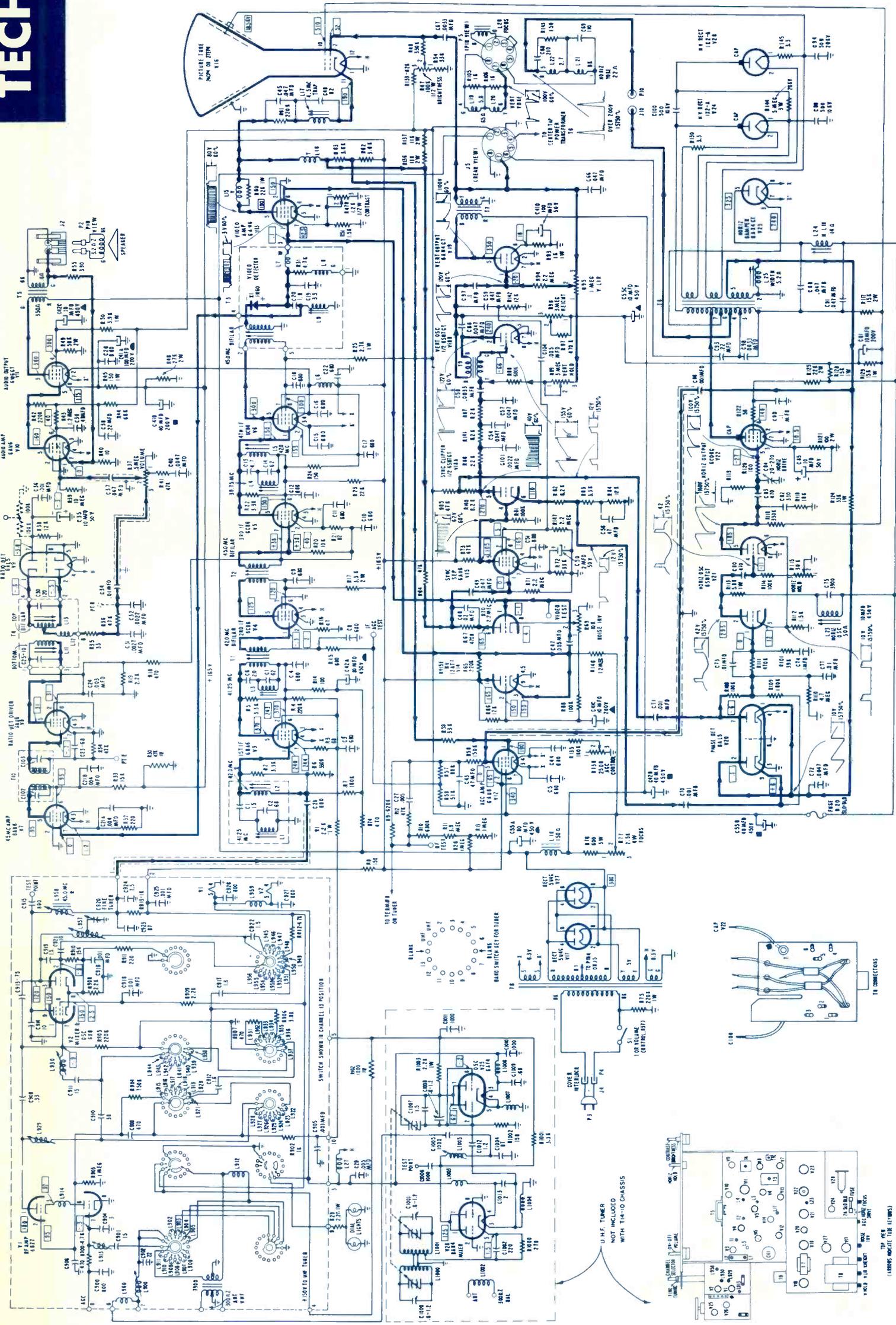
Please send my FREE copy of "How to Reach the Top in TV Servicing." I understand no salesman will call.

Name Age

Address

City Zone State

- NOTES:
1. ALL RESISTORS ARE 1/2W WITH VALUES IN OHMS UNLESS OTHERWISE SPECIFIED.
 2. RESISTORS ARE IN OHMS UNLESS OTHERWISE NOTED.
 3. MEASUREMENTS ARE IN OHMS UNLESS OTHERWISE NOTED.
 4. MEASUREMENTS ARE IN OHMS UNLESS OTHERWISE NOTED.
 5. MEASUREMENTS ARE IN OHMS UNLESS OTHERWISE NOTED.
 6. MEASUREMENTS ARE IN OHMS UNLESS OTHERWISE NOTED.



NOISE INVERTER ADJUSTMENT

NOTE: The noise inverter control is adjusted at the factory to give optimum performance under varied conditions. Therefore, adjustments should be made only when necessary. If the picture has a high noise level, or this control becomes adjusted by one means or another it can be satisfactorily set by the following procedure:

Select and properly tune in the strongest station in the area. Turn the noise inverter control to its maximum position (full clockwise). With the noise inverter control set at minimum, slowly turn it in the clockwise direction until a slight shifting of the picture in the horizontal plane is observed, then back off (counter clockwise) 1/8 of a turn.

CAUTION: If this control is set too far in the clockwise direction, an erratic jumping of the picture will be encountered when switching channels.

FOCUS COIL ADJUSTMENT

The focus coil is held to the yoke mounting assembly by 3 slotted "L" brackets. By loosening the 11/32 nuts holding these brackets, the focus coil can be moved either forward or backward to obtain the optimum focus position, or tilted to any position which might be required for proper centering of the picture. The focus control should be set at mid-range before the optimum focus position is determined. Still further adjustment can be made by loosening the self-tapping screws that hold the coil to the "L" brackets. This allows the coil to be moved in a vertical to horizontal plane about the neck of the tube removing any shadows which may have appeared during the previous adjustment.

- Chassis T11-3: Models
FM27C, HB27C
Chassis T11-10: Models
TM24DS, TB24DS
Chassis T11-11: Models
TM24DU, TB24DU

BENDIX Chassis T14-3, T14-10, T14-11 Technician CIRCUIT DIGEST 116

I. F. ALIGNMENT
Remove the AGC Amplifier (V12) from its socket. Connect the negative terminal of a 3 volt dry cell supply to the I.F. AGC test point and the positive terminal to chassis ground.

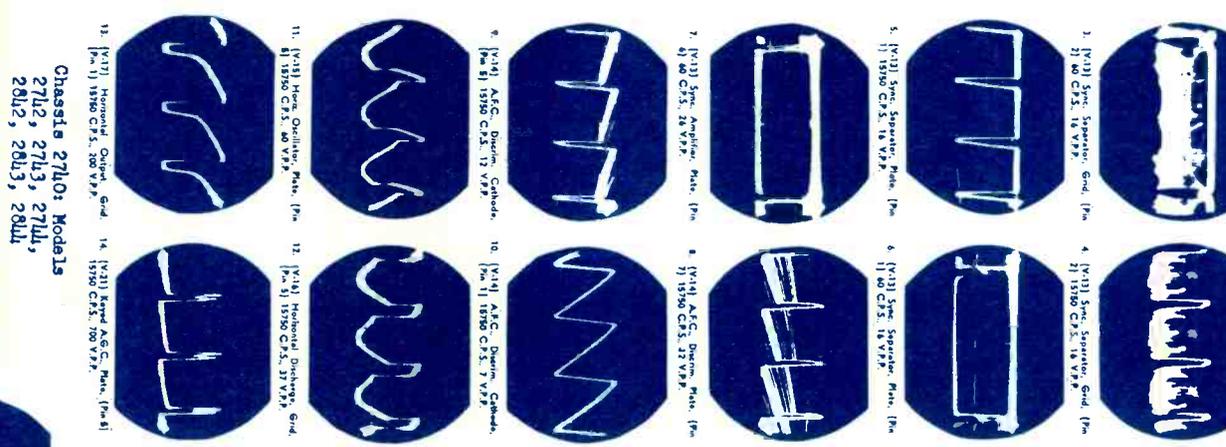
Generator Freq.	VTVM Connections	Adjustment	Remarks
45 MC	To Test Point (C) and Ground	T3-T2-L958*	Adjust for Max.
42 MC	To Test Point (C) and Ground	L5-T1-L2*	Adjust for Max.
41.25 MC	To Test Point (C) and Ground	L1-L3	Adjust for Min. with output of Signal Gen. at Max.
39.75 MC	To Test Point (C) and Ground	L4	Adjust for Min. with output of Signal Gen. at Max.

NOTE: It will be necessary to repeat the steps outlined above for optimum performance of the IF system. * The designated frequencies for L958 and L2 are to be used for preliminary alignment only. Since these two coils comprise a band pass circuit, final alignment should be made with a sweep generator.

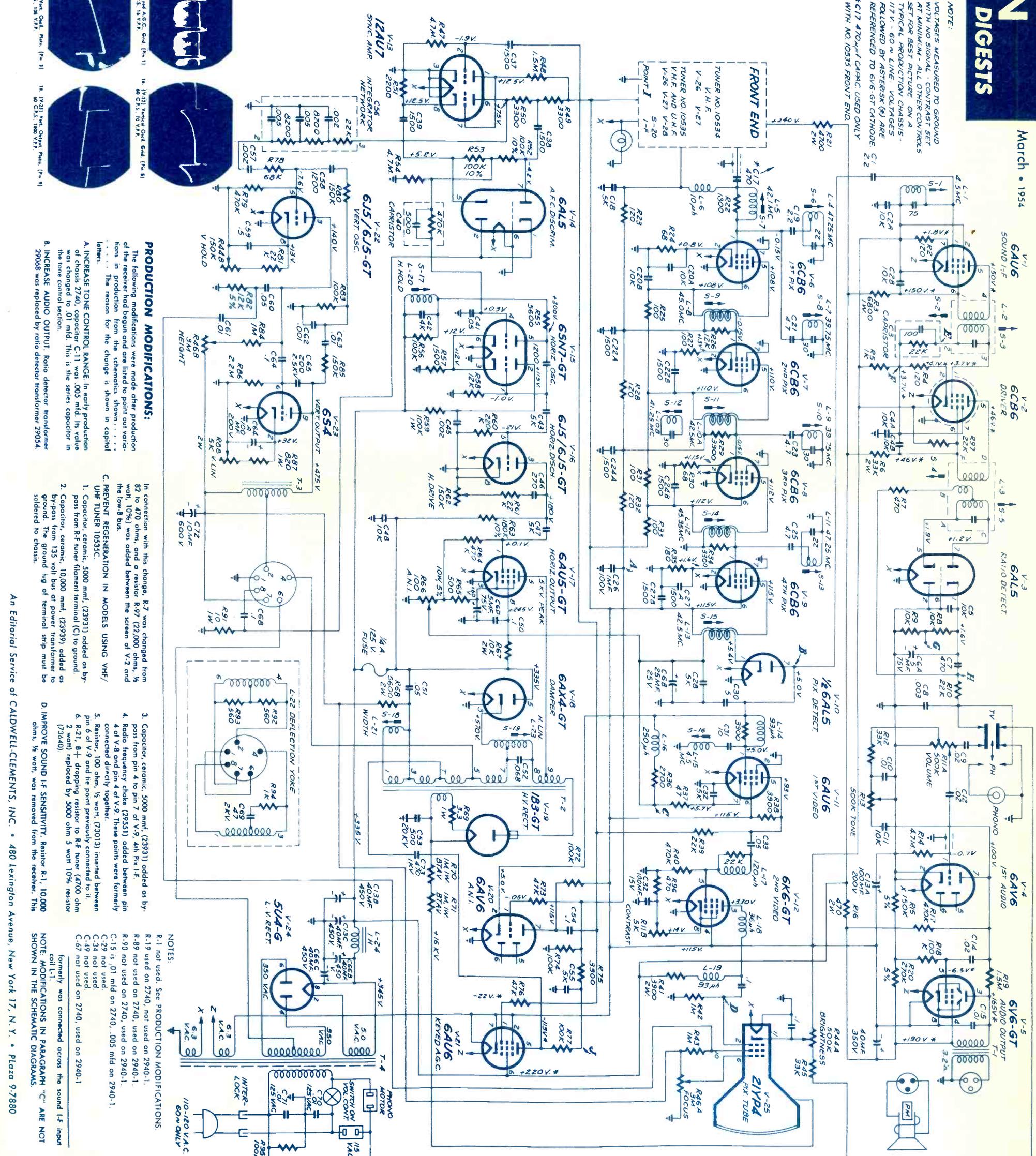
SOUND ALIGNMENT
Connect the Negative Terminal of a 9 Volt dry cell supply to the I.F. AGC test point and the Positive Terminal to Chassis ground.

Signal Generator Coupling	Frequency	Connect	Adjust	Remarks
High side to Pin 1 of V13 (Video Amp)	4.5 MC	DC probe of VTVM to "PT. E." Common lead to chassis.	L9 (top & bottom)	Adjust for Max reading keeping height of picture about 4V on "PT. E."
SAME	4.5 MC	Parallel R38 with two 100K resistors which are within 1% of each other. DC probe of VTVM to "PT. A." Common lead to Chassis.	L11	Adjust for Max reading
SAME	4.5 MC	DC probe of VTVM to "PT. B." Common lead to "PT. A."	L13	Adjust for Zero reading at cross over.

NOTE: VOLTAGES MEASURED TO GROUND WITH NO SIGNAL. CONTRAST SET AT MINIMUM - ALL OTHER CONTROLS SET FOR BEST PICTURE ON A TYPICAL PRODUCTION CHASSIS - 117V - 60 W LINE VOLTAGES. FOLLOWED BY ASTERISK (*) ARE REFERENCED TO 6V-6T CATHODE WITH NO. 10535 FRONT END.



1. [V-11] Sync Separator, Grid, (Pin 1) 40 C.F.S., 18 V.P.P.
 2. [V-11] Sync Separator, Grid, (Pin 1) 150 C.F.S., 18 V.P.P.
 3. [V-11] Sync Separator, Grid, (Pin 1) 150 C.F.S., 18 V.P.P.
 4. [V-11] Sync Separator, Grid, (Pin 1) 150 C.F.S., 18 V.P.P.
 5. [V-11] Sync Separator, Grid, (Pin 1) 150 C.F.S., 18 V.P.P.
 6. [V-11] Sync Separator, Grid, (Pin 1) 150 C.F.S., 18 V.P.P.
 7. [V-11] Sync Separator, Grid, (Pin 1) 150 C.F.S., 18 V.P.P.
 8. [V-11] Sync Separator, Grid, (Pin 1) 150 C.F.S., 18 V.P.P.
 9. [V-11] Sync Separator, Grid, (Pin 1) 150 C.F.S., 18 V.P.P.
 10. [V-11] Sync Separator, Grid, (Pin 1) 150 C.F.S., 18 V.P.P.
 11. [V-11] Sync Separator, Grid, (Pin 1) 150 C.F.S., 18 V.P.P.
 12. [V-11] Sync Separator, Grid, (Pin 1) 150 C.F.S., 18 V.P.P.
 13. [V-11] Sync Separator, Grid, (Pin 1) 150 C.F.S., 18 V.P.P.
 14. [V-11] Sync Separator, Grid, (Pin 1) 150 C.F.S., 18 V.P.P.



PRODUCTION MODIFICATIONS:
 The following modifications were made other production of the receiver had begun and are listed to point out variations in production from the schematics shown.
 A. INCREASE TONE CONTROL RANGE. In early production of chassis 2740, capacitor C-11 was .005 mfd. Its value was changed to .01 mfd. This is the series capacitor in the tone control section.
 B. INCREASE AUDIO OUTPUT. Ratio detector transformer 2908 was replaced by ratio detector transformer 29054.

C. PREVENT REGENERATION IN MODELS USING VHF/ UHF TUNER 10535C.
 1. Capacitor, ceramic, 5000 mmf. (23931) added on by-pass from RF tuner filament terminal (C) to ground.
 2. Capacitor, ceramic, 10,000 mmf. (23939), added as by-pass from 135 volt bus at power transformer to chassis. The ground lug of terminal strip must be soldered to chassis.

D. IMPROVE SOUND I.F. SENSITIVITY. Resistor R-1, 10,000 ohms, 1/2 watt, was removed from the receiver. This formerly was connected across the sound I.F. input coil L-1.
 NOTE: MODIFICATIONS IN PARAGRAPH "C" ARE NOT SHOWN IN THE SCHEMATIC DIAGRAMS.

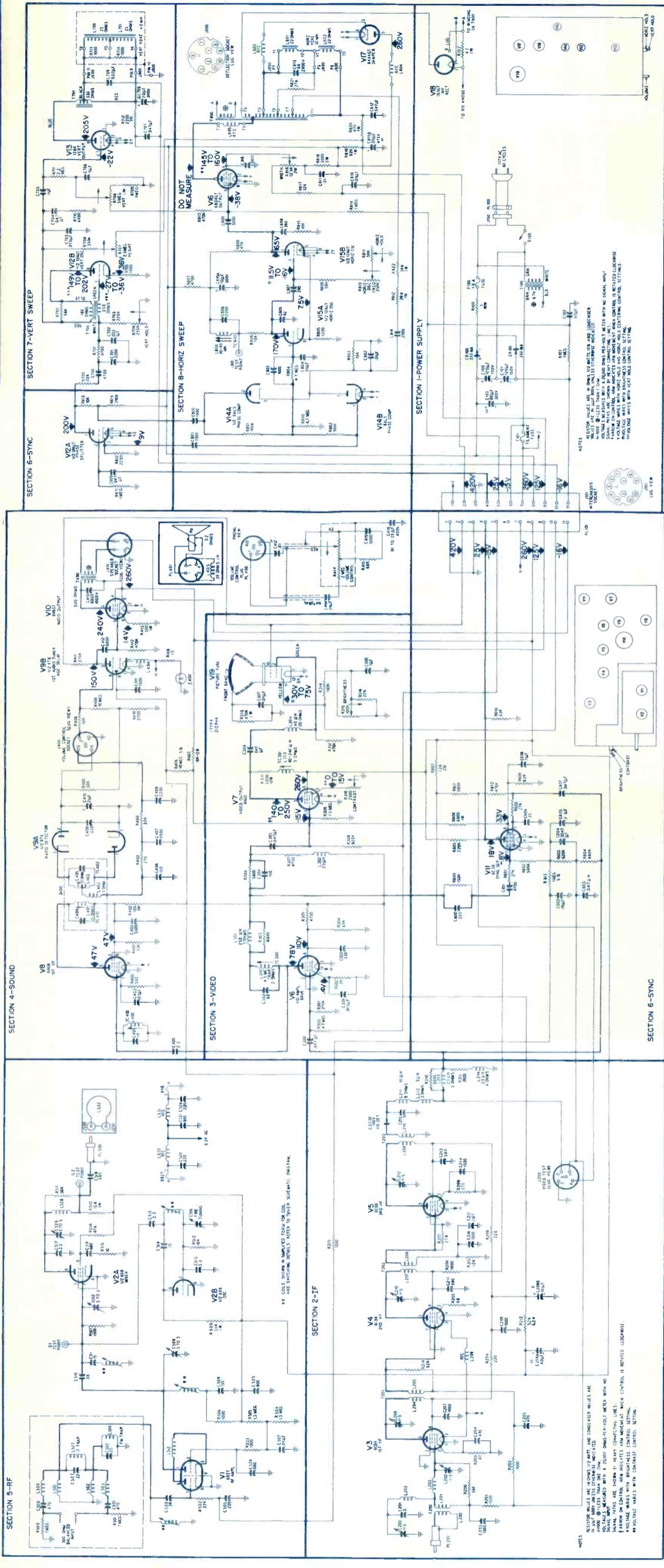
NOTES:
 R-1 not used. See PRODUCTION MODIFICATIONS.
 R-19 used on 2740, not used on 2940-1.
 R-89 not used on 2740, used on 2940-1.
 R-90 not used on 2740, used on 2940-1.
 C-15 is .01 mfd on 2740, .005 mfd on 2940-1.
 C-29 not used.
 C-34 not used.
 C-67 not used on 2740, used on 2940-1.
 col. L-1.
 110-120 V.A.C. 60W ONLY

TRANSMISSION LINE 300-ohm, twin-wire lead
 POWER CONSUMPTION... without UHF, 175 watts;
 with UHF, 180 watts

INTERMEDIATE FREQUENCIES
 Video Carrier 45.75 mc.
 Sound (intercarrier) 4.75 mc.
 OPERATING VOLTAGE 110 to 120 volts,
 60 cycles, a. c.

UHF TUNING (if provided) Continuous tun-
 ing, covering UHF Television Channels 14 through
 83; fine and coarse tuning

SPECIFICATIONS
 VHF TUNING Twelve channel, 12-position
 incremental tuner, covering VHF Television Chan-
 nels 2 through 13; fine tuning of local oscillator



CIRCUIT DESCRIPTION

Philco "B" line, Code 140, Television Receivers use two chassis—the r-f chassis R-191, containing the r-f, video, audio, and sync circuits, and deflection chassis D-191, containing the power and deflection circuits. Since these chassis are not isolated from the 60-cycle power line, all protruding shafts and mounting feet are insulated from the chassis.

R-F Chassis R-191, Deflected on Chassis D-191
 Models 3002, 4002, 4004, 4102, 4106, 4109, 4150, 4302, 4304, 4306, 4307, 4005, 4007, 4107, 4112

IMPORTANT

A-C LINE ISOLATION
CAUTION: The side of the a-c line is connected to the chassis through C101 and L403. The other side of the a-c line is connected to the chassis through F100, R100, CR101, and C103, in series. Grounding the chassis will result in a short circuit across one or the other of these two branches in the voltage-doubler circuit. During servicing and alignment it is desirable that an a-c line isolation transformer capable of handling at least 225 watts (Philco Part No. 45-9600) be used. Failure to use an isolation transformer will greatly increase the shock hazard, and may result in damage to the test equipment or receiver, or both.

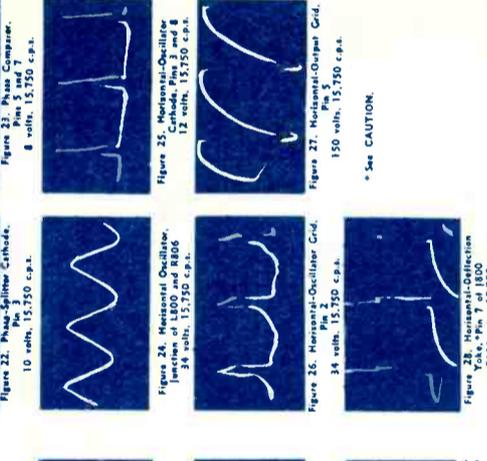
B SUPPLY FUSE REPLACEMENT
 The B supply protective fuse, F100, is wired into the low-voltage section, and is in series with the selenium rectifiers. For replacement, use a 1.6-ampere delayed-action-type fuse, Philco Part No. 45-2656-23.

CAUTION: Discharge the circuit before replacing the fuse.

HORIZONTAL-OSCILLATOR ADJUSTMENT
 To adjust the horizontal-oscillator circuit, tune in a station and proceed as follows:

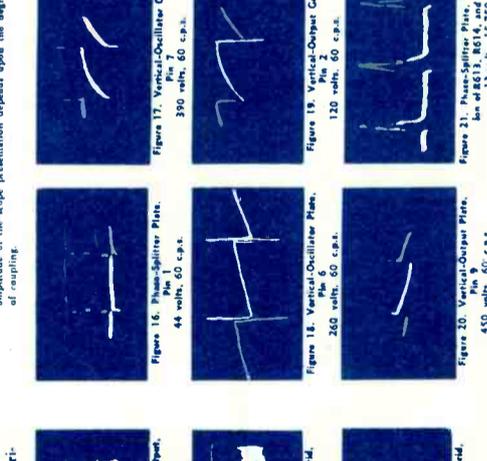
OSCILLOSCOPE WAVEFORM PATTERNS

These waveforms were taken with the receiver adjusted for an approximate peak-to-peak output of 2 volts at the video detector. The voltages given with the waveforms are approximate peak-to-peak values. The frequencies shown are those of the waveforms—not the sweep rate of the oscilloscope. The waveforms were taken with an oscilloscope having good high-frequency response. With oscilloscopes having poor high-frequency response, the sharp peaks of the horizontal waveforms will be more rounded than those shown, and the peak-to-peak voltages will differ from those shown.



OSCILLOSCOPE WAVEFORM PATTERNS

These waveforms were taken with the receiver adjusted for an approximate peak-to-peak output of 2 volts at the video detector. The voltages given with the waveforms are approximate peak-to-peak values. The frequencies shown are those of the waveforms—not the sweep rate of the oscilloscope. The waveforms were taken with an oscilloscope having good high-frequency response. With oscilloscopes having poor high-frequency response, the sharp peaks of the horizontal waveforms will be more rounded than those shown, and the peak-to-peak voltages will differ from those shown.



OSCILLOSCOPE WAVEFORM PATTERNS

These waveforms were taken with the receiver adjusted for an approximate peak-to-peak output of 2 volts at the video detector. The voltages given with the waveforms are approximate peak-to-peak values. The frequencies shown are those of the waveforms—not the sweep rate of the oscilloscope. The waveforms were taken with an oscilloscope having good high-frequency response. With oscilloscopes having poor high-frequency response, the sharp peaks of the horizontal waveforms will be more rounded than those shown, and the peak-to-peak voltages will differ from those shown.



PHILCO
R-F Chassis R-191
Deflection Chassis
D-191

Technician
CIRCUIT DIGEST
118

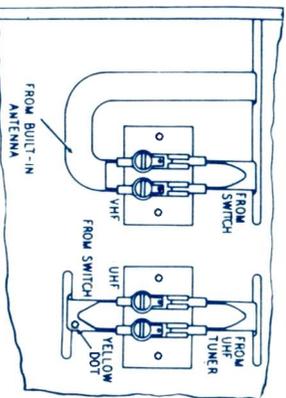


Figure 51. Antenna-Lead Connections, Common Built-In Antenna

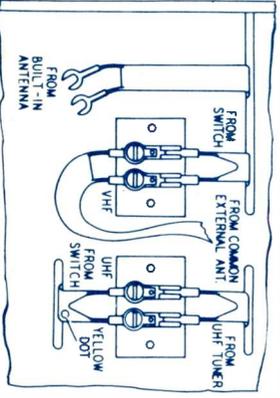


Figure 52. Antenna-Lead Connections, Common External Antenna

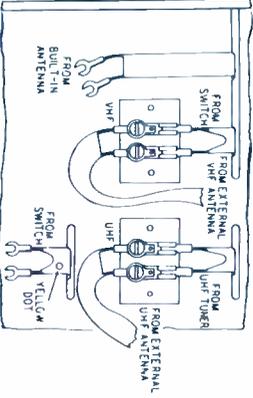


Figure 53. Antenna-Lead Connections, Separate External Antennas

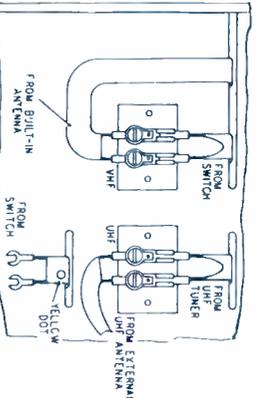


Figure 54. Antenna-Lead Connections, VHF Built-In and UHF External Antennas

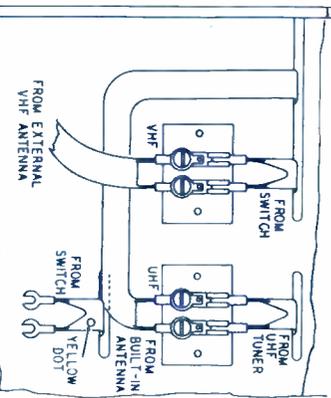


Figure 55. Antenna-Lead Connections, VHF External and UHF Built-In Antennas

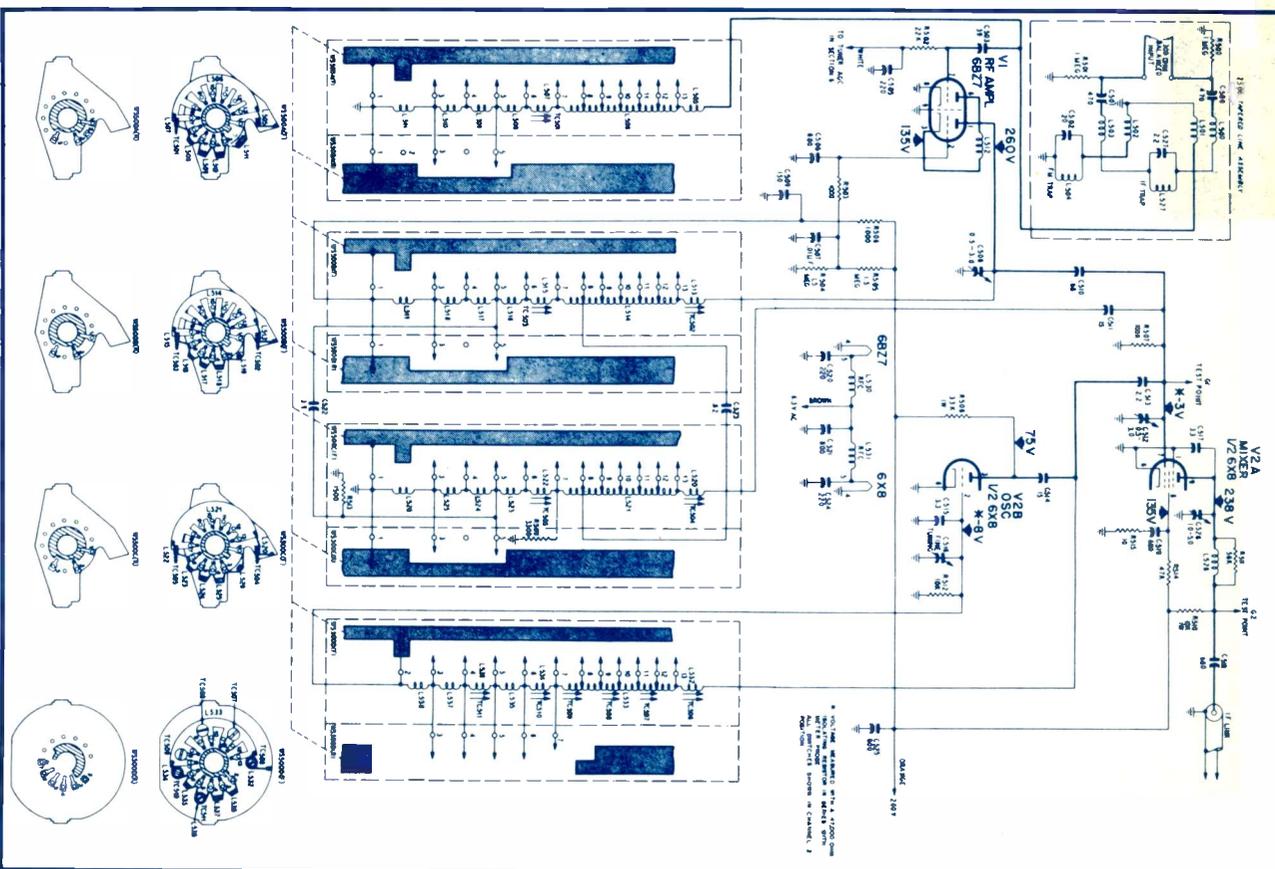


Figure 32. Television (VHF) Tuner, Part No. 76-8400, Schematic Diagram

VIDEO PEAKING-COIL ADJUSTMENT

The video peaking coil, L303, is adjusted at the factory for proper transient response of the video current. Ordinarily, this coil will require no further adjustment by the serviceman. On any station where excessive overshoot or excessive smear is present, a slight adjustment of L303 may improve the picture quality on that station; however, this adjustment may sacrifice the quality on other channels. If L303 is replaced in servicing, adjustment will be required.

Before adjusting L303, check the tuner alignment and if alignment is correct. Then tune in a station and adjust L303 until there are no trailing whites or smear in the picture. Turning TC301 clockwise reduces trailing whites and overshoot; turning TC301 counterclockwise reduces picture smear and increases trailing whites. The proper position is the point where no smear or trailing whites appear in the picture.

The above procedure for adjustment of TC301 applies to a particular station exhibiting smear or overshoot. After TC301 is adjusted, reception on all the other stations should be checked, to make certain that the adjustment has not impaired the picture quality.

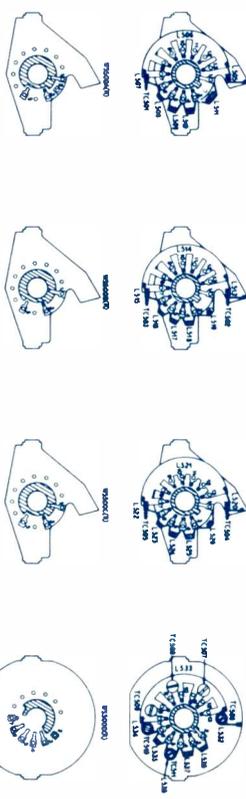


Figure 32. Television (VHF) Tuner, Part No. 76-8400, Schematic Diagram

Oscillator Alignment

General
 Tuning cores are provided in the oscillator coils at channels 13, 11, 9, 7, 6, and 4. By adjusting these tuning cores, all channels may be placed on frequency. This procedure should be carried out with the highest-frequency channel first, since the alignment of each channel affects the alignment of all the channels below it in frequency. The channel adjustments are so arranged that, with one exception, each adjustment corrects the tuning of more than one channel. The coverage of the various adjustments is as follows:

CHANNEL ADJUSTMENT	CHANNELS CORRECTED BY ADJUSTMENT
13	13 and 12
11	11 and 10
9	9 and 8
7	7 only
6	6 and 5
4	4, 3, and 2

Figure 37. Philco UHF Tuner-Adapter UT22, Part No. 43-6703, Schematic Diagram

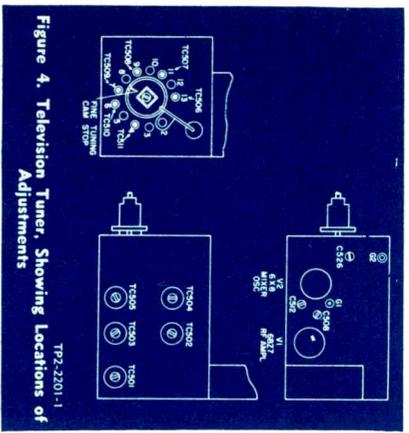
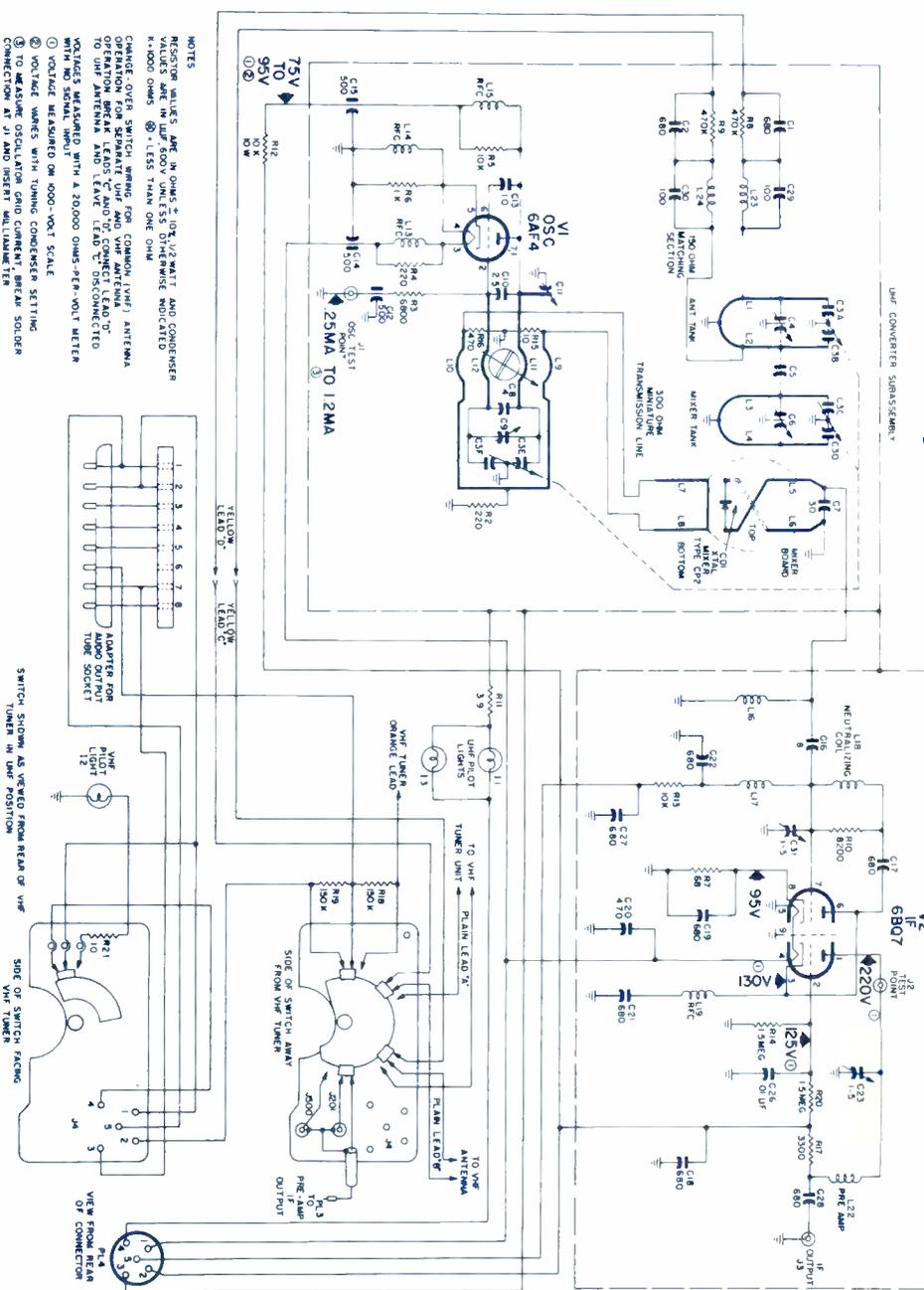


Figure 4. Television Tuner Showing Locations of Adjustments

The FINE TUNING gain should be preset for all adjustments by placing the stop on the FINE TUNING gain between the Channel 7 and 8 holes on the front plate of the tuner.

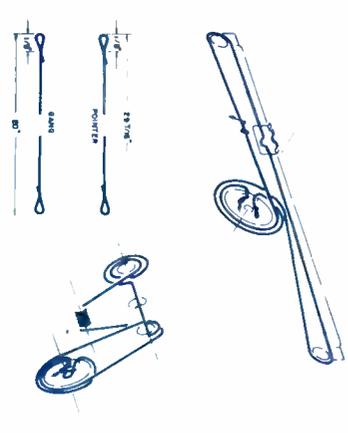


Figure 39. Drive-Cord Strapping Arrangement

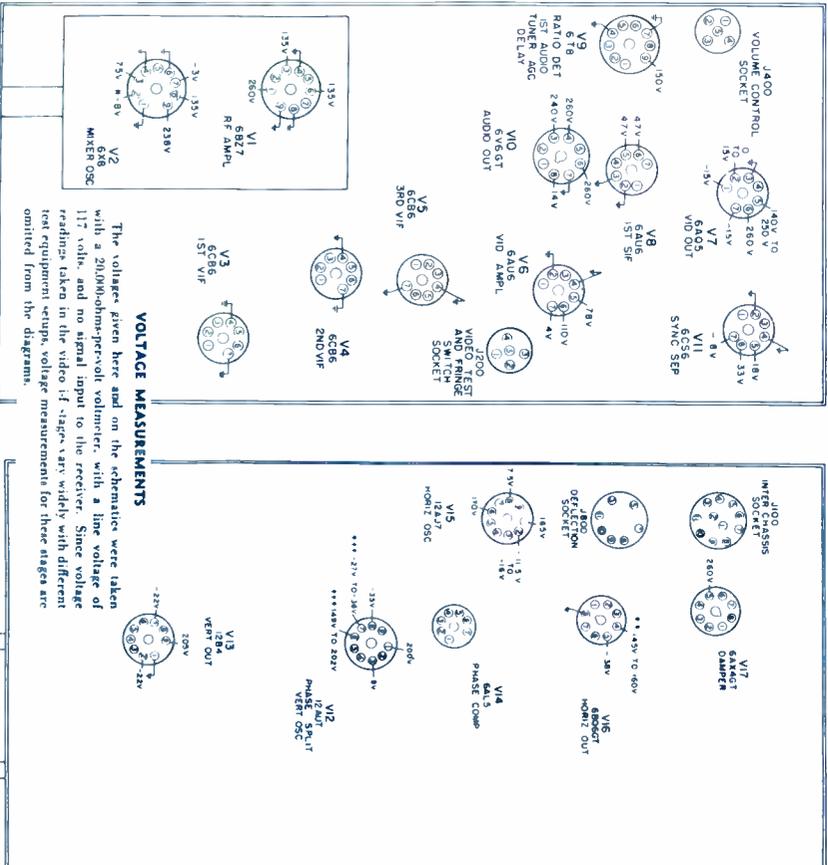


Figure 29. R-F Chassis R-191, Bottom View, Showing Voltages at Socket Pins

VOLTAGE MEASUREMENTS
 The voltages given here and on the schematics were taken with a 20,000-ohm-per-volt voltmeter, with a line voltage of 117 volts, and no signal input to the receiver. Since voltage readings taken in the video if stage vary widely with different test equipment setups, voltage measurements for these stages are omitted from the diagrams.

VOLTAGE MEASUREMENTS
 ** VOLTAGE TAKEN WITH METER HOLD CONTROL SETTING IN SERIES WITH METER PROBE
 *** VOLTAGE TAKEN WITH METER HOLD CONTROL SETTING IN SERIES WITH METER PROBE

ALIGNMENT PROCEDURE

(Continued from reverse side)

The correct adjustment of C20 is indicated by maximum amplitude of the curve midway between the markers C15 and C16. The r-f amplifier plate circuit and the frequency of the bias band most noticeably. C7 tunes the mixer grid circuit and, after C20, the bias band (500 kc) is slightly compressed. The bias band (500 kc) is slightly compressed by adjustment and hence primarily affects the response band width.

Connect the "VoltOhm" to test point TP1. Adjust C5 to read -3.0 volts dc on the "VoltOhm" at TP1. Readjust C2, C7, C10 and C15 for proper response. Adjust C20 for maximum gain at midpoint of the curve. Repeat if necessary until the proper response is obtained.

Set the receiver channel switch to channel 13. Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Turn the fine tuning control fully clockwise. Adjust L42 to obtain an audible beat. Slightly overshoot the adjustment of L42 by turning the plug an additional turn in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C2 to again obtain the beat.

Set the sweep generator to channel 13. From the signal generator, insert channel 13 sound and picture carrier markers, L41, 25 mc, and 215.75 mc. Adjust L43 and L45 for proper response as shown in Figure 18.

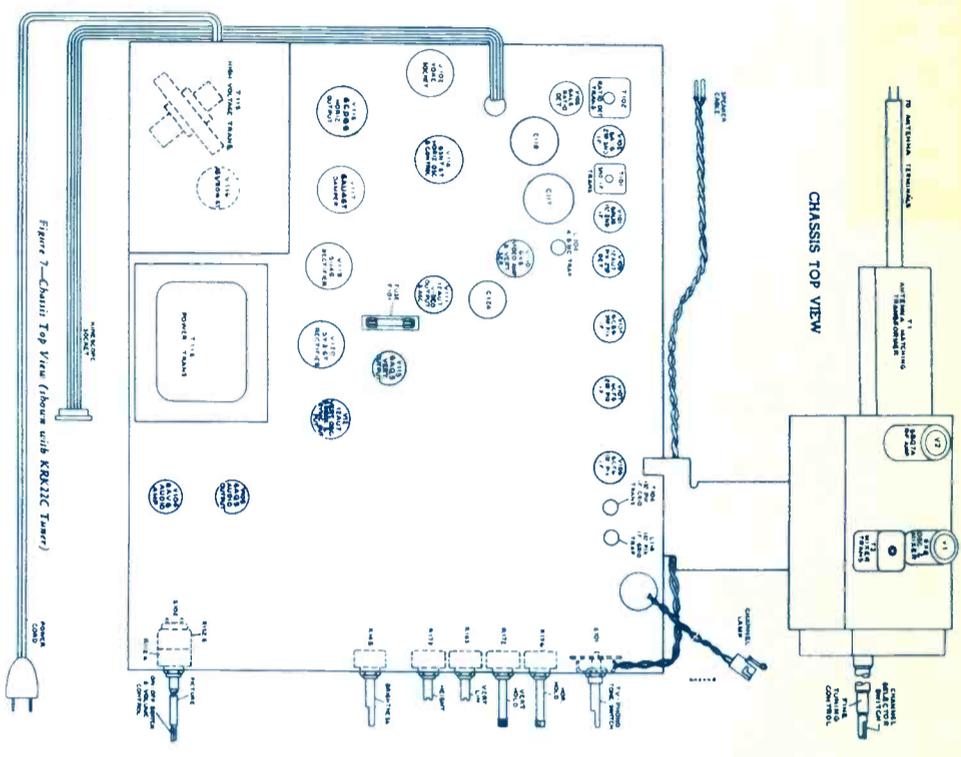


Figure 7—Chassis Top View (shown with KRK32C Tuner)

L44, L46 and L58 in order to obtain curves within the proper limits.

Switch the channel selector, signal generator and marker generator through channels 7 to 13 and observe the response curves, referring to Figure 18 for proper wave shape. Check the injection voltage of each channel to be within limits. If necessary, readjust C15, C7, or C10 to obtain the proper response.

With the receiver and signal generator on channel 13 and just L42 for an audible beat with the signal generator. Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator plug to obtain the audible beat. It should be possible to adjust the oscillator injection voltage on each channel. Check the oscillator injection voltage on each channel to verify that the voltage is within the specified limits.

Turn off the sweep and signal generators. Connect the "VoltOhm" to the tuner test point TP1. Check the oscillator injection voltage to be within limits as previously specified. Adjust if necessary to bring within range.

If it was necessary to readjust C5, turn the sweep and signal generator back on and recheck the channel 13 response. Readjust L43 and L45 if necessary. Set the receiver channel selector switch to channel 8 and readjust C2 for proper oscillator frequency, 227 mc. Set the sweep generator and signal generator to channel 8. Readjust C7, C10, C15 and C20 for correct wave shape, frequency and bandwidth.

Turn off the sweep and signal generators, switch back to channel 13 and check the oscillator injection voltage at TP1 if C7 was adjusted in the recheck of channel 8 response. If the initial setting of the oscillator injection trimmer was far off, it may be necessary to adjust the oscillator frequency and response on channel 8, adjust the oscillator injection on channel 13 and repeat the tracing procedure several times before the proper setting is obtained.

Turn off the sweep generator and switch the receiver to channel 6. Adjust the signal generator to the channel 6 oscillator frequency 129 mc. Set the fine tuning control to the center of its mechanical range. Adjust L44, L46 and L58 for proper response as shown in Figure 18. Recheck the oscillator injection voltage of TP1 to insure that it is within the limits specified. Readjust C5 if necessary.

If C5 required adjustment, switch the receiver and the signal generator to channel 8. Readjust C7 for correct frequency.

Check the response of channels 2 through 6 by switching the receiver channel switch, sweep generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See Figure 18 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

If the markers fail to fall within this requirement, readjust the fine tuning control fully clockwise.

Tube No.	Tube Type	Function	Operating Conditions	E-Plane	E-Screen	E-Cathode	E-Grid	Notes on Measurements
V1	6BG7A	R-F Amplifier	15000 Mc V No Signal	6 133	6 111	7 0	0	
V2	6BD6	Mixer	15000 Mc V No Signal	9 180	8 150	6 0	7 -2.4V -3.0V	
V3	6X4	R-F Oscillator	15000 Mc V No Signal	3 95	6 0	2 -3.8V -5.5V	-0.51	
V4	6AV6	I-F Amplifier	15000 Mc V No Signal	5 205	6 122	7 0	-2.05	
V5	6AU6	2nd I-F Amplifier	15000 Mc V No Signal	5 210	6 130	7 0	-2.05	
V6	6AL5	Detector	15000 Mc V No Signal	7 4.1	1 21	1 11.8	-1.12	
V7	6AV6	I-F Amplifier	15000 Mc V No Signal	2 1.7	5 11.6	1 -7	-	
V8	6AQ5	Audio Output	15000 Mc V No Signal	5 198	6 220	2 14.5	1.7	At max volume
V9	6C7S	I-F Amplifier	15000 Mc V No Signal	5 218	6 240	2 13.2	1.7	At max volume
V10	6C7S	I-F Amplifier	15000 Mc V No Signal	5 95	6 105	2 1.18	1	-0.1
V11	6C7S	I-F Amplifier	15000 Mc V No Signal	5 222	6 243	2 -0.1	1	-0.45
V12	6C7S	I-F Amplifier	15000 Mc V No Signal	5 95	6 105	2 0.53	1	<0.1
V13	6C7S	I-F Amplifier	15000 Mc V No Signal	5 138	6 150	2 2.3	1	0
V14	6C7S	I-F Amplifier	15000 Mc V No Signal	5 130	6 143	2 2.2	1	0
V15	6C7S	I-F Amplifier	15000 Mc V No Signal	5 25	6 1	2 2.2	1	<0.1
V16	6C7S	I-F Amplifier	15000 Mc V No Signal	5 25	6 1	2 2.2	1	<0.1
V17	6C7S	I-F Amplifier	15000 Mc V No Signal	5 25	6 1	2 2.2	1	<0.1
V18	6C7S	I-F Amplifier	15000 Mc V No Signal	5 25	6 1	2 2.2	1	<0.1
V19	6C7S	I-F Amplifier	15000 Mc V No Signal	5 25	6 1	2 2.2	1	<0.1
V20	6C7S	I-F Amplifier	15000 Mc V No Signal	5 25	6 1	2 2.2	1	<0.1

Tube No.	Tube Type	Function	Operating Conditions	E-Plane	E-Screen	E-Cathode	E-Grid	Notes on Measurements
V108	12AU7	Rect. Sync Separator	15000 Mc V No Signal	6 280	8 180	7 122	1.22	
V109	6X4	Video Amplifier	15000 Mc V No Signal	6 283	8 105	7 94.5	94.5	AGC control set for screen operation
V110	6X4	Video Amplifier	15000 Mc V No Signal	8 120	8 147	6 9	7 -1.85	AGC control set for screen operation
V111	12AU7	Video Amplifier	15000 Mc V No Signal	6 225	8 125	7 0	0	
V112	12AU7	Video Amplifier	15000 Mc V No Signal	6 231	8 125	7 0	0	
V113	12AU7	Video Amplifier	15000 Mc V No Signal	6 231	8 125	7 0	0	
V114	12AU7	Video Amplifier	15000 Mc V No Signal	6 231	8 125	7 0	0	
V115	12AU7	Video Amplifier	15000 Mc V No Signal	6 231	8 125	7 0	0	
V116	12AU7	Video Amplifier	15000 Mc V No Signal	6 231	8 125	7 0	0	
V117	12AU7	Video Amplifier	15000 Mc V No Signal	6 231	8 125	7 0	0	
V118	12AU7	Video Amplifier	15000 Mc V No Signal	6 231	8 125	7 0	0	
V119	12AU7	Video Amplifier	15000 Mc V No Signal	6 231	8 125	7 0	0	
V120	12AU7	Video Amplifier	15000 Mc V No Signal	6 231	8 125	7 0	0	

VOLTAGE CHART

The following measurements represent test set conditions. In the first condition, a 15000 microvolt test pattern signal was fed into the receiver. The correct adjustment of the AGC control properly adjusted. The second condition was obtained by removing the antenna leads and short circuiting the receiver antenna terminals. Voltages above or read with a sweep generator. "VoltOhm" between the indicated terminal and ground and with the receiver operating on 117 volts 50 cycles AC. The symbol < means less than.

Check the response of channel 2 through 6 by switching the channel selector, signal generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See figure 18 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

If the markers fail to fall within this requirement, readjust L48 and L32 in order to obtain curves within the proper limits. Switch the channel selector, signal generator and marker generator through channels 7 to 13 and observe the response curves, referring to figure 18 for proper wave shape. Check the injection voltage of each channel to be within limits. If necessary, readjust C11, C21 or C16 to obtain the proper response.

With the receiver and signal generator on channel 13 and just L48 for an audible beat with the signal generator. Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator plug to obtain the audible beat. It should be possible to adjust the oscillator injection voltage on each channel. Check the oscillator injection voltage on each channel to verify that the voltage is within the specified limits.

UHF ALIGNMENT—Ground the I-F transformer L307 by turning a clip and through the operator provided in the top of the unit. Ground the other end of the clip lead to the tuner case. Connect the oscilloscope to the test point TP301, employing the preamplifier if needed with the oscilloscope used.

Connect the output of the UHF sweep generator, through a 300 ohm attenuator pad, to the antenna terminals and readjust C21, C16, C11 and C7 for correct wave shape, frequency and band width. Recheck the oscillator injection voltage of TP1 to insure that it is within the limits specified. Readjust C22 if necessary.

Set the sweep generator and signal generator to channel 8. Readjust C21, C16, C11 and C7 for correct wave shape, frequency and band width. Recheck the oscillator injection voltage of TP1 to insure that it is within the limits specified. Readjust C22 if necessary.

Turn off the sweep generator and switch the receiver to channel 6. Adjust the signal generator to the channel 6 oscillator frequency 129 mc. Set the fine tuning control to the center of its mechanical range. Adjust L44, L46 and L58 for proper response as shown in figure 18. Recheck the oscillator injection voltage of TP1 to insure that it is within the limits specified. Readjust C5 if necessary.

If C5 required adjustment, switch the receiver and the signal generator to channel 8. Readjust C7 for correct frequency.

Check the response of channels 2 through 6 by switching the receiver channel switch, sweep generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See Figure 18 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

Repeat the above adjustments, as necessary, until the proper responses are obtained. Tune through the entire range and check the tracing. When perfectly tracked the three markers will be on the top of the response curves, however, mistaking to the extent that the 41.25 mc and 45.75 mc ride down the sides of the curves to a point not less than 70% will not seriously affect the alignment. Should the markers fall below this level, it will be necessary to knif the RF plates to correct the mistaking. The plates may be knifed through the two holes provided on the left side of the tuner. Always knif the plates while tuning lower in frequency to prevent deflecting the tracking above the point of knifing. Check which section requires knifing by rotating the plates and watching the knifing of the proper section or of both sections if required.

Connect the "VoltOhm" to test point TP301. Set the "VoltOhm" to the 1.5v DC scale. Tune over the entire range observing the reading on the meter. A reading between .05 and .4 volt should be obtained. Voltages outside these limits are an indication of low B voltage, low or high crystal impedance or an oscillator tube outside allowable limits.

Connect the "VoltOhm" to the "Bias" terminal of the tuner (refer to figure 9). A reading between 0.5 and 2.5 volts should be obtained. A reading above or below this range will cause crystal currents outside allowable limits and in such cases the oscillator tube should be replaced. Replace high and low frequency ends of the band as previously outlined.

Turn off the sweep generator and switch the receiver to channel 8. Readjust C21, C16, C11 and C7 for correct wave shape, frequency and band width. Recheck the oscillator injection voltage of TP1 to insure that it is within the limits specified. Readjust C22 if necessary.

Set the sweep generator and signal generator to channel 6. Readjust C21, C16, C11 and C7 for correct wave shape, frequency and band width. Recheck the oscillator injection voltage of TP1 to insure that it is within the limits specified. Readjust C22 if necessary.

Turn off the sweep generator and switch the receiver to channel 2. Adjust the signal generator to the channel 2 oscillator frequency 257 mc. Set the fine tuning control to the center of its mechanical range. Adjust L44, L46 and L58 for proper response as shown in figure 18. Recheck the oscillator injection voltage of TP1 to insure that it is within the limits specified. Readjust C5 if necessary.

If C5 required adjustment, switch the receiver and the signal generator to channel 8. Readjust C7 for correct frequency.

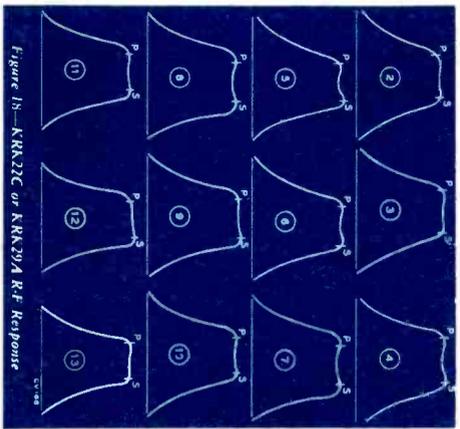


Figure 16—KRK32C or KRK39A R-F Response

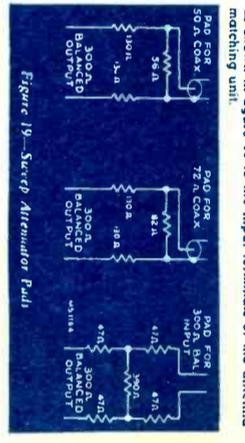


Figure 19—Sweep Attenuator Pad

Connect the signal generator loosely to the antenna terminals. Set the sweep generator to maximum gain and use the minimum input signal which will produce a usable pattern on the oscilloscope. Excessive input can change oscillator injection during adjustment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc and 181.75 mc. Adjust C21, C16, C11 and C7 for approximately correct curve shape, frequency, and band width as shown in figure 18.

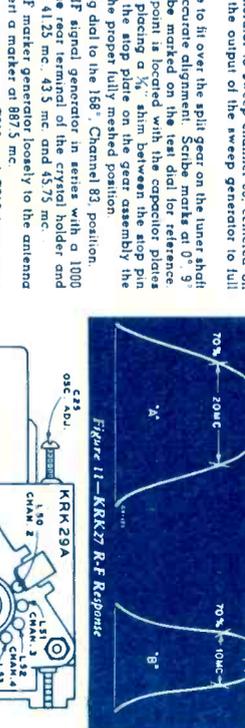
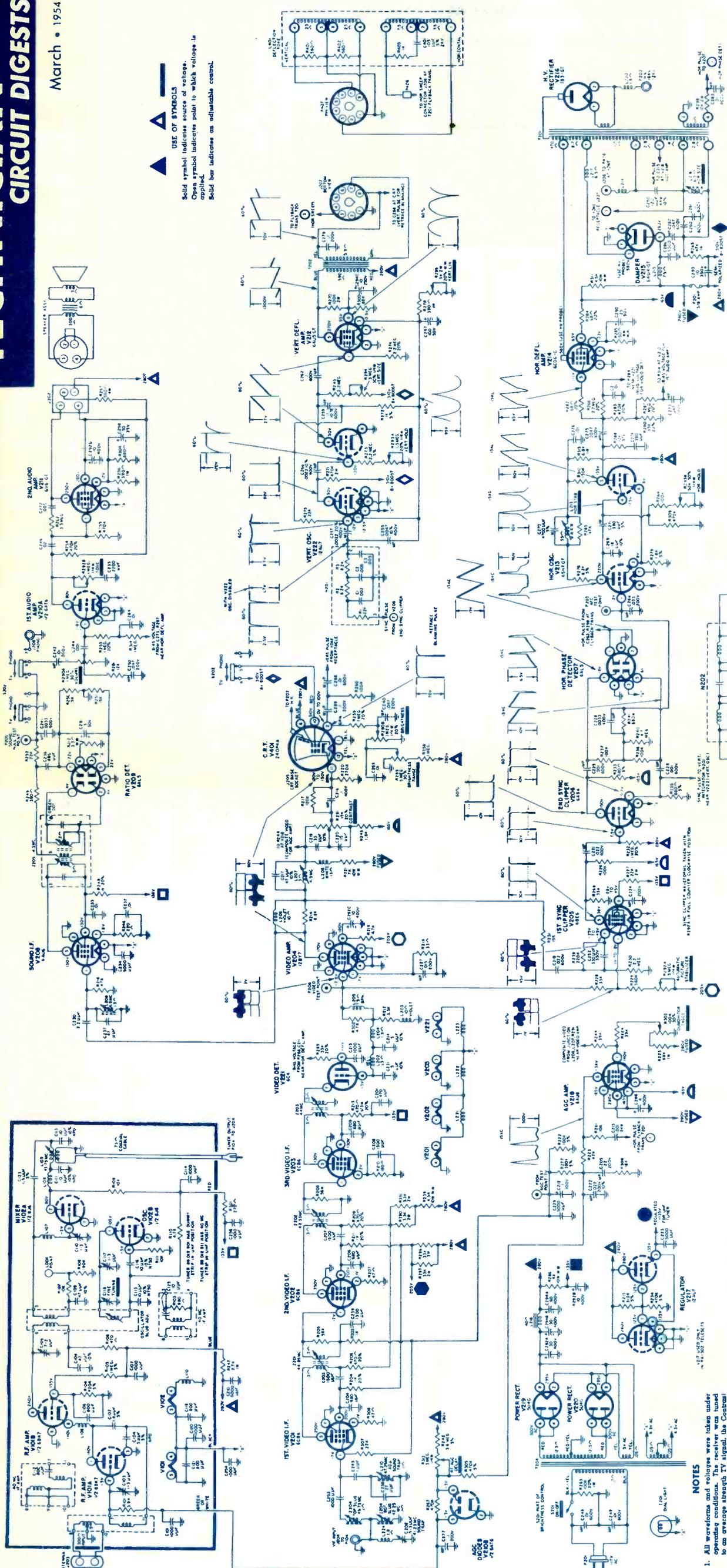


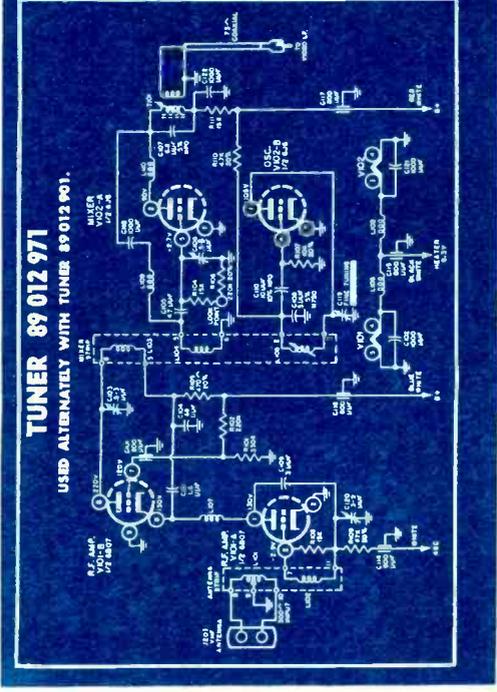
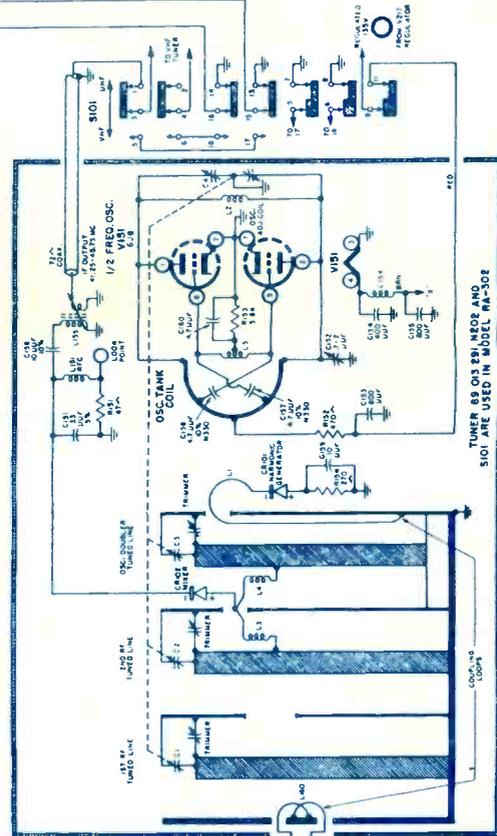
Figure 10—KRK39A/21 Oscillator Adjustments

▲ USE OF SYMBOLS
 Solid symbol indicates source of voltage.
 Open symbol indicates point to which voltage is applied.
 Solid bar indicates an adjustable control.



- NOTES**
- All waveforms and voltages were taken under operating conditions. The receiver was tuned to an average strength TV signal, the Contrast control rotated fully clockwise and the Du Mont monitor control (top) was adjusted for 4-7 volts at F104 (the eye test point).
 - All resistors are 10% one-half watt, unless W.W. indicates wire wound resistor.
 - All capacitors are 500V, unless otherwise indicated.
 - 8000 is used with 89 013 291 in RA-302 chassis stamped G. Chassis using Standard Coil tuner 89 012 971 are stamped S. In some sets C266 is a .0047 mfd 400 V capacitor, part no. 03 140 580, and R273 is a 1 meg 5% 1/2W resistor, part no. 02 031 200.
 - 8000 is used with UHF tuner 89 013 291 in RA-302 chassis stamped G. Chassis using Standard Coil tuner 89 012 971 are stamped S. In some sets C266 is a .0047 mfd 400 V capacitor, part no. 03 140 580, and R273 is a 1 meg 5% 1/2W resistor, part no. 02 031 200.

UHF TUNER 89 013 291



RESISTANCE MEASUREMENTS

All Readings to Ground

	1	2	3	4	5	6	7	8	9	0
V101	12K	0	0	35K-45K	40K-50K	0	0	0	0	0
V102	100K	47	0	35K-45K	40K-50K	0	0	0	0	0
V103	100K	0	0	35K-45K	35K-45K	0	0	0	0	0
V104	100K	33	150	0	0	0	0	0	0	0
V105	37K	0	0	0	0	0	0	0	0	0
V106	37K	0	0	0	0	0	0	0	0	0
V107	37K	0	0	0	0	0	0	0	0	0
V108	37K	0	0	0	0	0	0	0	0	0
V109	37K	0	0	0	0	0	0	0	0	0
V110	10K	0	0	0	0	0	0	0	0	0
V111	10K	0	0	0	0	0	0	0	0	0
V112	10K	0	0	0	0	0	0	0	0	0
V113	10K	0	0	0	0	0	0	0	0	0
V114	10K	0	0	0	0	0	0	0	0	0
V115	10K	0	0	0	0	0	0	0	0	0
V116	10K	0	0	0	0	0	0	0	0	0
V117	10K	0	0	0	0	0	0	0	0	0
V118	10K	0	0	0	0	0	0	0	0	0
V119	10K	0	0	0	0	0	0	0	0	0
V120	10K	0	0	0	0	0	0	0	0	0
V121	10K	0	0	0	0	0	0	0	0	0
V122	10K	0	0	0	0	0	0	0	0	0
V123	10K	0	0	0	0	0	0	0	0	0
V124	10K	0	0	0	0	0	0	0	0	0
V125	10K	0	0	0	0	0	0	0	0	0
V126	10K	0	0	0	0	0	0	0	0	0
V127	10K	0	0	0	0	0	0	0	0	0
V128	10K	0	0	0	0	0	0	0	0	0
V129	10K	0	0	0	0	0	0	0	0	0
V130	10K	0	0	0	0	0	0	0	0	0
V131	10K	0	0	0	0	0	0	0	0	0
V132	10K	0	0	0	0	0	0	0	0	0
V133	10K	0	0	0	0	0	0	0	0	0
V134	10K	0	0	0	0	0	0	0	0	0
V135	10K	0	0	0	0	0	0	0	0	0
V136	10K	0	0	0	0	0	0	0	0	0
V137	10K	0	0	0	0	0	0	0	0	0
V138	10K	0	0	0	0	0	0	0	0	0
V139	10K	0	0	0	0	0	0	0	0	0
V140	10K	0	0	0	0	0	0	0	0	0
V141	10K	0	0	0	0	0	0	0	0	0
V142	10K	0	0	0	0	0	0	0	0	0
V143	10K	0	0	0	0	0	0	0	0	0
V144	10K	0	0	0	0	0	0	0	0	0
V145	10K	0	0	0	0	0	0	0	0	0
V146	10K	0	0	0	0	0	0	0	0	0
V147	10K	0	0	0	0	0	0	0	0	0
V148	10K	0	0	0	0	0	0	0	0	0
V149	10K	0	0	0	0	0	0	0	0	0
V150	10K	0	0	0	0	0	0	0	0	0
V151	10K	0	0	0	0	0	0	0	0	0
V152	10K	0	0	0	0	0	0	0	0	0
V153	10K	0	0	0	0	0	0	0	0	0
V154	10K	0	0	0	0	0	0	0	0	0
V155	10K	0	0	0	0	0	0	0	0	0
V156	10K	0	0	0	0	0	0	0	0	0
V157	10K	0	0	0	0	0	0	0	0	0
V158	10K	0	0	0	0	0	0	0	0	0
V159	10K	0	0	0	0	0	0	0	0	0
V160	10K	0	0	0	0	0	0	0	0	0
V161	10K	0	0	0	0	0	0	0	0	0
V162	10K	0	0	0	0	0	0	0	0	0
V163	10K	0	0	0	0	0	0	0	0	0
V164	10K	0	0	0	0	0	0	0	0	0
V165	10K	0	0	0	0	0	0	0	0	0
V166	10K	0	0	0	0	0	0	0	0	0
V167	10K	0	0	0	0	0	0	0	0	0
V168	10K	0	0	0	0	0	0	0	0	0
V169	10K	0	0	0	0	0	0	0	0	0
V170	10K	0	0	0	0	0	0	0	0	0
V171	10K	0	0	0	0	0	0	0	0	0
V172	10K	0	0	0	0	0	0	0	0	0
V173	10K	0	0	0	0	0	0	0	0	0
V174	10K	0	0	0	0	0	0	0	0	0
V175	10K	0	0	0	0	0	0	0	0	0
V176	10K	0	0	0	0	0	0	0	0	0
V177	10K	0	0	0	0	0	0	0	0	0
V178	10K	0	0	0	0	0	0	0	0	0
V179	10K	0	0	0	0	0	0	0	0	0
V180	10K	0	0	0	0	0	0	0	0	0
V181	10K	0	0	0	0	0	0	0	0	0
V182	10K	0	0	0	0	0	0	0	0	0
V183	10K	0	0	0	0	0	0	0	0	0
V184	10K	0	0	0	0	0	0	0	0	0
V185	10K	0	0	0	0	0	0	0	0	0
V186	10K	0	0	0	0	0	0	0	0	0
V187	10K	0	0	0	0	0	0	0	0	0
V188	10K	0	0	0	0	0	0	0	0	0
V189	10K	0	0	0	0	0	0	0	0	0
V190	10K	0	0	0	0	0	0	0	0	0
V191	10K	0	0	0	0	0	0	0	0	0
V192	10K	0	0	0	0	0	0	0	0	0
V193	10K	0	0	0	0	0	0	0	0	0
V194	10K	0	0	0	0	0	0	0	0	0
V195	10K	0	0	0	0	0	0	0	0	0
V196	10K	0	0	0	0	0	0	0	0	0
V197	10K	0	0	0	0	0	0	0	0	0
V198	10K	0	0	0	0	0	0	0	0	0
V199	10K	0	0	0	0	0	0	0	0	0
V200	10K	0	0	0	0	0	0	0	0	0

The above resistance readings were taken with an RCA Model WV97A VTVM. All readings are in ohms. K=1000, M=Million. When the reading is affected by a control, two readings are given. These readings indicate the variation produced by the control.

DUMONT
 Chassis RA-301, 302
 Technician
CIRCUIT DIGEST
120

TUNER 89 012 971

USED ALTERNATELY WITH TUNER 89 013 291.

TV TECHNICIAN

March • 1954

CIRCUIT DIGESTS

In This Issue (No. 19)

Circuit Digest No. 116

BENDIX
Chassis T14-3: Models FM27C, HR27C
Chassis T14-10: Models TM24DS, TB24DS
Chassis T14-11: Models TM24DU, TB24DU

DUMONT
Chassis RA-301, 302: Models RA-301-A1, RA-301-A2, RA-301-A3, RA-302-A1, RA-302-A2, RA-302-A3

PACKARD-BELL
Chassis 2740: Models 2742, 2743, 2744, 2842, 2843, 2844

120

PHILCO
RF Chassis R-191, Deflection Chassis D-191, Code 140: Models 3002, 4002, 4004, 4102, 4106, 4109, 4150, 4302, 4304, 4306, 4307, 4005, 4007, 4107, 4112

118

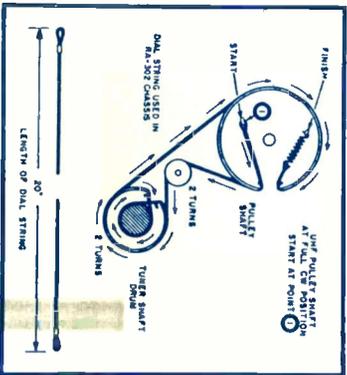
RCA
Chassis KCS84C: Models 24-T-420, 24-T-435
Chassis KCS84E: Models 24-T-420U, 24-T-435U

119

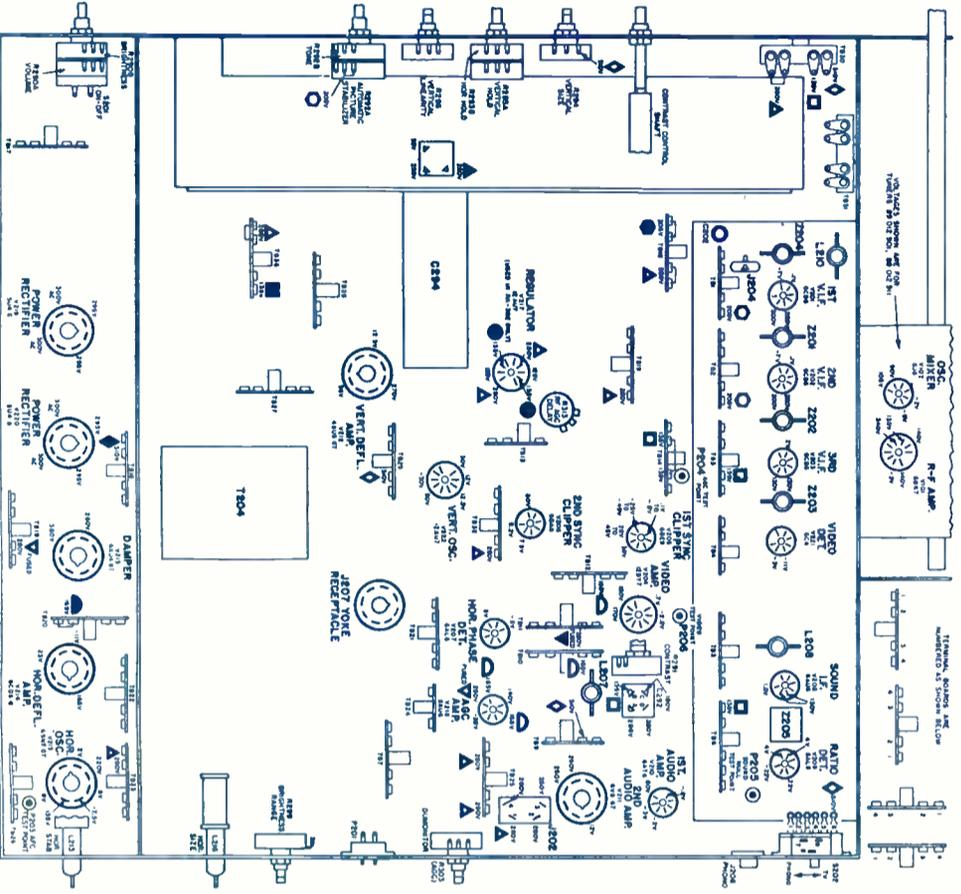


For complete Index to all earlier Circuit Digests, see main section of magazine

DIAL STRINGING



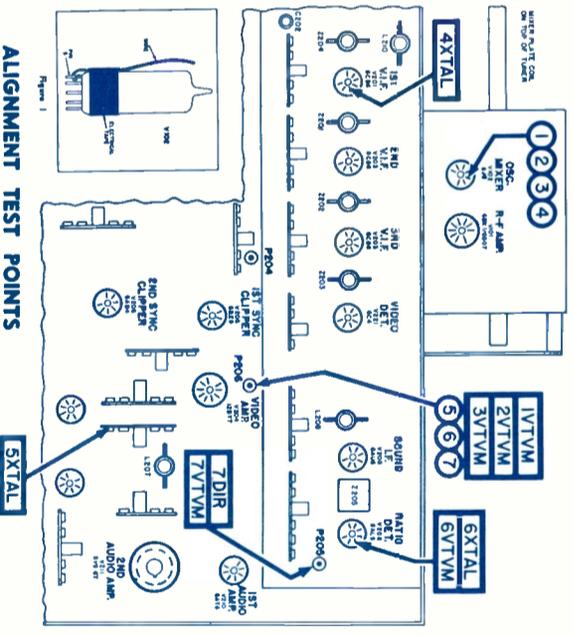
UNDERCHASSIS VOLTAGE POINTS



DUMONT Chassis RA-301, 302

CIRCUIT DIGEST 120

- NOTES
- When the alignment procedure has been completed the setting of the tuner oscillators also should be checked on each serviceable channel and corrected if necessary.
 - Tune the receiver to each serviceable channel. Place the front of the Fine Tuning control face downward and adjust the oscillator slug for best picture and sound.



Step	Frequency	Signal Generator	Connect to	Indicator	Output	Point	Adjust
1	4.0 MC	1 MC Sweep	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading. Set all other output stages for maximum reading on lowest range of V7VM.
2	4.25 MC	1 MC Sweep	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
3	4.5 MC	1 MC Sweep	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
4	4.75 MC	1 MC Sweep	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
5	5.0 MC	1 MC Sweep	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
6	4.5 MC	1 MC Sweep	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
7	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
8	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
9	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
10	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
11	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
12	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
13	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
14	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
15	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
16	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
17	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
18	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
19	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
20	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
21	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
22	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
23	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
24	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
25	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
26	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
27	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
28	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
29	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
30	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
31	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
32	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
33	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
34	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
35	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
36	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
37	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
38	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
39	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
40	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
41	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
42	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
43	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
44	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
45	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
46	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
47	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
48	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
49	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
50	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
51	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
52	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
53	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
54	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
55	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
56	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
57	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
58	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
59	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
60	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
61	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
62	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
63	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
64	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
65	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
66	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
67	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
68	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
69	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
70	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
71	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
72	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
73	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
74	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
75	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
76	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
77	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
78	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
79	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
80	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
81	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
82	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
83	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
84	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
85	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
86	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
87	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
88	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
89	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
90	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
91	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
92	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
93	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
94	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
95	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
96	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
97	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
98	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
99	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V20U	Z203 for maximum reading.
100	As Above	As Above	Ph. 5, V20U	V7VM	V7VM	Ph. 5, V	

capacitor replacements

BENDIX CHASSIS T14-3, T14-10, T14-11

Symbol No.	Rating MF @ WVDC	Bendix Part No.	Sprague Replacement
C35	10 @ 50	267024-16	TVA-1304
C41	100+40+10 @ 200/100 @ 50	267005-11	TVL-4516
C42	80+40+10 @ 450	267005-8	TVL-3792
C50	2 @ 50	267024-17	TVA-1301
C55	80+40+10 @ 450	267005-8	TVL-3792
C81	10 @ 200	267024-14	TVA-1504
C85	10 @ 50	267024-16	TVA-1304

PACKARD-BELL CHASSIS 2740

Symbol No.	Rating MF @ WVDC	Packard-Bell Part No.	Sprague Replacement
C6	5+5 @ 75/25 @ 25/100 @ 15	24069	R-1316
C13	40+40 @ 450/100 @ 200	24055	TVL-3764
C16	40 @ 350	24063	TVA-1611
C66	40+40 @ 450/100 @ 200	24055	TVL-3764
C72	10 @ 600	24068	R-1222
C56	Integrator Plate	23951	101C1

PHILCO R-F CHASSIS R-191, DEFLECTION CHASSIS D-191

Symbol No.	Rating MF @ WVDC	Philco Part No.	Sprague Replacement
C100	120 @ 150	30-2568-51	TVL-1428
C101	120 @ 150	30-2568-51	TVL-1428
*C103	20 @ 475/80+20+10 @ 300	30-2584-35	TVL-4801
C209	40+10 @ 300	30-2584-33	¹ TVL-3570
C410	2 @ 50	30-2417-7	TVA-1301

* Includes C708, C815A, C815B
Installation Notes: ¹Omit 20MF section

Sprague makes more capacitors . . . in more types . . . in more ratings . . . than any other capacitor manufacturer. Send 10c for 48-page TV Replacement Capacitor Manual to Sprague Products Co., 65 Marshall St., North Adams, Mass., or get it FREE from your Sprague distributor.

DON'T BE VAGUE...INSIST ON

FOR SETS OF THE MONTH

RCA CHASSIS KCS84C, KCS84E

Symbol No.	Rating MF @ WVDC	RCA Part No.	Sprague Replacement
C117	100 @ 400/20 @ 50	78212	¹ TVL-3672
C119	80+20 @ 400	77644	TVL-2673
C124	10+5 @ 350/30 @ 50	78213	TVL-3637

Installation Notes: ¹Omit 10MF section

DUMONT CHASSIS RA-301, 302

Symbol No.	Rating MF @ WVDC	Dumont Part No.	Sprague Replacement
C290	25 @ 50	03138760	TVA-1306
C291	5 @ 50	03120960	TVA-1303
C292	30+10+10+10 @ 400	03130811	TVL-4766
C293	10 @ 350 S.P.	03250421	R-1468
C294	60+30 @ 400/10 @ 250	03138731	TVL-3790
C296	4 @ 400	03115080	TVA-1702
C297	100 @ 50	03138770	TVA-1310
C298	50 @ 25	03000020	TVA-1206
N201	Integrator Plate	88000631	101C1

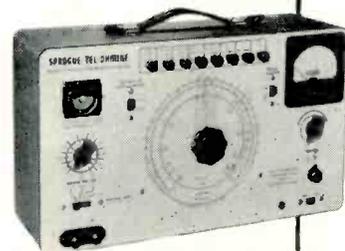
don't be vague...

insist on

SPRAGUE

TEL-OHMIKE®

**CAPACITOR-
RESISTOR
ANALYZER**



SPRAGUE

(Distributors' Div. of the Sprague Electric Co.)

\$50,000 "TELL & SELL" CONTEST

400 FABULOUS PRIZES

For Dealers and Servicemen* who use RCA Tubes

1954 Dodge, Deluxe 1/2-Ton Panel Truck
—complete with "Truck-o-matic" transmission, radio, heater and accessories . . . plus a full set of RCA Test Equipment, aluminum ladder, and winner's business name and address on truck panel.

1st prize
(your choice)



1954 DeSoto Automatic "Hard-Top"—170-H.P. Fire Dome V8 engine, Power-Flite Transmission, Power Steering . . . completely equipped, including radio and heater.

HURRY, HURRY, HURRY . . . contest closes April 30, 1954. See your RCA Distributor Salesman right away, and get your copy of the "clue book" that includes complete contest rules, official entry blank, and clues that will help you win.

* Your RCA Distributor Salesman will be glad to help you . . . because if you win, he wins a duplicate prize!

PLUS Powerful promotion campaign to help you sell more in '54

The RCA "Tell and Sell" campaign was designed to help you sell your service *on a local level*. Everything you need, from giant illuminated signs and window displays, to a consumer booklet that will give your customers the facts of TV servicing—is available from your RCA Distributor. See him today!

Consumer Booklet

Tells the customer what is needed to bring him expert service. Points you out as "the man who keeps the show going."



1954 RCA BABY DISPLAY



NEW GIANT OUTDOOR SIGN



NEW RCA SERVICE DECAL



RCA DOOR-BELL FLIPPER



DRAMATIC "EDGE LIT" SIGN



RCA TUBE RACK



RADIO CORPORATION of AMERICA
ELECTRON TUBES
HARRISON, N. J.