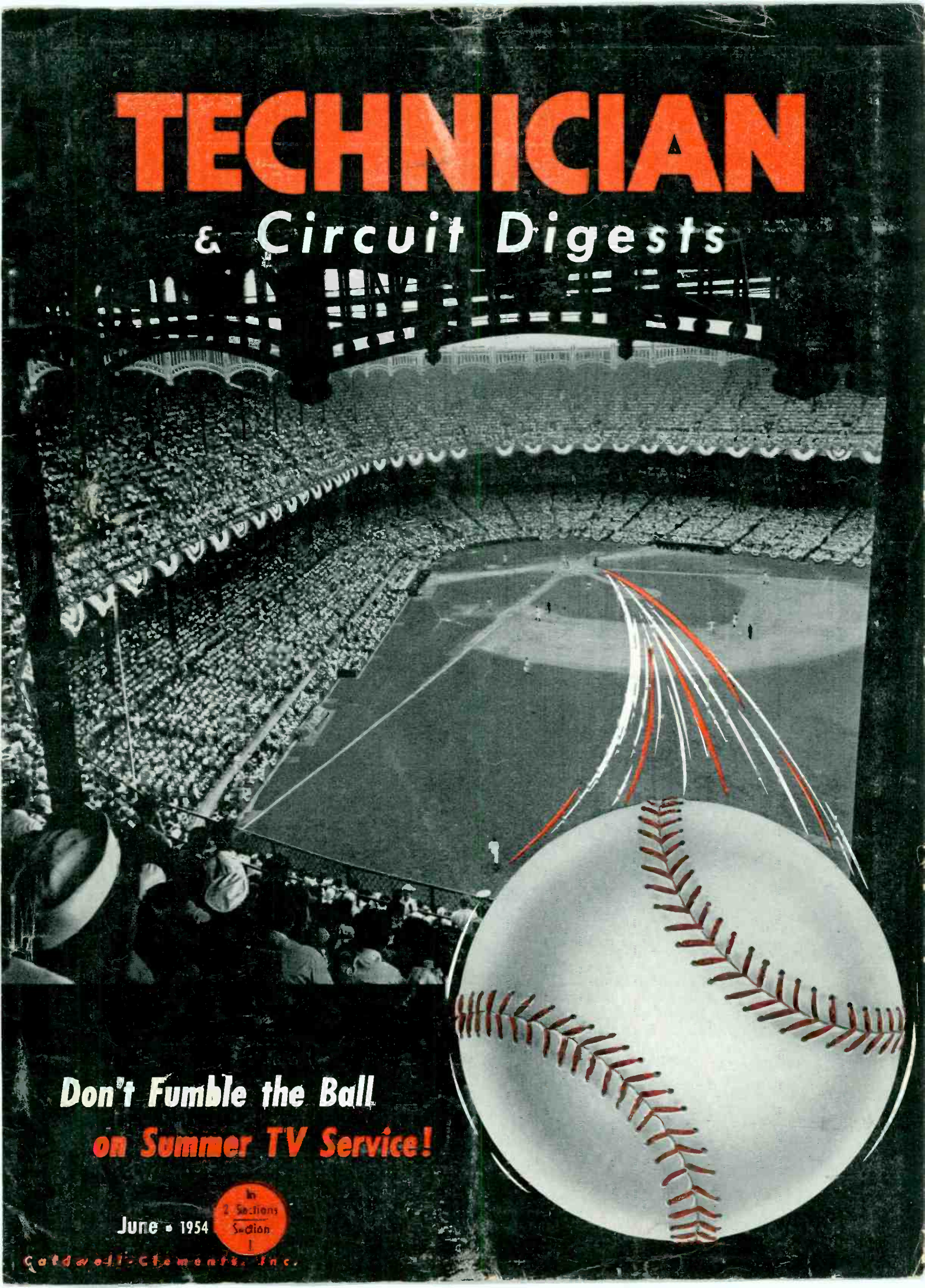
TECHNICIAN

& Circuit Digests



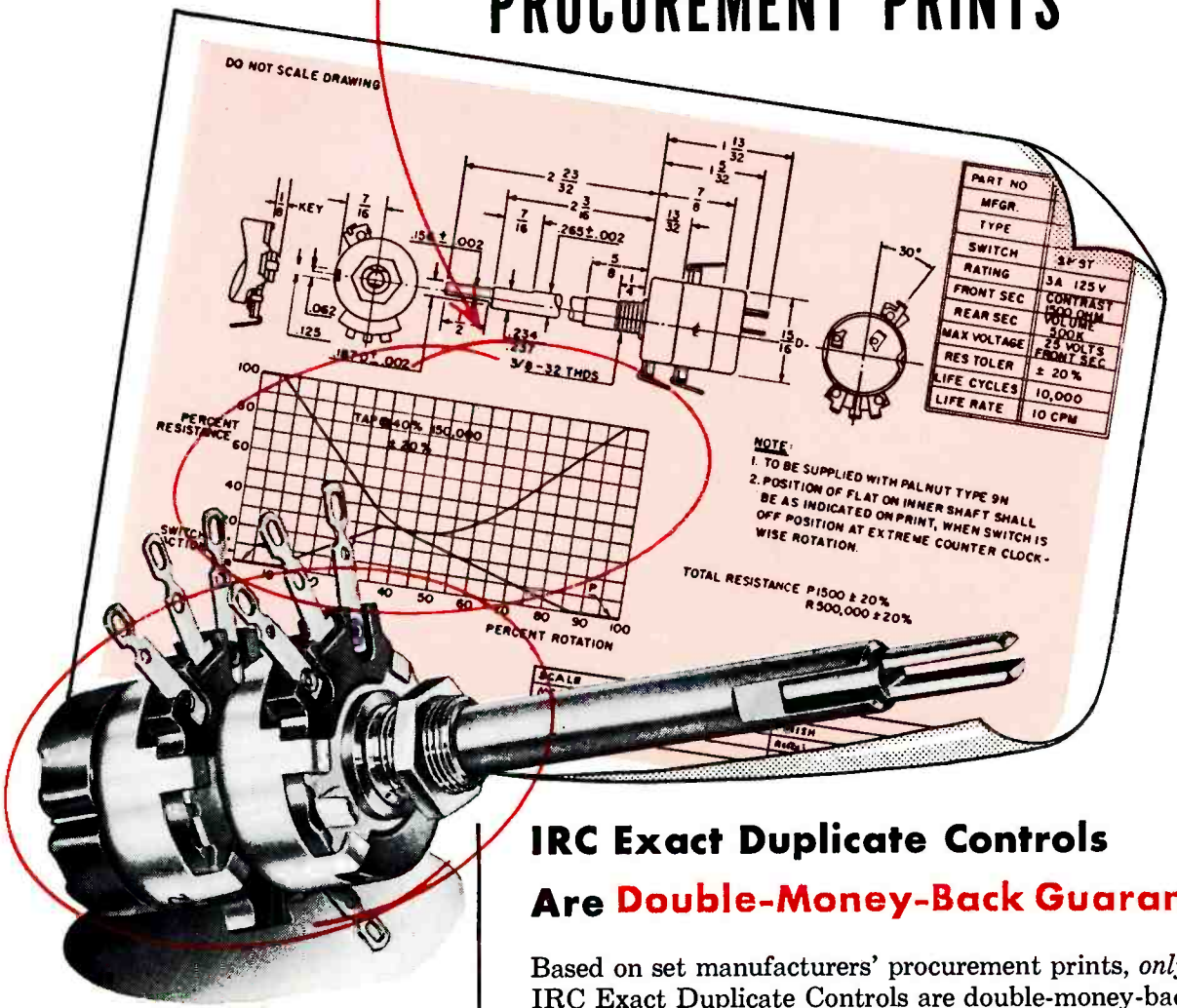
Don't Fumble the Ball on Summer TV Service!

In 2 Sections — Section 1

June • 1954

Caldwell-Clements, Inc.

ASSURED ELECTRICAL ACCURACY BASED ON MANUFACTURERS' PROCUREMENT PRINTS



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

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

IRC

Wherever the Circuit Says ~~~

IRC Exact Duplicate Controls Are Double-Money-Back Guaranteed

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

Set manufacturers' electrical specifications are closely followed.

Resistance values are carefully selected to match.

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

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

INTERNATIONAL RESISTANCE CO.

425 N. Broad Street, Philadelphia 8, Pa.

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

In Two Sections • Section Two • June 1954

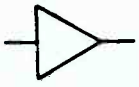
TECHNICIAN & Circuit Digests

CALDWELL-CLEMENTS, INC. ★ 480 LEXINGTON AVENUE, NEW YORK 17, N.Y. ★ PLaza 9-7880

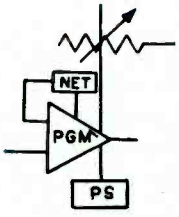
CIRCUIT SYMBOLS

Graphical representation of electronic and related components provides an efficient shortcut in conveying technical information. To establish a universal meaning for each of these symbols, a set of standards have been developed jointly by the Institute of Radio Engineers (54IRE21S1) and the American Standards Association (Y32.2—1954). Presented here are more than 175 symbols selected from the 67 major categories included in the IRE-ASA standards. These symbols represent those most frequently used in the electronic industries, and may be considered the building blocks of the complete set of standards.

AMPLIFIERS



General:
Triangle points in direction of transmission



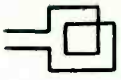
Program Amplifier with Associated Variable Attenuator, Feed Back Path, and Power Supply

ANTENNAS

Types or Functions may be indicated by words or abbreviations adjacent to the symbol

General

Dipole



Loop

Counterpoise

ARRESTORS, Gap

For Lightning or Electric Surges

General

Carbon Block

Horn Gap

Protective Gap

Sphere Gap

Multigap

ATTENUATORS

Balanced, General

Unbalanced, General

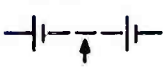
BATTERIES

Long line always positive; polarity may be indicated in addition

dc source, General

Multicell

Multicell with 3 taps



Multicell with adjustable tap

CAPACITORS

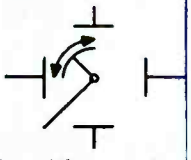
Curved Electrode represents: Outside Electrode and/or Negative Electrode and/or Moving Element in Variables and/or Low-potential in Feed-thrus

Shielded capacitor

Variable capacitor

Split stator Capacitor
Both parts increase simultaneously

Variable differential capacitor



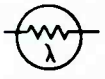
Phase-shifter capacitor

Feed thru capacitor (terminals on feed-thru element)

CELLS, Photosensitive

λ indicates Element Varies with Light

Asymmetrical Photo Conductive Transducer



Symmetrical Photo Conductive Transducer

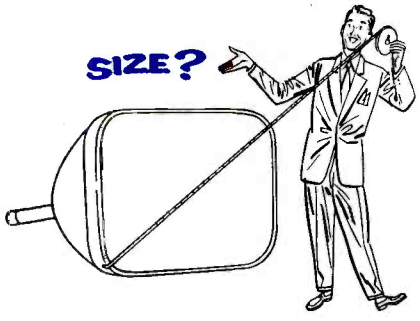
Photovoltaic Transducer

CHASSIS

Chassis Frame not necessarily at ground potential

What are your Aluminized Picture Tube Problems?

Now Sylvania offers a full line!

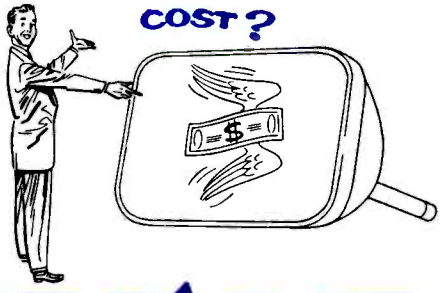


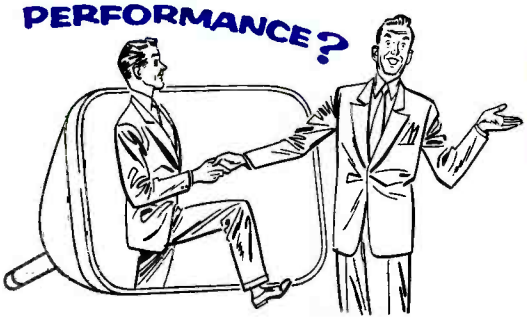
TODAY, because of greatly increased facilities and improved manufacturing techniques, Sylvania is in a position to offer you perfect answers to your aluminized picture tube problems.

And, much more than your physical spec requirements, Sylvania Aluminized Tubes also offer the finest *performance!* These tubes give whiter whites and blacker blacks . . . a 6-times better picture contrast.

This means Sylvania's new aluminized tubes make your sets stand out ahead of competition. The improvement is obvious . . . and immediate. And the low prices will amaze you!

For the full story concerning Sylvania's complete aluminized tube line, and how they can help your future sales, write a note on your letterhead to Dept. 4R-4206A at Sylvania TODAY!





SYLVANIA

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

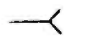
In Canada: Sylvania Electric (Canada) Ltd.
University Tower Building, St. Catherine Street, Montreal, P. Q.

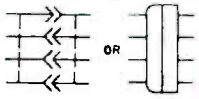
LIGHTING • RADIO • ELECTRONICS • TELEVISION

CONNECTORS

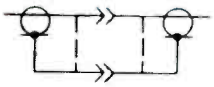
Symbol not an arrowhead, but larger lines at 90°

Male Contact


Female Contact

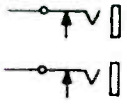


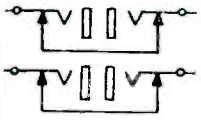
Engaged 4-conductor connectors. Plug has 1 male & 3 female contacts

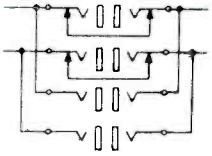

Engaged coaxial connectors. Outside conductor carried through


Two Conductor Jack


Two Conductor Plug


Jacks with circuit normalled through one way

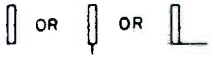

Jacks with circuit normalled through both ways


Jacks in Multiple, one set with circuit normalled through both ways

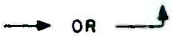

2, 3, 4 Conductor Polarized Plugs, female contacts

CONTACTS, Electric

Fixed Contact



Sleeve



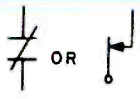
Adjustable or sliding contact for resistor, inductor, etc.

Segment: bridging contact

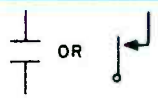

Vibrator Reed


Rotating Contact and brush

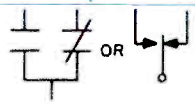
CONTACTS, Electric (Continued)



Closed Contact (break)

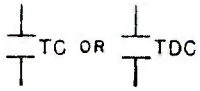


Open Contact (make)

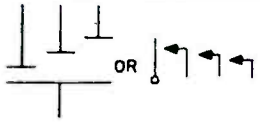


Transfer


Make-before-break



Open Contact w/time delay closing feature



Time Sequential Closing

CORE

Magnetic Core of Inductor or Transformer

Magnetic Core of Magnet or Relay

COUNTER, Electromagnetic Operated

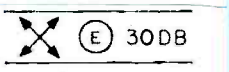

General


With Moke Contact

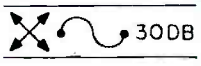
COUPLER, Directional

Arrow Indicates Direction of Power Flow. Number of Coupling Paths, Type of Coupling, and Transmission Loss May Be Indicated


General



E-plane Aperture Coupling 30 db Transmission Loss



Loop Coupling 30 db Transmission Loss

Probe Coupling 30 db Transmission Loss

COUPLING

E, H or HE inside circle indicates type of coupling. E indicates plane at aperture is perpendicular to transverse component of major E lines. In H the plane is parallel. HE indicates coupling by all other kinds of apertures. Transmission loss may be indicated.

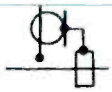
E-plane Coupling By Aperture to Space

E-plane Coupling 3 ends of Transmission Path Available

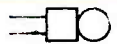

Coupling by Loop to Space

Coupling by Probe to Space

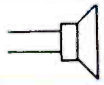

Coupling by Loop from Coaxial to Circular Waveguide with DC Grounds Connected


Coupling by Probe from Coaxial to Rectangular Waveguide with DC Grounds Connected

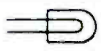
DEVICES, Audible Signal


Bell, general telephone ringer

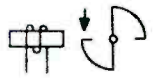

Buzzer

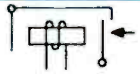

Horn, Howler, Loudspeaker, Siren

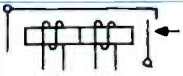
DEVICES, Visual Signal


Switchboard Type Lamp


Annunciator, general

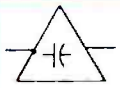

Annunciator, Drop or Signal, Shutter or Grid Type


Manually Restored Drop


Electrically Restored Drop

DISCONTINUITY

General


Capacitive Reactance

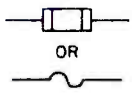

Inductive Reactance


L and C with Infinite Reactance at Resonance

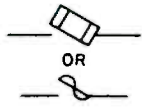

L and C with Zero Reactance at Resonance

Equivalent Shunt Element General

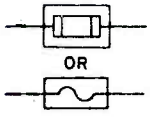
FUSES



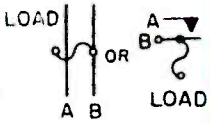
Fusible element



High Voltage Primary Fuse Contact, Dry



High Voltage Primary Fuse Contact, Oil



With Alarm Contact (When fuse blows alarm bus B is connected to power bus A. Letters for explanation only)

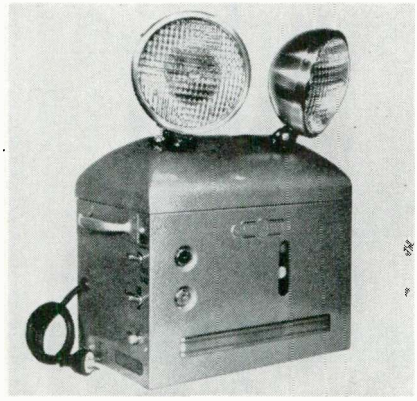
GROUND

TV-Electronic Technician

New Test Instruments, Shop Equipment and Service Items

Carpenter EMERGENCY LIGHT

Automatic stand-by light model 116 provides instant light when fuses blow or power fails. Unit conforms to requirements of the Na-



tional Fire Code and is UL-approved. The glass jar battery can deliver 91% of rated capacity after 30 minutes of actual use. Features include external switches for testing; switches to control the battery charger, and to disconnect lamp-heads for servicing; red pilot light to indicate when battery is on high charge; an amber light to indicate readiness for service; visible disc-float hydrometer. Carpenter Mfg. Co., Boston 45, Somerville, Mass. —TECHNICIAN

Hickok VTVM

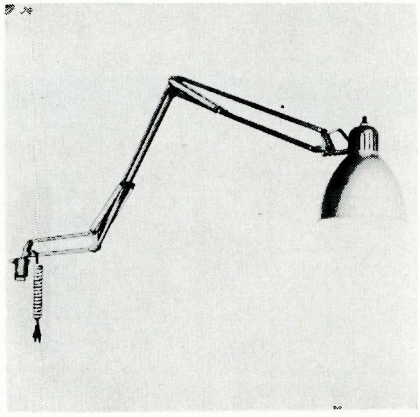
Hickok Model 225 offers many features to improve the speed of servicing. Long scales minimize reading errors. Built-in audio tone speeds up checks for continuity. Peak-to-peak scales are included for measurement of complex waveforms. Zero-center scale. Single-unit probe provides both a-c and d-c measurements through use of a slide switch. DC voltmeter section provides 7 ranges to 1200 v. Input resistance: 10 megohms with dual-probe. Ohmmeter has 7 ranges going from x1 to x1 meg. Readability: 0.2 ohms to 1,000 megohms. AC voltmeter section has 7 ranges and reads ac rms voltages to 1200 v, peak-to-peak voltages to 3200 v. Flat from 40 cps to 3.5 mc. Price, $89.50. Hickok Electrical Instrument Co., 10523 Dupont Avenue, Cleveland 8, Ohio—TECHNICIAN

Dutch COLOR VINYL TAPE

These plastic tapes, intended for electrical use, are available in 8 colors, have excellent adhesive qualities. They have a high resistance to destructive elements such as oil, acids and corrosive chemicals. The colors are red, yellow, green, blue, gold, silver, black and white. Available in four widths, ⅜", ½", ¾" and 1". Dielectric strength, 1000 v per mil. Van Cleef Bros., Inc., 7800 Woodlawn Ave., Chicago 19, Ill.—TECHNICIAN

Luxo ADJUSTABLE LAMPS

Four models of adjustable extension-arm lamps, useful in service work, are available with a choice of six wall, floor, bench-clamp and



other mounting bases. Lamp illustrated is model L-3, with triple-extension arm, 5-ft. radius and wall-mounting bracket. Other dual-extension types range down in size to 30-in. radius. Luxo Lamp Corp., 102 Columbus Ave., Tuckahoe, N. Y. —TECHNICIAN

Planet ELECTROLYTICS

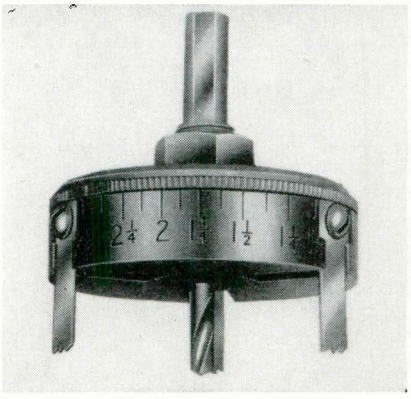
Type IL Lyticap capacitors are dry electrolytics, hermetically sealed in aluminum tubes, equipped with flexible insulated leads. Riveting leads directly to the condenser has eliminated the use of rigid terminal risers, allowing type IL capacitors to fit into a smaller space and reducing risk of lead breakage. Available in single and dual section units. Planet Mfg. Corp., 225 Belleville Ave., Bloomfield, New Jersey—TECHNICIAN

Sylvania OSCILLOSCOPE

New 7-in. oscilloscope, model 404, is a high-gain, wide-band instrument. Vertical sensitivity is 10 millivolts per inch and vertical response is flat from 10 cycles to 2 mc, useful to 4 mc. The instrument is said to have excellent tilt, rise-time, and overshoot characteristics. Features: four - position frequency - compensated step attenuator; low impedance smooth attenuator; low internal hum level; input impedance of 5.0 megohms and 26 mmfd, for negligible circuit loading; phasing control; internal 60-cycle sine-wave sweep; vertical and horizontal polarity-reversing switches. The 404 is supplied with a 7VP1A (green trace) tube or it can use a standard 7-in. TV picture tube, type 7JP4 (white trace). Sylvania Electric Products, Inc., 1221 W. 3rd St., Williamsport, Penna.—TECHNICIAN

R & R ADJUSTABLE HOLE-SAW

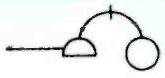
The "Dial-Saw" may be used to drill any size hole from 1⅛ in. to 2½ in. in diameter in metal, wood, plastic and other materials. Three high-speed cutting blades are simultaneously adjusted by rotation of a calibrated dial. The device also makes circular discs, washers, gaskets, bosses and plugs, and may be used as a rotary planer or grooving tool. Intended for use with electric



or manual hand drills, drill presses, lathes and milling machines. Priced at $12.95; replacement cutting blades, $1.00 for set of 3 blades. Robertson and Ruth, Box 534, Elmhurst, Ill.—TECHNICIAN

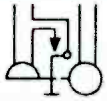
HANDSET

General



With push-to-talk switch

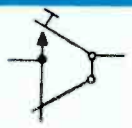
3 conductor handset



4 conductor handset with push-to-talk switch

KEY, Telegraph

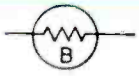
Simple



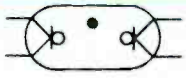
Simple with shorting switch

Open circuit or pole changing

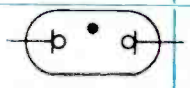
LAMP



Ballast Lamp, Tube



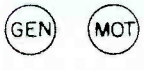
4 terminal fluorescent lamp



2 terminal fluorescent lamp

Incandescent illuminating lamp

MACHINE, Rotating

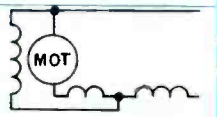


General, Generator and Motor

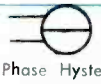
Rotating Armature with Commutator and Brushes or Slip Rings

Compensating, or Commutating, Series and Shunt Fields

Generator or Motor dc, Permanent Magnetic Field



DC compound Motor with Commutoting or Compensating Field Winding



1 Phase Hysteresis Motor

Reluctance Motor

Synchronous Motor with Neutral brought out

MAGNET, Permanent

METERS

A letter or letter combination from the following list shall be placed within the circle to indicate the function of the meter or instrument unless some other identification is provided in the circle and explained on the diagram.

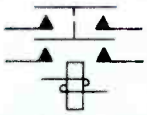
A	Ammeter
AH	Ampere-hour meter
CMA	Contact-making (or breaking) ammeter
CMC	Contact-making (or breaking) clock
CMV	Contact-making (or breaking) voltmeter
CRO	Oscilloscope or cathode-ray oscillograph
D	Demand meter
DB	DB (decibel) meter
DBM	DBM (decibels referred to 1 milliwatt) meter
DTR	Demand-totalizing relay
F	Frequency meter
G	Galvanometer
GD	Ground detector
I	Indicating
M	Integrating
μA or UA	Microammeter
MA	Milliammeter
N	Noise meter
OHM	Ohmmeter
OP	Oil pressure
OSCG	Oscillograph, string
PH	Phase meter
PI	Position indicator
PF	Power-factor meter
RD	Recording demand meter
REC	Recording
RF	Reactive-factor meter
S	Synchroscope
TLM	Telemeter
T	Temperature meter
TT	Total time
VH	Varhour meter
V	Voltmeter
VA	Volt-ammeter
VAR	Varmeter
VI	Volume indicator
VU	Standard volume indicator
W	Wattmeter
WH	Watthour meter

MICROPHONE

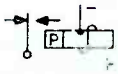
RELAYS

Relay, basic

Relay coil



2-pole, double make



Polarized Relay with Transfer Contact

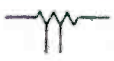
Relay Protective Function Balance, General

Relay Protective Function under, General

Relay Protective Functional Differential, General

RESISTORS

General



Tapped Resistor

Resistor with Adjustable Control

Adjustable or Continuously Variable Resistor

Instrument or relay shunt

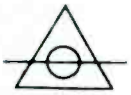
RESONATORS

General: Common for coax and waveguide

SHIELDING

Normally used for electric or magnetic shielding. For other shielding, note should so indicate

SHIFTER, Phase



General

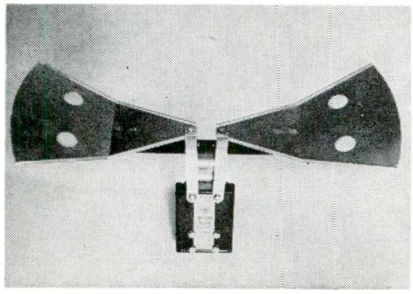
Adjustable

Products for Sales & Service

Antennas, Audio Equipment, Parts and Components

Insuline UHF ANTENNA

Existing VHF aerials can be converted for reception of UHF by addition of the Combo-Fan, No.



6720, a fan-shape, weather-proof, all-aluminum antenna said to provide high gain on Channels 14 through 83 without affecting normal VHF operation on Channels 2 through 13. The unit includes a filter that permits use of the VHF down-lead present. Unit is easily installed above or below the VHF antenna with a mounting bracket provided for the purpose. Insuline Corp. of America, Manchester, N. H. —TECHNICIAN

Halldorson FLYBACKS

Flybacks FB414 and FB415 are described as being specific replacements for well over 100 Emerson models and chassis. Halldorson Transformer Co., 4500 N. Ravenswood Ave., Chicago 40, Ill.—TECHNICIAN

ITI SOUND LEVEL METER

The IT-140M, a portable, sound-level meter featuring accuracy, can be used to check frequency response and dynamic range of high-fidelity sound systems, or as an aid to sound-system installers. Applications include checking of individual loudspeakers, record-players, recorders, and overall checks including response of the room or auditorium. Acoustical level can be checked for recording, and noise level can be checked in buildings, homes, factories, streets, subways. etc. Dealer price, including carrying case, batteries and microphone, $79.95. Industrial Television, Inc., 369 Lexington Avenue, Clifton, New Jersey—TECHNICIAN

K-F PRECISION RESISTORS

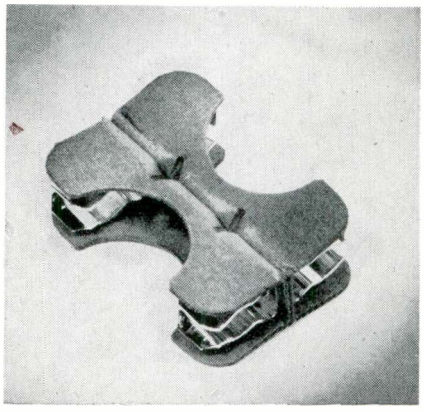
Available in accuracies of 1%, 0.5%, and 0.1%, K-F resistors are offered in standard values from 0.1 ohm to 1 megohm. Wound non-inductively on non-hygroscopic ceramic bobbins and impregnated for moisture protection, nine sizes are supplied ranging in power capability from ¼ watt to 1 watt. K-F Development Co., 2711 Spring St., Redwood City, Calif.—TECHNICIAN

Vidaire VOLTAGE BOOSTER

The Line-Up model LU-10 Booster Transformer provides a 10-volt increase of line voltage in areas where heavy power consumption results in drops below the 115-volt level. Features: compact size, plug-in installation, rating of 350 w, single switch to provide "normal" or "boost" operation, depending on change in line-voltage level. Vidaire Electronics Mfg. Co., 576 W. Merrick Rd., Lynbrook, L. I., N. Y.—TECHNICIAN

Littlefuse FUSE MOUNTS

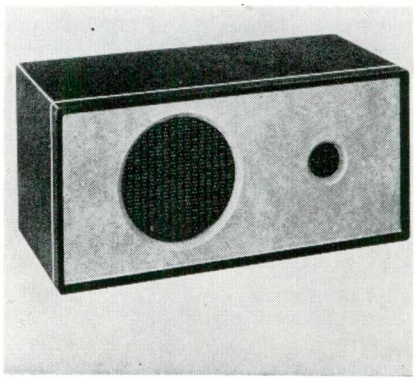
Design of this TV snap-on fuse mounting provides substantial cut-outs on each side of the holder, facilitating quick fuse replacement. One side can be readily snapped on to a blown pigtail-type fuse; the regular replacement fuse is inserted on the other. Use of the mounting eliminates need for cutting the pigtail fuse out of the circuit and sol-



dering in a replacement, with the threat of damage from a hot iron. Part no. 350130. Littlefuse, Inc., 1865 Miner St., Des Plaines, Ill.—TECHNICIAN

Kingdom SPEAKER SYSTEM

The Audette uses a Lorenz LP-215 Woofer and LP-65 Tweeter, and is housed in a simulated leather



cabinet of small size. Retails for $49.50. Kingdom Products, Ltd., 23 Park Place, New York 7, N. Y.—TECHNICIAN

Delco AUTO ANTENNAS

Two universal auto radio aerials, designed for one-man installation on any passenger car or truck, feature elimination of "rod rattle" through the use of nylon plastic inserts. Aerial masts are made of admiralty brass, chrome plated, with top sections of stainless steel; high impact plastic bases allow adjustment to any desired angle and contour. The base construction eliminates "rough-road flutter." Aerials are shipped factory pre-assembled. United Motors Service, Div. of General Motors Corp., GM Bldg., Detroit 2, Mich.—TECHNICIAN

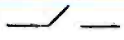
Leak HI-FI AMPLIFIER

Model TL/10 amplifier features a separate sub-chassis for the control unit and preamplifier. Input and output jacks for a tape recorder are front-panel mounted for easy access after installation in a cabinet. Control unit has inputs for tape, tuner and phono, 4 positions of phono equalization, separate calibrated bass and treble tone controls and volume control. 10-watt amplifier features ultralinear circuit with low hum and distortion, and with damping factor of 23. Dept. LP-2, British Industries Corp., 164 Duane St., New York 13, N.Y.—TECHNICIAN

SUPPRESSION, Mode

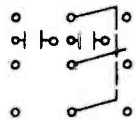
Commonly Used in Coax and Waveguide

SWITCHES



General Single Throw

2-pole double-throw switch showing terminals



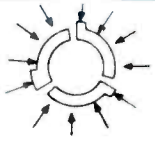
3-pole double-throw knife switch with auxiliary contacts and terminals

Switch with horn gap

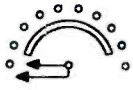
Pushbutton make switch spring return

Toggle Key
Relay
Jack
Transfer Switch Non-Locking

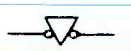
2-position Key Switch with Locking Transfer and Break Contacts



Wafer, 3-pole, 3-circuit with 2 non-short & 1 shorting moving contacts

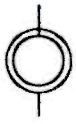


10-point selectar switch with fixed segment



Safety Interlock Circuit Opening

SYNCHROS



Synchro, general

If identification is required, add abbreviations

CDX—Control Differential Synchro Transmitter
CT —Synchro Control Transformer
CX —Synchro Control Transmitter
TDR—Torque-Differential Synchro receiver
TDX—Torque-Differential Synchro Receiver
TR —Torque-Synchro Receiver
TX —Torque-Synchro Transmitter

TERMINATIONS

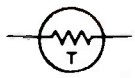
Cable Termination

Short Circuit, Movable Common for Coax and Waveguide

Terminating Resistor Common for Coax and Waveguide

Path Open Path Shorted Terminating Series Capacitor

THERMISTORS



THERMOCOUPLES

Temperature Measuring Thermocouple

TRANSDUCERS, Mode

General: commonly used in coax and waveguide

Transducer from rectangular to circular waveguide

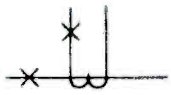
TRANSFORMERS

General

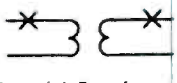
Shielded Transformer with Magnetic Core

One Winding with Tap, one Winding Adjustable

3-phase Induction Regulator



Current Transformer, Polarity Marked

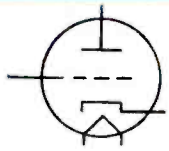


Potential Transformer Polarity Marked

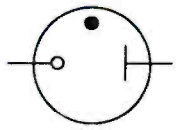
Delta Wye Transformer Connections 3-phase

NOTE: IRE-ASA standards provide two types of symbols, single line and complete. Single line symbols are intended to show essential components and functions in simplified form. Complete diagrams indicate the complete circuit and the devices used therein. In some cases, only a single or complete symbol is available for a particular component. Where a choice of single or complete is available, the complete type is used here, with the exception of amplifiers, adjustable phase shifters, and synchros, where more common usage has dictated the use of single line forms.

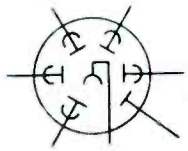
TUBES, Electron



Triode, Indirectly Heated Cathode. Add grids for tetrode, pentode, etc.

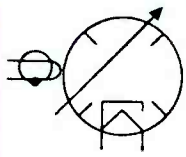


Cold Cathode Gas Tube, Rectifier, regulator for dc

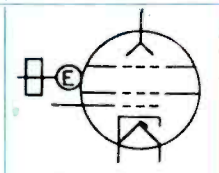


Photomultiplier Tube

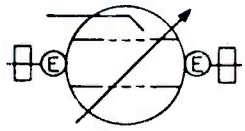
Cathode-ray Tube with Electrostatic Deflection. Remove De for Magnetic Deflection



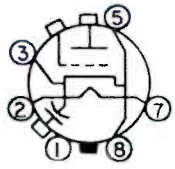
Magnetron Tunable, Loop Coupled



Reflex Klystron Integral Cavity, Aperture Coupled



Transmit-Receive (TR) Tube. Gas filled, tunable integral cavity, aperature coupled, with starter

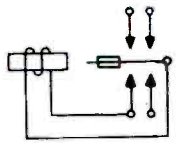


UHF triode (disk-seal type) with internal capacitor. Tube terminals added as shown where desired

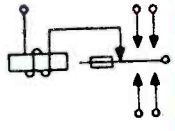
CRYSTALS

Piezoelectric Crystal

VIBRATORS



Shunt Drive Vibrator



Series Drive Vibrator

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Now, due to advanced manufacturing techniques and precision testing methods, Sylvania tubes can point to outstanding records, both in long life and fine performance. Today 7 of the 10 leading set manufacturers use Sylvania Picture Tubes and Receiving Tubes.

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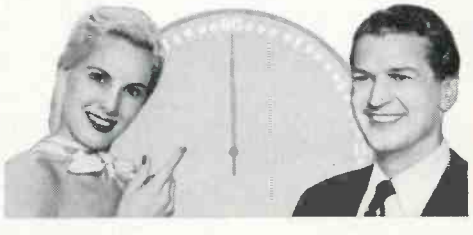
Television keeps telling about Sylvania quality



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CIRCULATION

This issue 50,000, which includes 45,114 professional servicemen and service managers of retail stores, 2,006 parts distributors, plus manufacturers and miscellaneous.

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JUNE, 1954

TECHNICIAN'S COVER this month links up the keen public interest in sports with summer service income. There's an important relation between the two, as you'll find by reading *Mailings Boost TV Income.*

THE CIRCUIT SYMBOL INSERT contains the latest approved graphical representations of electronic components. You'll want to refer to this data when some symbol you are unfamiliar with appears in CIRCUIT DIGESTS.

Spend a Little Time to Make a Lot of Money! **13**

"Tuning in the Picture" **14**

Servicing Convergence Trouble in the Color TV Receiver — *Peter Orne & Sol Heller* **16**

Orienting Your Customers on Antenna Reflection Problems — *M. G. Goldberg* **18**

The 3-Gun Color Teletron **20**

Tracking Down Intermittents ..... *Frank A. Bramley* **21**

Making the Most of Your Test Equipment ..... *M. G. Goldberg* **23**

Clock Radio Service Data **24**

Servicing AC-DC Radios ..... *Michael Craig* **26**

Shop Hints **28**

Can You Solve These? **29**

Mailings Boost TV Income ..... *Irving Roberts* **30**

Color Shorts **31**

"Tough Dog" Corner **32**

Audio & Hi-Fi Products **36**

New Antennas & Related Products **38**

Shop Equipment **42**

Improving TV Set Performance **48**

Circuit Digests Cumulative Index **61**

Circuit Digests* **65**

DEPARTMENTS

Calendar of Coming Events	15	Manufacturers' Catalogs & Bulletins	54
New Products	34	New Books	55
News of the Trade	50	Technician's Lighter Side	56
Service Ass'n. Reports	52	Letters to the Editors	57
Industry Keyhole	57		

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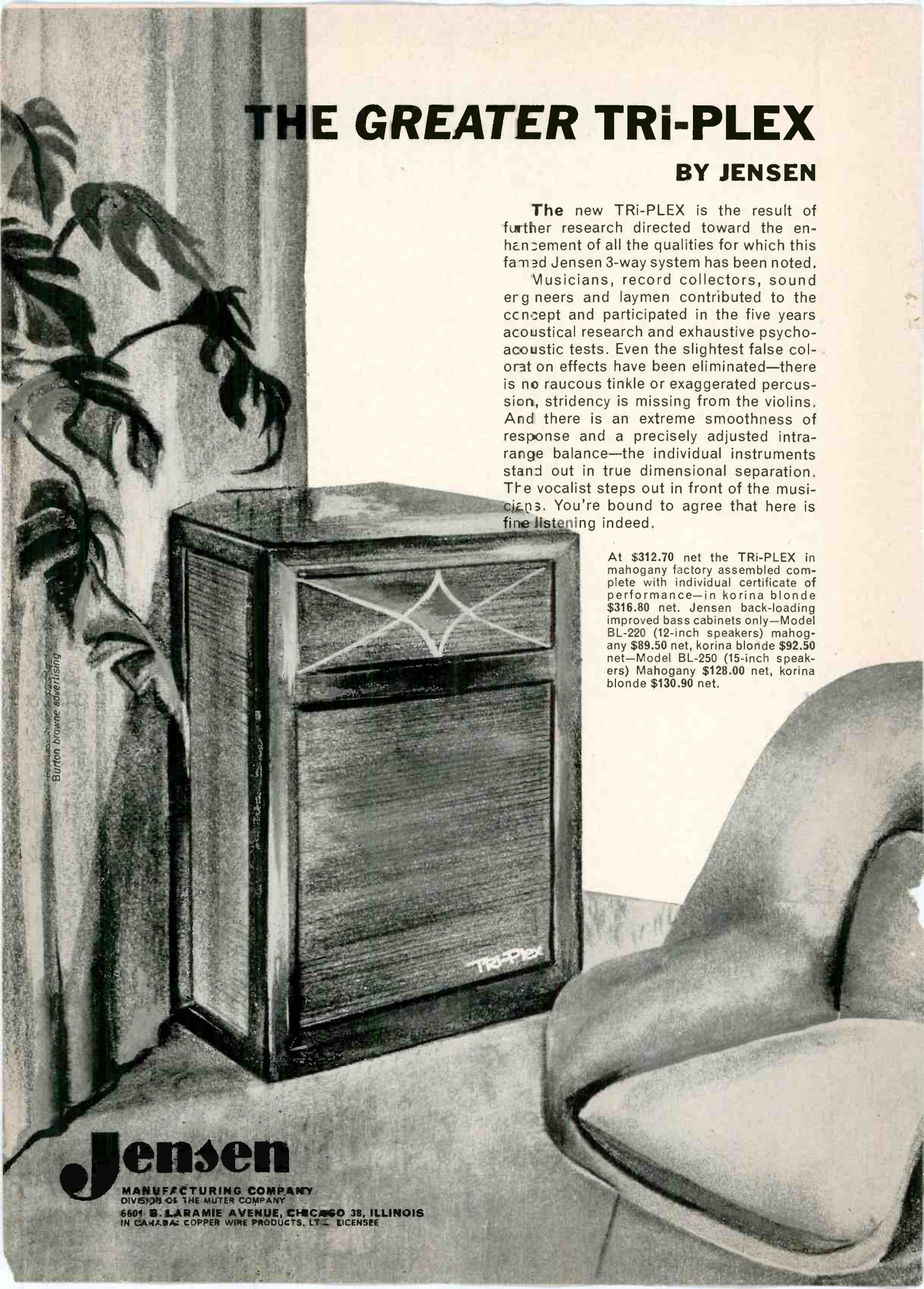
THE GREATER TRi-PLEX
BY JENSEN
The new TRi-PLEX is the result of further research directed toward the enhancement of all the qualities for which this famed Jensen 3-way system has been noted.
Musicians, record collectors, sound engineers and laymen contributed to the concept and participated in the five years acoustical research and exhaustive psychoacoustic tests. Even the slightest false coloration effects have been eliminated—there is no raucous tinkle or exaggerated percussion, stridency is missing from the violins. And there is an extreme smoothness of response and a precisely adjusted intrarange balance—the individual instruments stand out in true dimensional separation. The vocalist steps out in front of the musicians. You're bound to agree that here is fine listening indeed.
At $312.70 net the TRi-PLEX in mahogany factory assembled complete with individual certificate of performance—in korina blonde $316.80 net. Jensen back-loading improved bass cabinets only—Model BL-220 (12-inch speakers) mahogany $89.50 net, korina blonde $92.50 net—Model BL-250 (15-inch speakers) Mahogany $128.00 net, korina blonde $130.90 net.
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WHEN THE

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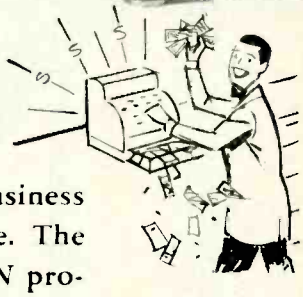
ELECTRONIC TECHNICIAN

PROGRAM

REMOVES THIS CHIP...

You're in the chips!



Customer confidence in you and your way of doing business is the greatest single business asset you can have. The *RAYTHEON Bonded ELECTRONIC TECHNICIAN* program, now in its 10th year, has helped and continues to help many thousands of Radio and Television service dealers break down the barrier of public mistrust. And in so doing increases the volume and profit of these Raytheon Bonded Technicians.

Ask your Raytheon Tube Distributor if you can qualify for this priceless sales asset. If you can, the program costs you not one cent, it's Raytheon's investment in *your* future.

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RAYTHEON MANUFACTURING COMPANY

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RAYTHEON MAKES ALL THESE:

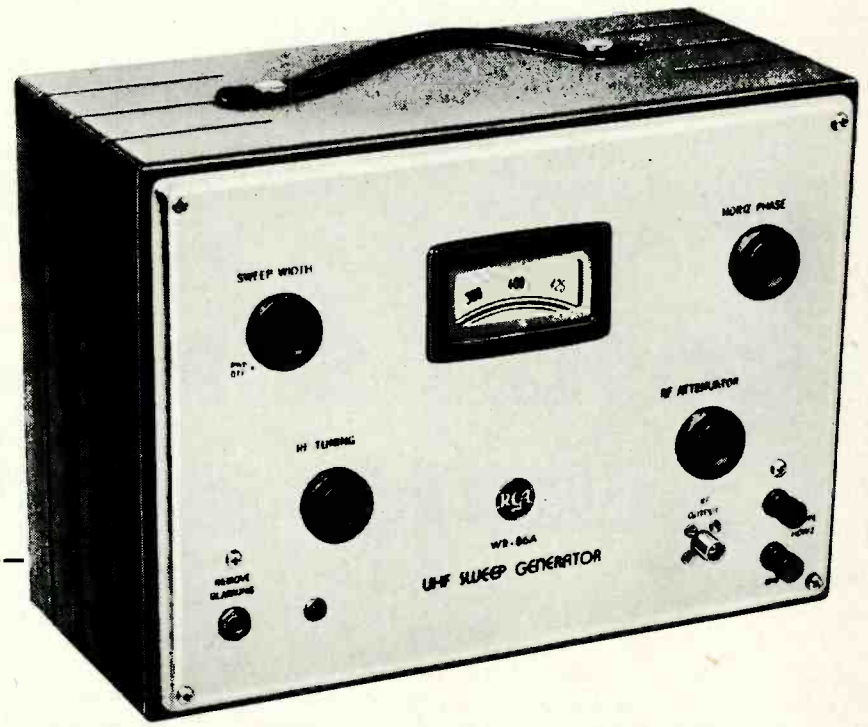
RECEIVING AND PICTURE TUBES • RELIABLE SUBMINIATURE AND MINIATURE TUBES • SEMICONDUCTOR DIODES AND TRANSISTORS • NUCLEONIC TUBES • MICROWAVE TUBES

Now—the RCA WR-86A

...a UHF Sweep Generator

for research, production and servicing for the price of a service instrument

only $275.00 (Suggested User Price)



Now, for the first time, RCA offers a UHF Sweep Generator having the precision and stability of laboratory types, for the price of a service instrument. Because of advancements in engineering design, the new WR-86A UHF Sweep Generator is suitable for both production-line testing and for general service applications on color and black-and-white UHF receivers, converters, tuners, filters, antennas, transmission lines, and other equipment operating in the range from 300 to 950 Mc.

The sweep oscillator uses an RCA-6AF4 UHF triode in a specially designed circuit providing excellent sweep linearity and a maximum amplitude variation of 0.1 db/Mc combined with a large sweep width.

The oscillator compartment and its associated components are specially designed and sturdily constructed to assure maximum stability and reliable performance over extended operating periods. Critical parts are silver plated, and the entire oscillator section is enclosed in a silver-plated compartment to minimize leakage.

A blanking circuit is included to provide a reference base line on an oscilloscope. Horizontal sweep for the 'scope can be obtained from front-panel terminals.

The RCA WR-86A comes completely equipped with 4-foot rf output cable, 50- to-300-ohm padded balun, and instruction book.

CHECK THESE FEATURES

- **Wide frequency range**—continuous from 300 to 950 Mc.
- **Wide sweep range**—continuously adjustable up to 10% of indicated dial frequency for any frequency up to 750 Mc; up to 75 Mc for frequencies from 750 to 950 Mc.
- **Flat output**—maximum voltage amplitude variation 0.1 db/Mc over swept range.
- **High output voltage**—0.6 volt across 50 or 300 ohms.
- **Wide range attenuation**—continuously adjustable over a range of 60 db.
- **Electro-mechanical sweep** of rugged, time-tested design.
- **Phased blanking circuit** provides essential zero-reference line.
- **Phased horizontal deflection** voltage for oscilloscope.
- **50- and 300-ohm outputs**—balanced 300-ohm output provided by shielded, padded 50- to 300-ohm balun.

Specification

- **Power Supply:** 105-125 volts, 60 CPS.
- **Dimensions:** 13½" long, 9¾" high, 7½" deep.
- **Weight:** 14 lbs.
- **Finish:** Blue-grey hammeroid.

Get full details today from your RCA Distributor or clip coupon and mail to:

RCA Commercial Engineering
Section F46W, Harrison, N. J.
Please send me information on the RCA WR-86A UHF Sweep Generator.

Name_____
Address_____ Zone_____ State_____
City_____
My local RCA Distributor is_____

RADIO CORPORATION of AMERICA
TEST EQUIPMENT **HARRISON, N. J.**

"Customers bring own sets in for service"

CHARLES W. RHODES

"Back-breaking chassis tugging belongs to the past"

L. B. HALLBERG

"Another wonderful feature—easier circuit tracing"

ROY R. THOMPSON

CROSLEY SUPER-V IS A SERVICE MAN'S DREAM

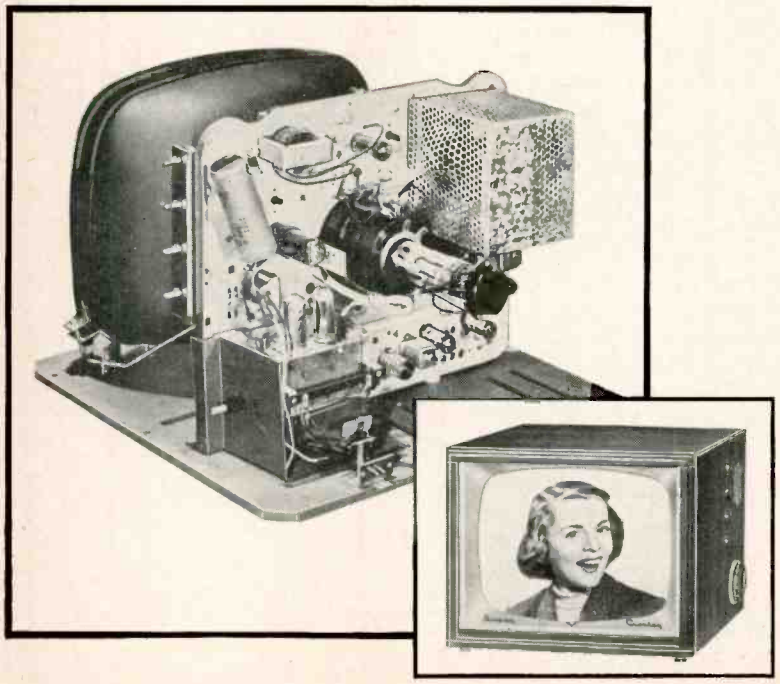
—read these letters

"I now find many customers bring their own sets in for service because the Super-V has reversed the trend toward heavy, bulky sets. I can service more sets per day, and my overhead is less by truck expenses. The Super-V is not only a low-priced set, but a set that can be maintained at a low price, which is equally important."

Charles W. Rhodes, Electronic Service Mgr.
Robert L. Rice & Co., Portland, Oregon

"By removing the cabinet back, every tube is right in front of one's eyes. No more groping and twisting to relocate tube-socket pins. Back-breaking tugging of the chassis belongs to the past. If a repair or check of chassis components is necessary, a few screws are removed and the cabinet lifts off like a bonnet. The separate diagram showing the actual filament wiring makes the search for an open filament a matter of seconds."

L. B. Hallberg, Manager, Service Dept.
Hardware Products Co., Sterling, Ill.



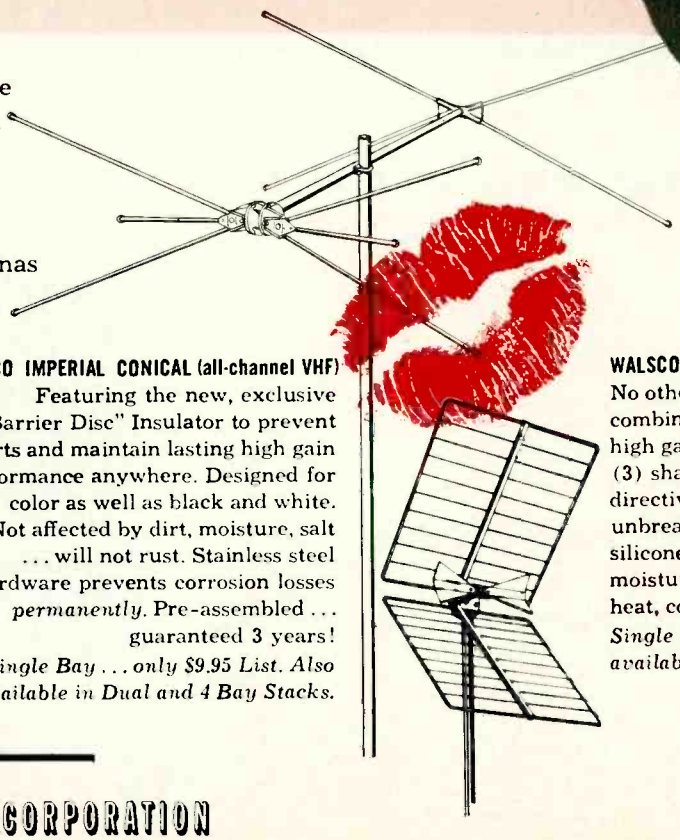
"The Crosley Super-V is a service man's dream; the new vertical plane chassis allows the changing of any tubes in a very few minutes. When service of a more complicated nature is required, the entire cabinet can be removed by loosening 6 screws; this leaves the entire chassis accessible for service. Another wonderful feature is that the picture-tube chassis and bracket are incorporated in one common mounting board along with the points wired on terminal strips for easier circuit tracing."

Roy R. Thompson, General Service Manager
Saginaw Distributors, Inc., Saginaw, Mich.

Crosley Division AVCO Cincinnati 25, Ohio

"...and all I did was install a WALSCO antenna"

Buyers are getting wiser. The quality of *their* TV reception is *your* responsibility . . . and they'll hold you to it! For *your* protection, sell and install WALSCO, the finest antennas ever built for VHF and UHF.



WALSCO IMPERIAL CONICAL (all-channel VHF)
Featuring the new, exclusive "Barrier Disc" Insulator to prevent shorts and maintain lasting high gain performance anywhere. Designed for color as well as black and white. Not affected by dirt, moisture, salt . . . will not rust. Stainless steel hardware prevents corrosion losses *permanently*. Pre-assembled . . . guaranteed 3 years!
Single Bay . . . only $9.95 List. Also available in Dual and 4 Bay Stacks.

WALSCO CORNER REFLECTOR (UHF)
No other UHF antenna so effectively combines all three . . . (1) extra high gain; (2) all-channel reception; (3) sharp vertical and horizontal directivity. Features the hollow, unbreakable X-77 Insulator . . . silicone treated to shed dirt and moisture . . . not affected by extreme heat, cold or wind.
Single Bay . . . $10.95 List. Also available in 2 and 4 Bay Stacks.

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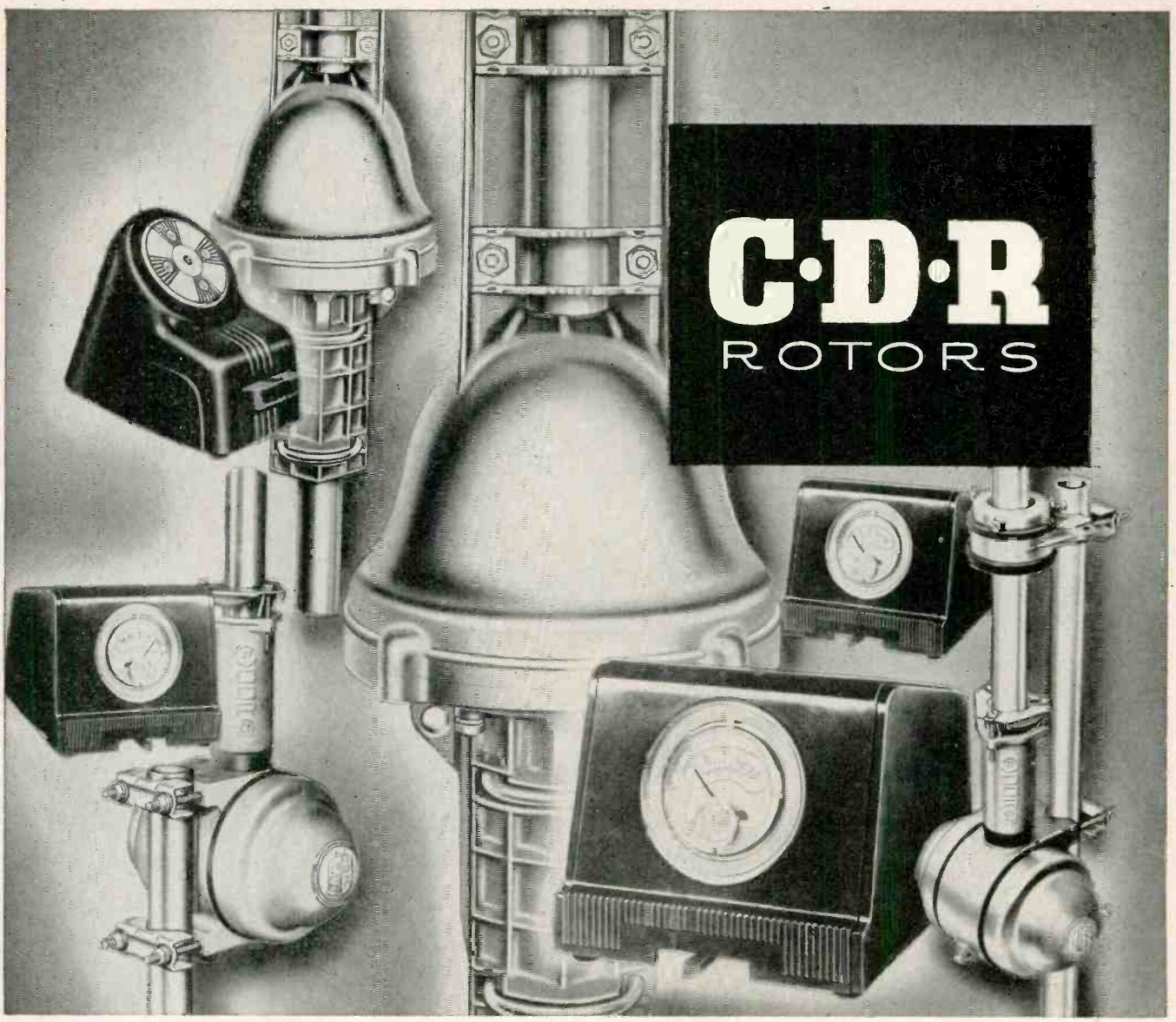

no other rotor offers SO MUCH

a complete line

TR-2 the heavy duty rotor with compass control dial cabinet.

TR-4 the heavy duty rotor with meter dial cabinet.

TR-11 all purpose rotor with meter dial cabinet.

TR-12 all purpose rotor for large TV antenna arrays with meter dial cabinet.

widely promoted on TV

widely promoted to consumers on TV... ALL CDR ROTORS are PRE-SOLD for you through an extensive campaign to millions every week exploiting the advantages of the CDR.

completely merchandised

completely merchandised...the easiest to sell ... in addition to the TV spot coverage ... there are newspaper mats, window streamers envelope enclosures ... and an animated point of sale display... all the tools you need to sell the BEST SELLING ROTOR!

CORNELL-DUBILIER
SOUTH PLAINFIELD, N. J.

THE **RADIART** CORPORATION
CLEVELAND 13, OHIO

Boost your converter sales

The Mallory Concealed Converter—first on the market

Give Your Customers their choice

The Mallory Cabinet Converter—first on the market

...with two Mallory converter styles

Mallory . . . and only Mallory . . . offers you both types of ALL-CHANNEL UHF CONVERTERS—one designed to fit inside any TV set and the other to be used on or beside any set.

The New Mallory '188' Concealed Converter is mounted inside the TV set . . . out of sight! All that shows is a clear plastic selector dial and switch. Installation is easy. A bracket and four screws are supplied to mount the unit on either side or at the top in wood cabinets. For plastic or metal cabinets, the converter may be mounted on the fiber-board rear enclosure.

Both the Mallory '188' and the Mallory '88' Cabinet Model give the same trouble-free performance that has made Mallory the leading converter in every area since the start of UHF telecasting.

No radiation problem! Mallory Converters contain specially designed components to prevent troublesome interference from radiation—a problem common to low quality converters which can ruin TV reception over a wide area.

Give yourself greater Converter Sales . . . By giving your Customers Their Choice of Mallory Converters.

P. R. MALLORY & CO. Inc.

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RECTIFIERS • POWER SUPPLIES • CONVERTERS • MERCURY BATTERIES

APPROVED PRECISION PRODUCTS

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

MORE DEALERS ARE INSTALLING

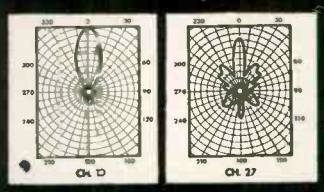
CHANNEL MASTER'S CHAMPION

THAN ANY OTHER ANTENNA IN TELEVISION HISTORY!

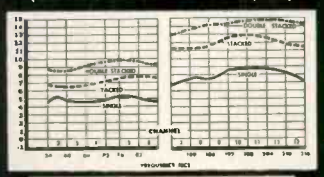
model no. 325-2

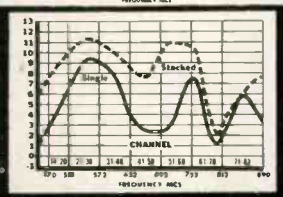
All-channel reception: VHF & UHF

HORIZONTAL POLAR PATTERNS
(Relative Voltage)



Gain
(above tuned reference dipole)





ONLY THE CHAMPION enjoys this overwhelming acceptance: over 300,000 already sold!

ONLY THE CHAMPION is powered by the unique "Tri-Pole," the triple-powered dipole system that provides fabulous VHF-UHF fringe area performance. 100% aluminum; rugged, exclusive alloy. Installs in a flash!

ONLY THE CHAMPION gives you this four-star promotion program:

- ★ ***FREE newspaper ads***
- ★ ***FREE TV film commercials***
- ★ ***FREE colorful display material***
- ★ ***FREE consumer literature***

See your Channel Master distributor for full details.

The antenna America knows best!

Introduced to millions through the editorial pages of their favorite magazines and newspapers, and on TV.

DON'T BE MISLED BY "LOOK-ALIKES" . . .
THERE'S ONLY ONE REAL CHAMPION!

Model no. 325, Single bay; Model no. 325-4, Four bay; Model no. 325-6, Super Champ

INSIST ON PREASSEMBLED ANTENNAS

CHANNEL MASTER CORP. ELLENVILLE, N. Y.

The World's Largest Manufacturer of Television Antennas

TECHNICIAN
& Circuit Digests

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

Spend a LITTLE Time to Make a LOT of Money!

In most localities, The Good Old Summer Time brings a slump in service revenue. When the mercury goes *up*, the people *go out*—to beaches, parks and to vacation spots. And the shop volume *goes down* as a result. It's an old, familiar pattern.

Unfortunately, though, the shop's overhead, like Tennyson's Brook, "goes on forever," and many an owner is hard put to make both ends meet—let alone making a buck or two to stash in the bank.

However, numbers of smart owners and technicians keep the dough rolling in by spending an extra five minutes or so in the home.

And how do they make money spending this time? It's simple—they keep their eyes open to the opportunity to sell something the household needs . . . perhaps a new large-screen TV set to replace the small one. Or they suggest a new portable, a table model, or a modern phono. Many sell room air conditioners, too—a comparatively easy job when the thermometer is climbing hell-bent for a hundred.

Opportunity Waits in the Home

Such "servicer-salesmen" take a leaf out of the book of the electrical contractors, and the plumbers, to name just a couple of tradespeople. The contractors just mentioned sell a great many electric light fixtures, and bathroom and kitchen equipment, respectively, by "talking up" business.

The TV technician has an even better opportunity to sell in the home. He is looked upon as an "unbiased" expert. His opinion is often sought when customers want advice on various brands. *And furthermore, more TV-radio men visit homes every day in the year than do all other tradesmen combined.*

Actually, the technician doesn't have to be a trained salesman to sell. All he has to do is capitalize upon several things *already in his favor:*

1. He's in the home as a respected, skilled person.
2. He can sell effectively without a "sales spiel" because people realize that he knows what he's talking about.
3. He has eyes he can use in looking around to see what equipment needs replacing, or what products should be owned.

Simple Salesmanship Pays Off

Look at it this way: Today, and every day in the year, thousands of people are buying, without *any* solicitation whatsoever, from technicians in homes throughout the country. *Such folk are asking the servicers to take orders!*

Think what a huge volume these technicians could ring up if *they would take the initiative in asking their customers to buy;* using a little simple salesmanship!

An extra five minutes in the home can spell the difference between profit and loss during the Summer months ahead.

Try it and see. The results may be little short of amazing.

Tuning In the

SELENIUM FUMES: Concern over the health hazard to service technicians and set owners offered by selenium rectifiers appears to be unwarranted. The American Medical Association's investigations in this matter included overload and burn-out tests of these rectifiers, carried out in sealed rooms of small size. The resultant atmospheric concentration of selenium gases was found to be well below the danger point.

VERTICAL CHASSIS DESIGN is getting quite a play from set makers. Hallicrafters has already joined Crosley and Kaye-Halbert in using this type of layout. Raytheon is going vertical with a 21-in. set, as well as with a 17. Other manufacturers are said to be considering the changeover.

AROUSE CURIOSITY and you have an audience. An enterprising service outlet (Starlit Television Service Center, of Detroit) distributed the reverse-message card illustrated below in its territory. When puzzled recipients of the card followed the top-line instruction (printed in normal type) to hold the card to a mirror, they read: "The print is backward but we're going forward!" For the best in TV repairs, they were urged to call Starlit. Phone number and address were conveniently printed in normal fashion at the bottom of the card.

HI-FI CONFUSION may be cleared up somewhat if a newly-formed organization can deliver on its aims. The High Fidelity Institute, headquartered in Chicago, numbers several leading Hi-Fi manufacturers among its members. Major purpose is to set up uniform standards of measurements, which may be used by manufacturers to specify performance claims. After certification of the claims by an independent testing laboratory, the non-profit Institute plans to issue seals of approval to products. Only field of sound reproduction is to be covered.

Ad in reversed message gets across when card is held up to mirror.

(PLACE IN FRONT OF MIRROR)

THE PRINT IS BACKWARD BUT WE'RE GOING FORWARD!
FOR THE BEST FOR LESS IN T.V. REPAIR ($3.00 HOME
CALL) CALL STARLIT TELEVISION SERVICE CENTER –
UN 2-6073.

(15 YEARS' ELECTRONIC EXPERIENCE)

UN 2-6073 7120 FENKELL

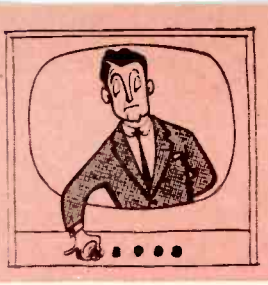
TECHNICIAN WE KNOW IS STILL MUTTERING over this "Tough Dog," which he ran into a couple of months ago. Customer complained that no matter how the set was tuned, the same program came over on all available channels but one. What weird whim of tuner treachery tied the same signal to six of seven New York channels? No, it wasn't the tuner, it was the program—the all-star, all-network, hour-and-a-half musical tribute to Rodgers and Hammerstein.

"Well, if it's Winston Churchill it's fine. If it's Groucho Marx it still needs adjusting."

SOME OF THE LARGER SERVICE OUTLETS doing a land-office business servicing PA and other electronic equipment at amusement parks, the majority of which opened on Decoration Day. In smaller towns and cities numbers of "independents" are handling sales and service work in vacation spots, stadiums, ball parks and so forth. Juke-box "routes" are profitable business for many shops, even some of the small ones, in certain localities. . . . Some big-city TV service contractors are taking on air-conditioning installation and maintenance work.

"TELL YOUR READERS TO look over all telephone-answering services with an eagle eye," a Midwestern shop owner advises. Seems he engaged a certain outfit to take calls evenings and holidays, and lost some customers through the deal because the answerers were curt, discourteous and poorly informed as to the nature of his business. New phone-answering concern he hooked up with insisted that they get a run-down on his shop operation and policies before signing him up, and it's working out fine. This owner believes that 24-hour telephone service of the right kind is extremely valuable to his business.

Picture.....



UNUSUAL, BUT TRUE: A new repair shop opened up in Philadelphia a couple of months ago, and its owner specializes in servicing radios only! Claims he gets lots of work, especially on small sets, turned down by his busy competitors.

THE "YOUNG" TV FIELD must be getting on in years when "old timers" can sit around and reminisce about early phenomena that have passed out of the picture. Some items from the past: Ads about "giant, life-size 10-in. pictures" . . . "portable" TV receivers with 5-in. tubes and carrying handles. They could be used at the beach—provided you could turn off the sunlight, find an ac outlet in the sand and put an antenna on the lifeguard's tower . . . "electronic magnifiers" that would produce a large picture on a small screen when you operated a switch. The center area of the transmitted picture was blown up to fill the screen, close-up style, but the rest of the picture was deflected off the crt face. Remember?

WAYS TO AVOID TROUBLE: If you make an estimate, stick with it. . . . If you say you guarantee your work, put it in writing and live up to the terms. . . . Exercise great care in handling those C.O.D. repair jobs. The customer owns the set at all times. . . . Don't gossip about your customers to others. . . . Don't "forget" tools, meters and other equipment. The "I've-got-to-go-back-to-the-shop" statement is irritating to all set owners. . . . Listen carefully to, and don't laugh at, the customer's description of his set's symptoms. . . .

BIG BATTLE ON SUBSCRIPTION TV is in the offing, with sponsors of at least 3 different systems for scrambling and uncoding signals expected to bid for FCC approval. Several conflicting systems are being mentioned. Payment method may be in advance (via purchase of decoding card), pay-as-you-go (coin box) or after-billing. That word *compatibility* is coming up again, this time in connection with efforts to reach a compromise on a single system or, at least, to make certain that the consumer can use competing systems with a single set-up.

TV TRENDS: More models are incorporating removable legs. Receiver may be used as consolette or table model . . . Tendency among manufacturers is to reduce number of models in current lines, in some cases to fewer than half of last year's number.

MORE HI-FI NOTES: In recognition of the separate-unit systems favored by many audio hobbyists, more manufacturers are marketing "flexible" tables or enclosures that can be adapted to accommodate different set-ups and allow a wide choice of chassis and changer sizes and shapes. More radio and TV manufacturers are swinging over to making Hi-Fi equipment, both in complete-system and separate-unit form. Some will add tape recorders to their lines.

"Al, do we have a replacement .05 MFD around anywhere?"

DEPARTMENT STORES IN SOME CITIES are making good headway in selling TV service, but few of the set-ups—some quite elaborate—are a paying proposition so far as the store is concerned. A great many department stores farm out all their installation and maintenance work.

"BENEFITS" OF SOME LICENSING LAWS have been demonstrated in St. Paul, Minn., where a licensing statute is on the books. Fee: $25 per year. Only requirement: A place of business—NO examination is involved. Fork over your dough and you're qualified. This protects the public? Fee is strictly a fund-raising gimmick. Flat charge is same for every shop, whether one or a dozen men are employed. The shop, not the individual technician, is licensed.

SERVICE REVENUE HYPOED in many big cities as sets went haywire during the McCarthy-Army ruckus and the heightening interest in the baseball season. The service was all of the rush-rush variety, with technicians running themselves ragged to keep up with the avalanche of calls.

CALENDAR OF COMING EVENTS

- **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.
- **Aug. 25-27:** Western Electronic Show & Convention, Pan-Pacific Auditorium, Los Angeles (show) Ambassador Hotel, Los Angeles (convention hq.)
- **Sept. 24-26:** Fifth Annual TV-Radio Service Industry Convention and Exhibitions, Morrison Hotel, Chicago, Ill.
- **Sept. 30-Oct. 2:** High Fidelity Show, International Sight and Sound Exposition, Palmer House, Chicago, Ill.
- **Oct. 4-6:** Tenth Annual National Electronics Conference, Hotel Sherman, Chicago, Ill.
- **Oct. 8-20:** Radio-Electronics-Television Mfrs. Assoc. Radio Fall Meeting, Hotel Syracuse, Syracuse, N.Y.
- **Oct. 13-16:** The Audio Fair, Sponsored by Audio Engineering Society, Hotel New Yorker, New York.

Servicing Convergence Trouble

Identifying and Remedying Misconvergence . . .

By Peter Orne
and
Sol Heller
Managing Editor, TECHNICIAN

• In our last article, we discussed defects relating to incorrect coloring of a black-and-white picture. In a receiver using a three-gun tube, such as the RCA tricolor kinescope, there is another type of defect involving coloring of black-and-white pictures that we have not yet considered; this is a defect of convergence.

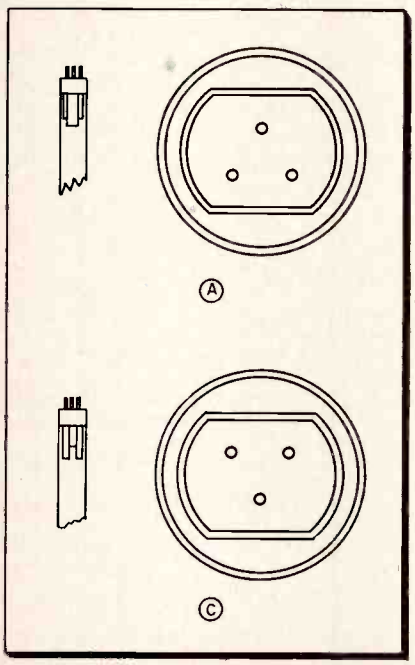
As briefly indicated in previous articles, convergence is the name given to the process of getting the three beams from the three crt guns to go through the same hole in the shadow mask. The appearance of a misconverged black-and-white picture is similar to a poor reproduction of a color page in a cheap comic book, in that individual colors can be seen at the edges of all objects in the picture.

It will be helpful to consider how convergence is achieved, before we discuss troubles that may affect the process. Two problems are actually involved. One is the problem of getting three beams to converge at the center of the screen; this is called *dc convergence.* The other is the problem of obtaining convergence over the whole screen; this is known as *dynamic convergence.* Convergence at the center of the screen is obtained by suitably adjusting gun voltages.

When dealing with one gun alone, the only problem is to get the beam to focus at the screen. If the undeflected beam does not hit the exact center of the tube screen, a number of different ways of adjusting centering so that the beam does hit the center, are available. The dc current through the yoke may be varied (by means of a potentiometer); or the focus coil may be tilted; or permanent-magnet centering devices may be utilized.

In the case of the 3-gun color tube, the problems of centering and focusing present in single-gun b & w crt's remain. Electrostatic focusing is employed, and the dc current through the yoke is varied by potentiometers to attain centering. Present crt manufacturing techniques cannot maintain sufficiently small tolerances to assure that the three undeflected beams in the color tube will all strike the same point on the screen. An additional electrode, common to all three guns, is therefore used in the 15-in. tube to provide this action. The unit is called the *convergence electrode.*

Fig. 1—Front view of crt, showing decorative mask built into tube. Tube is installed correctly when straight lines of mask are horizontal and one gun is on top (A). If two guns are on top (C), tube is upside down.



Convergence Changes

Varying the voltage present between this electrode and ground (usually 10-14 kv) changes the relative positions of the three beams at the screen. The beam from the blue gun will, for example, move *vertically* when the convergence voltage is adjusted, while the red beam moves *diagonally,* from the *lower* left (looking at the tube face) towards the *upper right-hand corner*; the green beam moves along the other diagonal, from *lower right* to *upper left* (see Fig. 2).

To clearly understand the process, it must be known that there is only one correct way to install the picture tube, and that is with the blue gun positioned on top. Fig. 1 shows how one can check for such correct gun positioning.

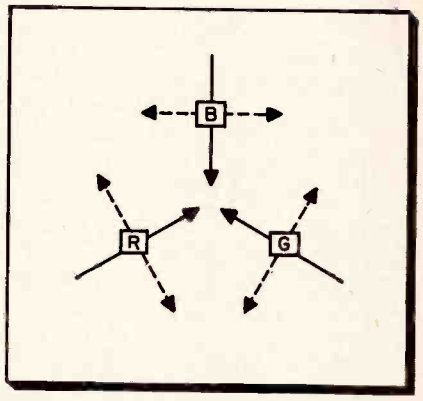


Fig. 2—Direction of motion of the individual color dots due to the action of the dc convergence control is shown by the solid lines. Counterclockwise rotation of control, decreasing voltage of convergence electrode, will cause dots to move in directions to which arrows point. Dotted lines indicate the individual motion of each dot when the magnet nearest its gun is moved in or out.

The best way to make convergence adjustments is by the use of a dot generator. A number of such instruments are on the market. The reason for using dots is that the errors in convergence at any part of the screen can be readily noted. If no dot generator is available, any stationary picture, such as a test pattern, can be used instead. Since the test pattern is stationary and provides video information all over the screen, it is possible to check convergence at all points by noting whether edge coloring is present anywhere.

It is preferable to use an instrument that provides white dots on a black background, since the convergence errors will show up in their correct colors in such a case. For example, a blue edge on top of the white dot indicates that the blue gun is aiming its beam too high. If black dots are used on a white background, the improper tints will show up as complimentary colors—that is, a bluish-looking edge on top (pointing to the absence of red) would mean that the red gun is aiming its beam too low. (Adjustments re-

in the Color TV Receiver

Generator Tests . . . Magnet and Control Adjustments

quired in each case will be discussed soon.)

Let us assume that the c-r tube has been properly installed and that a dot pattern is present. (Most dot generators put out video signals for application to the video amp; some have an r-f output, and connect to the antenna terminals.) We are for the moment concerned only with the centermost dot. This dot is, actually, *three* superimposed dots; these dots move with respect to each other when the dc convergence control is varied. When the attempt is made to converge the three beams on the center dot, difficulties may be encountered. For example, the serviceman may find that when the red and green dot are superimposed on each other, the blue dot is too far over to one side. Adjusting the convergence pot will not help matters in such a case, since this control moves the blue dot up or down only. Similar problems may affect the other two guns. To remedy such problems, individual permanent magnets are placed near each gun, permitting the guns to be separately adjusted, and allowing dot movement *at right angles* to the movement produced by the dc convergence pot. These magnets are known as *convergence magnets.*

The directions in which the dots may be moved by the convergence control and the three magnets are indicated in Fig. 2. The magnets are in the form of screws mounted on the shield of the purity coil; these screws can be pulled out and reversed, when it is desired to reverse the direction of motion.

The reader will realize that the set-up described permits a great variety of adjustments. The problem is slightly complicated by the fact that each magnet will have some effect on all three guns, with the most pronounced effect on the gun it is nearest to.

One adjustment procedure (for obtaining proper convergence) is as follows:

Start by adjusting the dc convergence control for best convergence of the center dot, with the magnets as far away from the guns as possible. The center dot is then inspected and the magnet of the gun whose beam is "sticking out"—i.e., whose beam is most out of convergence—is adjusted, to improve convergence. If the beam in question moves the wrong way, the magnet being adjusted is unscrewed and reversed. Adjustment of a convergence magnet will require a slight resetting of the dc convergence pot. Proper convergence of *the center dot only* is gradually achieved by successive adjustments of the magnets and the dc convergence control, as outlined. It should be kept in mind that the convergence magnets are intended to correct for slight errors in production, and that the best adjustment will require minimum movement of the magnets.

Convergence at Edges

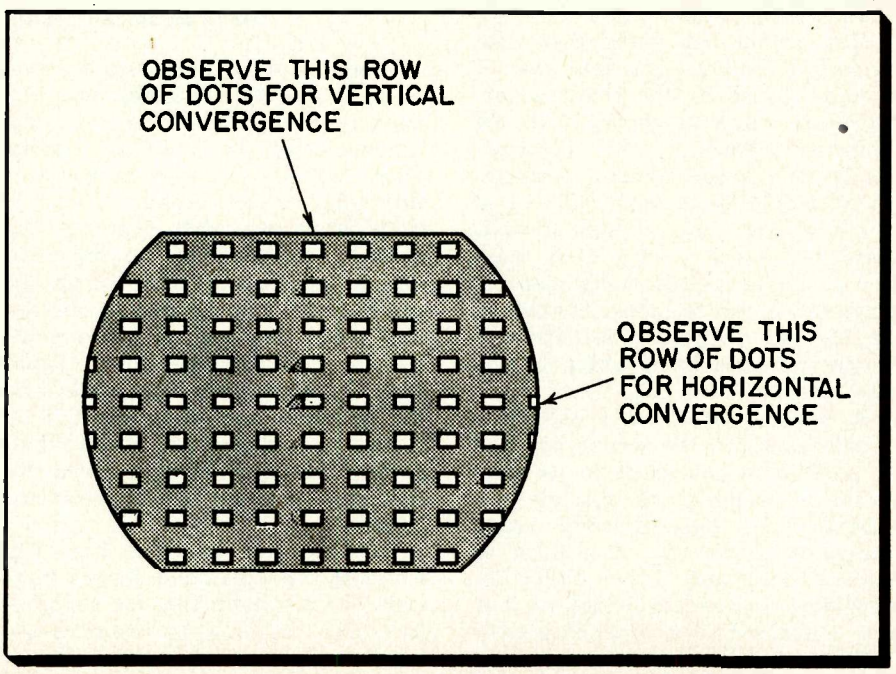
Now what about convergence adjustment at areas other than the center? Since the distance any beam travels from its gun to the center of the screen is shorter than the distance to the screen edges, additional correction is needed, to provide proper convergence at the edges. The required convergence voltage correction is referred to as *dynamic convergence.* Both vertical and horizontal dynamic convergence must be considered. Addition of a voltage with a parabolic wave shape to the dc convergence and focus voltages insures proper convergence and focus near the screen edges. To boost the correction voltages to the necessary amplitudes, a *convergence amplifier* is used.

Let's consider the vertical correction process first. The process must provide 1—A correction symmetrical from top to bottom. (This is known as proper *vertical convergence shape.*) 2—An adequate amount of correction (vertical convergence amplitude).

To make the adjustment referred to, turn up the vertical convergence amplitude control and inspect the center vertical row of dots. The vertical convergence shape control is then adjusted to introduce equal amounts of *misconvergence* near the top and bottom of the picture. This obtained, the amplitude control is turned down, to provide equal misconvergence over the *entire center row* of vertical dots; finally, the dc

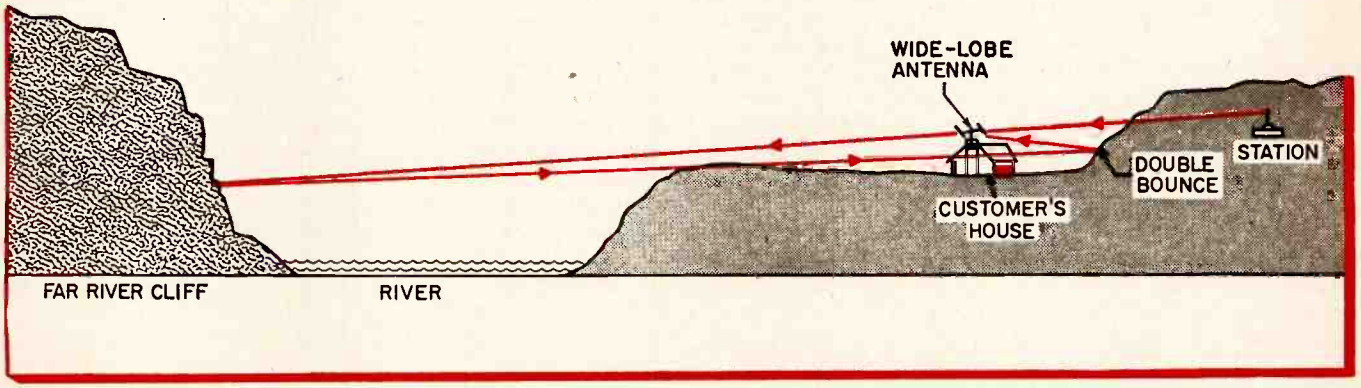
(*Continued on page* 59)

Fig. 3—Typical dot pattern. The arrows indicate the lines of dots to be inspected.



Orienting Your Customer On

Antenna Reflection Problems



Sketch used to show customer that his antenna was picking up too many reflections. Narrower-lobed antenna would have reduced this pickup.

Human Element. Pointers on Reflected and Direct Signals

By M. G. Goldberg

• Starting right from the time he grabs his service kit to answer his first service call of the day, the TV technician comes up against the human element. At times this human element may be the most important part of the servicing business, especially when it becomes necessary to pacify a customer who expects the impossible from his or her receiver and assumes that by "adjusting" the set, the technician can simply and cheaply cure any trouble that arises, whatever its cause.

The author has found that clear technical explanations that can be comprehended by the customer are of great value in coping with the "human element." This is especially true when antenna problems exist. Not only is the good will of the customer kept—additional business also results very often, since the customer who is really made to understand the technical limitations of his old antenna installation is much more ready to order a new one, when needed.

A number of antenna reflection problems which the writer has had to explain to customers in as non-technical language as possible are described in the following paragraphs, and may be of interest to other technicians. Other reflection problems that had to be solved, but not explained, are also discussed.

The technician may have occasion to point out to his customer how a reflected signal is distinguished from a direct one. This differentiation is not always a simple one, and when the customer is inclined to blame the "ghosty" reception on his set, the technician has a job of explaining cut out for him. Our effort here will be to first clarify some of the technical situations that may confront the serviceman; he can adapt the explanations to his customer's needs, or work out others along similar lines.

Using Reflected Signal

Now the important consideration is, of course, to obtain the *best* picture, regardless of the fact that the antenna may be pointing "galley west" as far as the transmitter direction is concerned. There is nothing wrong with beaming the antenna to pick up a reflection which produces a more clean-cut pix than the one created by the direct wave. We are trying to point up the fact that the direct signal from the station may not always be the strongest one. Even when it is, it may be confused with a reflection, particularly when two so-called direct waves and one reflected one are present.

To illustrate: consider Fig. 1A, which shows a diamond-shaped pattern. We are assuming, for simplicity's sake, that such an image is being picked up by a roof antenna in a fairly good signal area. One direct signal and a single reflection is being received in this case. In Fig. 1B we have the same patterns with the conditions reversed—that is, the darker pattern is now on the *right*. Next, look at 1C, in which two reflections seem to be present. In each case, which are the direct signals, and which the reflections?

The diamond on the *left* in 1A is the direct signal, since it arrives first (closest to the left side of the screen); the reflection is to the *right* since it arrives a short time later. Remember that negative transmission is used in this country; as a result, the strongest signal is the blackest, *regardless of whether it is the direct or the reflected one.* This tells us then that in Fig. 1B the reflected signal is the stronger one—just the reverse of the situation in Fig. 1A.

In 1C we have a slightly different condition. The receiver is located in a strong signal area, and uses a roof antenna, four stories up, with 160 feet of low-impedance co-ax to reduce noise pickup. The direct signal picked up by the roof antenna produces the strong center diamond pattern, and the weaker reflection is shown to its right. The light pattern on the extreme left is caused by an even more direct pickup than the one from the antenna on the roof. In this case, because of the receiver's location in a strong signal area, sufficient energy

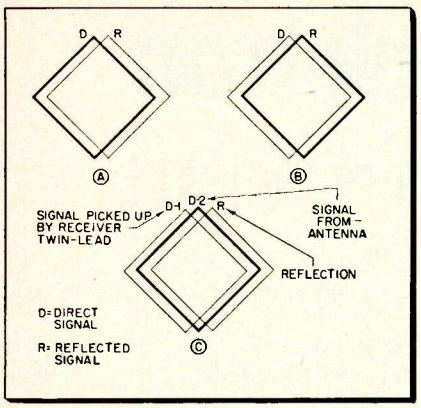


Fig. 1A—Strong direct signal, weaker reflected one. B—Strong reflected signal, weaker direct one. C—One weak and one strong direct signal, one weak reflected one. If lead-in within set is short, D-1 may blend with D-2, causing lines of image to thicken.

is picked up by the 12 to 15 inches of 300-ohm lead within the receiver to show up as a visible pattern—the one on the extreme left. This is followed by the direct signal from the roof antenna, which is delayed slightly due to the length of co-ax line used (the TV signal travels more slowly in a conductor than in free space), after which the reflected signal arrives (extreme right).

If it wasn't necessary to use co-ax line with its increased loss, the signal from the roof antenna would come in stronger; this would cause the agc voltage to increase, which in turn would bring about somewhat reduced set sensitivity, thus weakening ghost *D-1*. The change described would not, however, affect reflection *R*; that is, *R*'s strength would vary in step with the direct signal *D-2* since both signals are received on the same antenna system.

As an instance of how the author used information along the lines indicated to solve a customer-technician problem, take the following case:

A customer who lived in Highland Park, St. Paul, and enjoyed satisfactory ghost-free TV reception, moved about a mile down the street to a site near Edgecumbe Blvd. The latter is a road that runs along the edge of the pre-historic river bank of the Mississippi (see Fig. 2). Cliffs are present at both sides of this river.

The customer used a rabbit-ear antenna in both locations; in her new home, however, the ghosts present (particularly on Channel 11) were severe, and the position of the antenna had to be carefully adjusted each time the station setting was changed, to minimize them.

This was quite a nuisance to the customer, who attributed the trouble to her set—something must have been jarred in moving it, she thought.

Proving Diagnosis

The writer patiently explained the circumstances, saying that whereas reflections present in the old location were weak because of built-up sections at the rear of her home, they were much stronger in her new home, due to the absence of such absorbers.

To prove more conclusively that this diagnosis was correct, I moved the antenna around, showing her how the ghost faded in and out, and was even supplanted by other ghosts, while the direct image stayed put, although varying considerably in strength and quality. I also pointed out that moving her indoor antenna 180 degrees produced no change, showing that it did not reject signals from the rear, and explained why an outdoor antenna, with reflector elements, would cancel out undesired rear pickup.

Her final reaction was acceptance of the trouble as being externally-caused, and due to the lack of an outdoor antenna; and a decision to have an outdoor antenna installed.

Sharper Pattern Needed

A mile down the street, just below Edgecumbe Blvd., lives another customer whose antenna is a fan type with fairly broad pickup lobes, and not too good a front-to-back ratio. When Channel 11 was on lower power, he could pick it up, but poorly. Since the station increased its power to 316 kw March 1st, reception on Channel 11 is hopeless at this site; at least 5 or 6 ghosts are visible, and the direct signal is lost in the mess. Channels 4 and 5 are less affected.

It happens that the ground slopes downward after passing a hill between the receiving antenna and the station, and the strong signal bounces back and forth several times between the river banks and the hill in front (see drawing under title of article). I drew a sketch for the customer, and explained to him that the lobes of his antenna were broad, and that he needed a more sharply-patterned antenna array, since the three stations were within a 10-degree angle with respect to the set. The several ghosts on the screen were pointed out, and their points of origin and travel paths indicated. Because of the location of the house, I explained, and the side pickup of the antenna, he was getting some double reflections as well. The man greatly appreciated the explanation and the time spent in making the sketches, gladly paid for the service call, and stated he would call soon to have another and sharper antenna

(*Continued on page* 51)

Fig. 2—Map showing two reception sites not far from each other, in which marked differences in picture reception were noted.

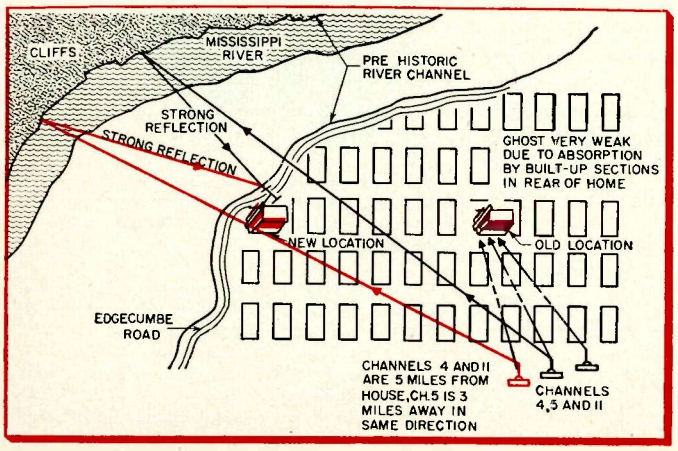
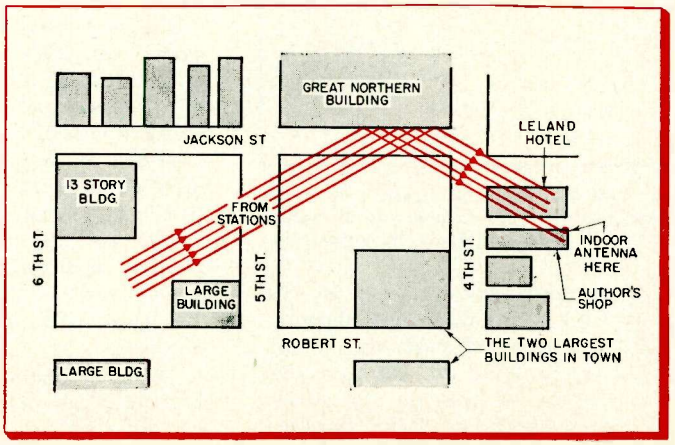


Fig. 3—Sketch indicating why shop antenna worked well only at the site indicated. Lines with arrows represent incoming signals.



The 3-Gun Color Teletron

Simplified Du Mont CRT Provides a Large Picture

• Accepting the 3-gun color tube and its associated circuitry, engineers of Allen B. Dumont Laboratories, Inc., have been working toward producing a color crt that may be mass-produced at relatively low cost, but will provide a large viewing area without adding to the complications of color receiver design. This approach has resulted in the recently announced Chroma-Sync Teletron, a round tube with a 19-in. diameter, capable of producing a picture with an area of 185 sq. in.

The diameter of the reproduced image is close to the nominal diameter of the tube. Maximum diameter is 19 5/16 in. Usable diameter is 16 9/16 in., as compared to 15 5/16 in. on earlier 19-in. types—a gain of an inch and a quarter (see Fig. 1). At the same time, however, overall length of the tube has been reduced so that it is shorter than both its 19-in. and 15-in. predecessors.

The shorter length is made possible by the use of a 60-degree deflection yoke, and the depositing of the phosphor dots directly on the faceplate. In earlier types, the phosphor was deposited on a transparent screen, which was recessed behind the glass faceplate.

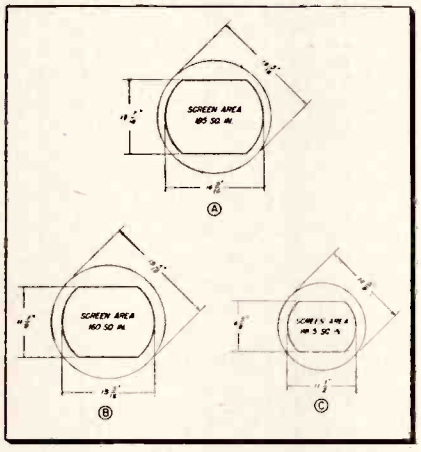


Fig. 1A—Diameter and screen area of Du Mont color crt. B,C—Comparable dimensions for earlier 19-in. and 15-in. three-gun types.

A photographic process is employed for laying down the phosphor dots. Diameter of each dot is approximately 0.012 in. At this size, the number of dots on the screen has been approximately doubled, compared to the number on the 15-in. shadow-mask type. The increase in the number of dots produces a corresponding increase in definition.

Heart of the tube is a new 3-beam electron gun assembly that allows 70 percent closer beam-to-beam spacing. Since this arrangement brings the 3 beams closer to the single-beam condition, it is said to reduce substantially the problem of obtaining acceptable convergence over the entire screen area. Compensating circuits are kept to a minimum, being no more elaborate than the circuits already in use for 15-in. tubes.

Mask Details

The nature of the electron mask has also been changed in this design. Instead of a flat shadow mask, an aperture plate is used whose curvature follows the shape of the curved faceplate. Furthermore, the individual apertures in this mask all have the same size. In the design of other large-screen 3-gun color tubes, the diameter of the apertures on the flat mask that are farthest from the center is decreased. This measure, which reduces a tendency toward misconvergence at the screen's edges, also reduces brightness in the areas away from the center. The mask is constructed of only one material, further simplifying it, as well as minimizing mask misalignment due to expansion and contraction with temperature changes.

Teletron Adaptability

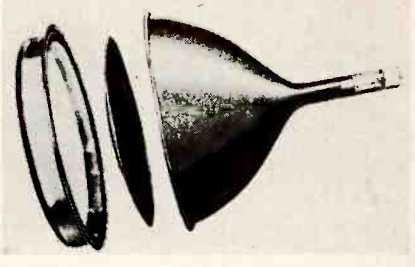
The new mask weighs only a little over 7 oz. This, together with the elimination of other elements within the tube, has resulted in a considerable reduction of overall weight. The exploded view of Fig. 2 gives some idea of the simplification in construction. Except for the curved mask, as can be seen, there is greater similarity to conventional monochrome types than has been the case with other 3-gun color tubes.

Ready adaptability of the Chroma-Sync Teletron for use in current circuits is an important feature, not only to the manufacturer, but to the service technician and dealer as well. Even the value of 2nd-anode voltage is no problem, since the 20 kv applied to the 15-in. color picture tube is satisfactory for operating this larger type. All that is needed, aside from the new tube itself, to make operation possible with a chassis built for the 15-in. tube, is a change in the deflection yoke. The old yoke is replaced with the 60-degree assembly now being made for the 19-in. RCA tubes. Physical adaptation of the tube for the cabinet cutout, etc., should be no more complicated than is the case when converting a small-screen monochrome receiver to accommodate a larger crt.

In summary, then, this color tube is a step forward in a number of respects: 1—Manufacture in sizes comparable to present black-and-white tubes, including rectangular types, is believed to be possible. 2—Design has been simplified. This simplification not only results in a shorter, lighter assembly, but is expected to reduce manufacturing costs. 3—Further complications in receiver circuit design have been avoided.

Samples of the experimental type B1103, as the tube is tentatively designated, are expected to be available to receiver manufacturers before the end of the summer. Production in limited quantities is expected later this year.

Fig. 2—Exploded view of Chroma-Sync CRT.



The business that considers itself immune to the necessity for advertising sooner or later finds itself immune to business.—Derby Brown

* * *

The servicer who leaves dirty fingerprints on the TV set cabinet is a prime candidate for the customer's rogues' gallery.

* * *

The good outside servicemen pats the family dog, talks to the kids and is polite to the adults. He has, in short, a fine "set-side" manner.

Tracking Down Intermittents

Heating and Cooling Techniques. Vibration Troubles, Relay Faults

By Frank A. Bramley
Regional Service Manager,
Motorola Communications and Electronics, Inc.

• Locating the cause of intermittents in electronic equipment is an ever-recurring problem. Unnecessary delays result in the dissatisfaction of the user through lost service, and present difficulties in collecting fees for the actual time spent on the repair. The suggestions made here may, in a general way, be applied to all electronic equipment.

Heat and Cold. Since extremes of temperature are a common cause of trouble, *both* extremes should be investigated. Servicemen have used heat to produce failures for some years, but it remained for a taxi owner in Wolfeboro, New Hampshire, a Mr. Francis W. Roy, to suggest placing equipment in a refrigerator for a period, to induce a persistent but fleeting intermittent to stay "in" until located. He put a receiver into a beer cooler, and the trouble was located *immediately*. Many service attempts with the temperature normal had failed. The trouble was a rosin joint.

Heat Lamps. Equipment may be quickly subjected to abnormal heat on the bench by use of an infra-red, paint-drying or heat lamp. It is suggested that every well-equipped service bench might well be equipped with a gooseneck lamp, normally furnished with a 100-watt bulb for inspection of hard-to-see places. This item will itself aid in locating intermittents; if the heat lamp is substituted, the whole or parts of a chassis may be quickly brought to a very high temperature.

If the lamp is close, say 3 to 5 inches, it is seldom that more than 3 to 5 minutes are required to bring the equipment well above any reasonable operating temperature, so be careful. This is a shot-gun approach; if the trouble occurs you still don't know what part is at fault. When the receiver has been brought above normal operating temperature, place a sheet of aluminum containing a one-inch hole over the chassis and reheat. Movement of the hole over the various items in the chassis should then help locate the individual component at fault.

Old style wax-filled or dipped components can't stand much heat, and are especially subject to failures due to temperature and humidity extremes, to say nothing of vibration. The heat test just described will often cause failure (of bad units, sometimes of good ones too). Paper condensers are particularly vulnerable. A good detection method is to hold the "hot" prod of a vtvm on the grid side of a suspect coupling condenser. The voltage will usually be zero or slightly negative. Then, as the condenser is heated by letting the infra-red light shine through the hole in the metal plate, the voltage may often be observed to go less negative, than quite positive. This may be the part causing the trouble, but don't be too sure.

While not commonly known, modern ceramic condensers occasionally act in a similar manner. Since they are ceramic, they are not permanently damaged by heat. A quick test may be made by placing the tip of a soldering iron against the ceramic body of the unit. If faulty, trouble may be induced in a matter of 15 to 30 seconds, and will often disappear as quickly, when the iron is removed. Do not touch the bare leads with the iron, since the resultant capacity to the power line may cause some circuit change not due to heating the condenser.

Warning: The location of faulty parts by these methods does not necessarily mean that the true cause of the intermittent has been found. Failure to locate the real cause is often due to the smoke-screen of finding other troubles, definite though they may be. Always review the original complaint. Ask yourself, could this have been the real trouble? If the answer is "Yes," don't be too sure. Most failures to find the real trouble are due to a rationalization and perversion of the symptoms to conform with what you did find, not the real trouble that you did not find. Be honest with yourself.

The Double Feature. The most confusing feature of troubleshooting is the double-feature—the double-troubles with similar symptoms but separate causes. Don't overlook the unfortunate fact that equipment often contains two, or even three, simultaneous troubles having similar symptoms. Many failures to find intermittents can be laid at the door of the double-feature.

Vibration and Shock. Loose connections induced by vibration and shock are an important cause of intermittents. Poor grounds are most common. Coil shields and equipment frames, especially, should be checked. Try prying each can in various directions with a screwdriver. Riveted or swaged contacts are often at fault. Solder them over, if possible, or make bolted connections, using lock washers or pigtail connections when necessary. Use good, solid conductors for common connections between sub-chassis.

Changes in the value of capacitors, inductors and resistors may be caused by vibration, as well as by temperature, voltage or humidity factors.

Voltage and Current. Improper voltage and current may often cause intermittent conditions. Low voltage tends to prevent oscillations, or

Refrigerating a TV set to cause an intermittent to "surface" is not as silly as it sounds. But it's probably mean letting the beer get warm. A taxi driver thought this one up.

makes oscillator circuits unstable. Some means of gradually changing the voltage of primary supplies should be available on any well-equipped test bench. Vibrator and relay operating limits may be checked in this manner. In order to thoroughly check tube and circuit conditions, the voltage should be changed very slowly, to allow tube temperatures to follow voltage changes. (If a voltage is critical, it can only be discovered by changing voltages slowly.)

Circuit failures may sometimes occur only at higher than average voltages. To test for this kind of defect, some means of raising voltages should be available. Always increase a voltage *slowly*. Tubes are vulnerable to excessive voltage, and both tubes and vibrators have reduced life if voltages are as much as 10% above normal. Tube shorts may occur only at excessive temperatures; such temperatures may be approximated by increasing circuit voltages.

Fuses. Fuse contacts (among others) are affected by heat. A vicious circle is present here; a slightly loose contact produces a slight voltage drop and consequent heat; heat causes expansion, possibly resulting in a poorer connection, with more heat, more oxidation or even burning resulting in further destructive action. Spring fuse clips, if loose, often initiate this pattern.

Fuses should never run hot, just slightly warm when operated near their rating; the voltage drop across them should be very small—usually unmeasurable on an ordinary voltmeter. Poor fuse contacts often cause fuses to blow. The heat of the poor contact outside of the fuse melts the fuse link inside, although current through the fuse itself is not excessive. Such troubles are occasionally intermittent.

Relays. Relay faults constitute some of the most difficult intermittents to locate. Metal filings, dust and oxidation are common causes of trouble. Metal filings, resulting from careless repairs, or abrasion and vibration, manage to get between the pole piece and the armature and cause partial or complete lack of operation. Peculiarly, these filings only interfere occasionally, yet remain in a position to cause intermittent trouble for long periods. Careful inspection with strong lighting, plus careful cleaning of pole piece and armature, are recommended. Use of sticky black tape to pick up the filings in tight places is helpful. Compressed air also is useful.

Some chassis are plated with a material that flakes off gradually, causing perennial trouble. Such cases require drastic action, or the equipment may as well be discarded. Complete removal of the finish plus refinishing or replacing is required (probably uneconomical).

Dust is a mortal enemy of small relays. All relays operating on small currents, or involved in switching small currents or voltages, should be provided with dust covers. The light contacts present are easily held apart by small dust particles. Small relays must be kept spotlessly clean. Contamination of the contacts by oxidation, dust, and grease films of atomic thicknesses will prevent the flow of small currents, such as those involved in audio circuits. Contacts must be cleaned with *very mild* abrasives. Point files are much too coarse. Standard relay cleaning tools, such as those manufactured by the Western Electric Company, are the tools to use.

Where pressures are light, they may also be uncertain and contribute to an intermittent condition. Small and variable currents may only break through contaminated contacts intermittently. Vibration of components such as transformers, as well as the relay itself, when it is large, may contribute to intermittency. The relay frame must be *tight;* operation *firm* and certain. Contacts must travel far enough to wipe their opposite members and be capable of overtravel. If cleaning with solvents such as carbon tetrachloride is attempted, the equipment must be allowed to dry thoroughly, then the contacts must be recleaned by the mechanical method; otherwise a film of grease may be left on the contacts, making conditions worse than before. Always wash twice, wipe once (after second washing, let contact dry by evaporation).

Failure of relays to pull up or to make positive contact every time may commonly occur when voltages are low. Relays should be tested regularly, to determine their low voltage drop-out point and their reliability at the low end of their normal operating range. What the relay may actually need is adjustment—not higher voltage—but this is another subject in itself.

Humidity and Dust. Dust and dirt accumulations anywhere in electronic equipment can lead to trouble, especially when combined with moisture and high voltage. The trouble may well be intermittent, due to variations in temperature and humidity. One swipe of a dust cloth in the right spot will often remove such trouble.

Miscellaneous Considerations. The fact that a trouble may occur at a particular time of day, or a particular day of the week, etc., should not be overlooked. Possibly this fact may be a clue. A particular voltage condition may then be present, a particular person may be using the equipment, or other special conditions may exist. Determine what these may be.

Sometimes there appears to be a loose connection in one corner of a set, as evidenced by poking in that area, yet it cannot be found. Eventually, it is found at the opposite end of the set, yet the trouble was easily induced from afar.

A most exasperating fault is a broken tube socket lug. Measurement shows voltages are present at the socket, yet the set is inoperative with known good tubes in it. Investigation reveals a concealed break within the socket structure, such that the voltage does not actually reach the tube pin.

Technician-Induced Troubles. Equipment may fail when used by one particular technician, but never when used by anyone else. This could quickly lead to a discussion of personalities, rather than a repair. In one public-address job, technicians found no trouble for several days, but eventually the microphone cord was found to be defective when held in the particular manner characteristic of the complaining operator.

"Hated to call you out on a Sunday, but I've an annoying little hum in my set that's been worrying me for months."

Making the Most of

Your Test Equipment

Part 2. Using Oscillograph and Signal Generator to Pre-Set Traps

By M. G. Goldberg

• Proper use of the scope around the shop can save much time otherwise spent on "hit or miss" methods. Many minutes can be saved, for instance, in adjusting to approximate frequency tuned circuits which are going to be added to a TV or radio set to trap out unwanted signals. Some examples of what can be done along these lines are illustrated in Fig. 1A through 1F.

Fig. 1A shows the set-up needed for this purpose, using only an AM signal generator and a scope. The response of the scope is relatively unimportant, since it is only the indication of minimum response that is required. Few technicians are probably aware that ordinary 455 kc i-f transformers will cover most of the standard broadcast band, and can therefore be used as single or double-tuned traps either to attenuate or eliminate an excessively strong broadcast station signal that is interfering with reception in a TV set, or in a broadcast radio receiver (say, one operating in the shadow of an AM transmitter that is blanketing adjacent channels with its excessively strong signal).

Whether the trap to be used is a home-made or commercial one, connect it as shown in Fig. 1A, using a 25 mmfd capacitor in series with it in order to 1) approximate the circuit capacitance that will be present when the trap is connected into the set, and 2) isolate the low impedance of the signal generator output from the resonant trap circuit. The scope gain is set near maximum, and sufficient generator output is used to provide near full screen deflection amplitude.

Set the generator to the frequency to which the trap is to be tuned, and adjust the latter for *minimum* deflection on the scope screen. After this is done, check the trap action by swinging the dial above or below the generator frequency setting. The output should rise rapidly at each side of this point. Only a slight touching up will be required when the trap is connected to the receiver on which it is to be used.

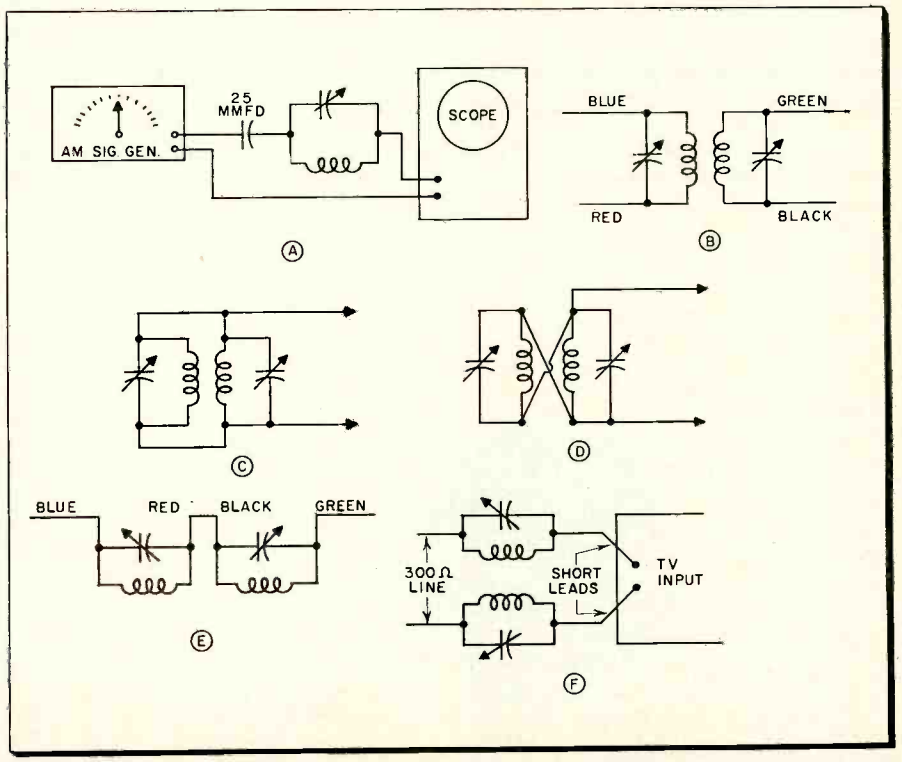
Fig. 1B shows a standard i-f transformer schematic with normal color coding. The unit used by the author in the tests just referred to was a Meissner 455 kc i-f transformer no. 16-6660 (shielded); any other good i-f unit, however, will do for this purpose.

If one winding is shorted by twisting the leads together, and the other is connected as in Fig. 1A, the tuning range will be from approx. 375 to 1250 kc. If two traps are connected in series, as shown in Fig. 1E, the frequency range will be from about 375 to 1100 kc for *each* trap. Since there is less than critical coupling between the two coils, each trap can be tuned independently to a different frequency without appreciably detuning the other. (The polarity of the windings is of little consequence when the units are used in this manner.) One trap, for instance, can be tuned to the intermediate frequency, and connected in series with the antenna input, to eliminate interference from a station whose beat with another carrier may fall in this band (Fig. 1F); the other trap can be tuned to an interfering ship station in coastal locations.

Both traps can be connected in series and tuned to the same frequency (Fig. 1E) to provide greater attenuation, if desired; or they may be inserted in each leg of the input antenna of a TV receiver (Fig. 1F) and tuned to the same frequency, to eliminate a local BC carrier. If the coils are in a shield can, the latter should be grounded to the chassis with a short piece of braid. If the station to be attenuated falls between 1200 and 1600 kc, turns can be removed from one coil until the proper trap range is reached. Thus, through the presence of the two overlapping ranges, the full BC band can be covered, with one trap providing coverage between 550 to 1600 kc, and the other from about 375 to 1200 kc.

(*Continued on page* 53)

Fig. 1A—Equipment setup for pre-setting trap. B—Color-coded 2nd i-f transformer. C, D—Parallel connection of i-f windings. E—Primary and secondary connected in series. F—Inserting double-tuned traps at input to TV set. Xformer leads can generally be used to connect to TV set.



Clock Radio Service Data

Troubleshooting Information on G.E. Models 555 and 556

Two clocks are used: Model 555 early production receivers use Clock Assembly RZC-027 (Telechron Mfg. No. C87G5); Model 555 late production and all Model 556 receivers use Clock Assembly RZC-028 (Telechron Mfg. No. C88G5). Either clock assembly may be used interchangeably in these receivers.

The first clock assembly, RZC-027, may be identified by the spring contacts of the selector switch being held by a screw between phenolic blocks. Also, this type clock has two shafts extending from the back for alarm and time set. Exploded view and parts information for this clock are presented on these pages.

Later clocks, RZC-028, employ a switch mechanism set within a phenolic enclosure. The single shaft extending in the back serves a dual purpose: Push in to set time, pull out to set the alarm. The clock front plate and base plate of this assembly are factory-assembled by a staking process of the baseplate studs, instead of the former use of screws. Therefore, mechanism disassembly by any but well-equipped service organizations is not recommended. Special tools and skill are needed. Should such disassembly be required for servicing purposes, remove the clock from the radio and have your nearest Telechron Service Station make the necessary repair. Appearance items (knobs, hands, etc.) or field core and rotor are, however, readily accessible for service. The appearance items, with the exception of Dial and Alarm Set Indicator, are identical to those of early clocks, RZC-027.

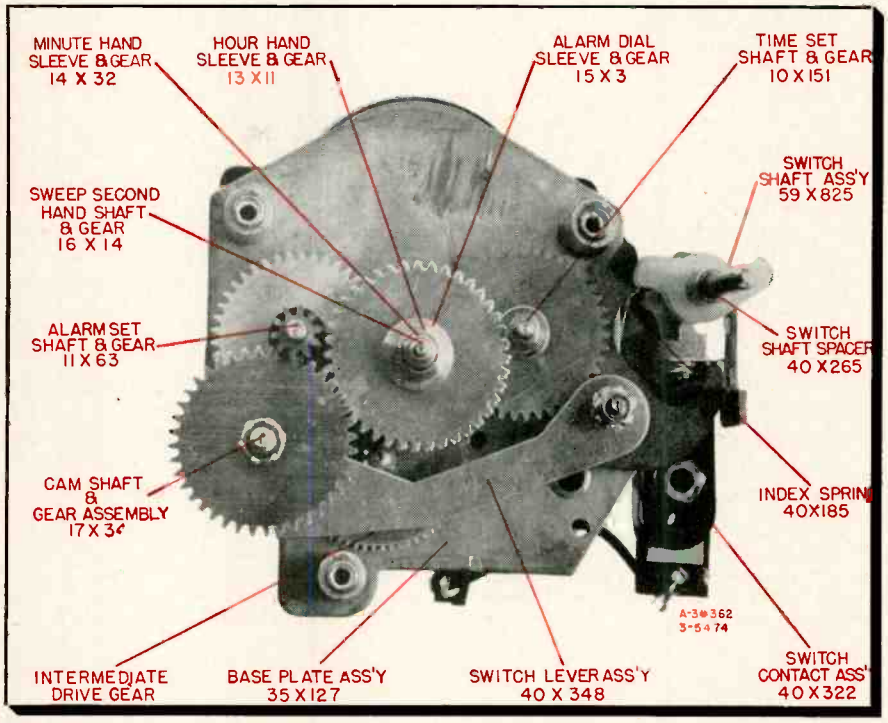


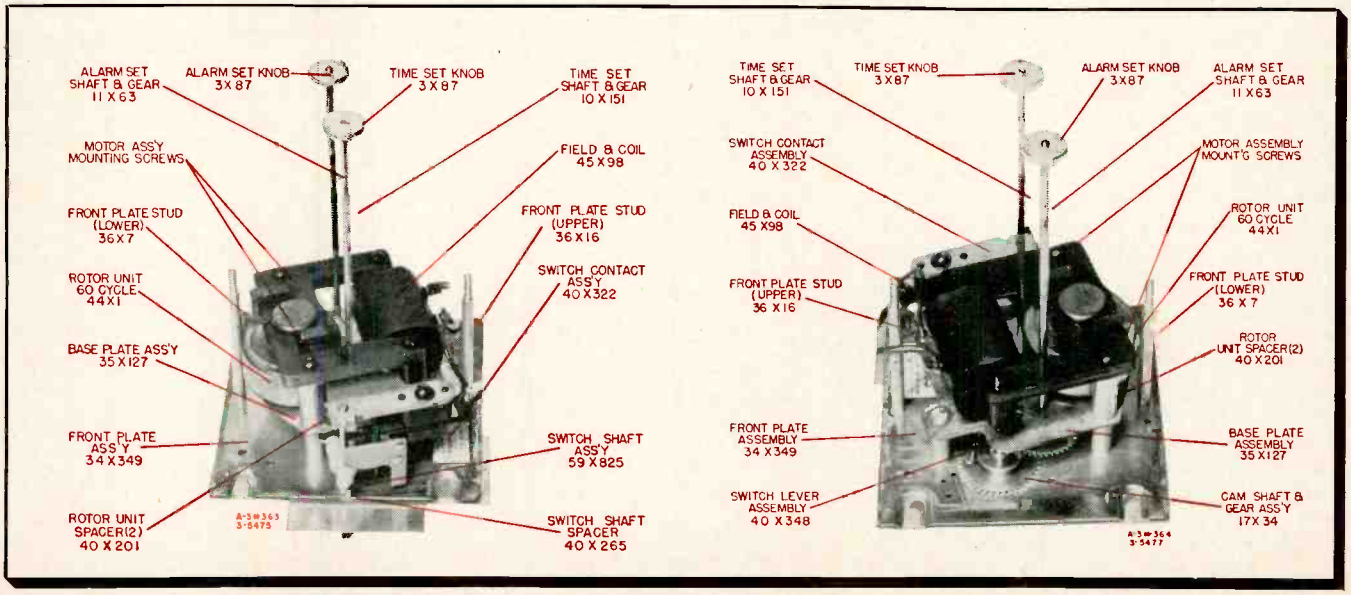
Photo of Clock Assembly RZC-027 (Telechron Mfg. No. C87G5). The front plate has been removed.

CLOCK SERVICE— C87G5—RZC-027

Disassembly of Clock Movement

After removing the clock from the radio cabinet, pull off sweep second,

(Left) Photo of Clock Assembly RZC-027, providing a switch-shaft view of the unit. (Right) Cam-shaft view of the same assembly.



minute and hour hands, and alarm set dial; take off alarm set and time set shaft knobs. Remove dial face, and after taking out the three screws, carefully lift off front plate assembly. Remove switch shaft spacer and switch shaft assembly. Then, to completely disassemble all shafts, gears, sleeves, etc. from the baseplate, remove the following items in the order listed:

1. Alarm Dial Sleeve and Gear
2. Hour Hand Sleeve and Gear
3. Cam Shaft and Gear Assembly
4. Alarm Set Shaft and Gear
5. Time Set Shaft and Gear, and Spacer
6. Minute Hand Sleeve and Gear
7. Sweep Second Hand Shaft and Gear, and Washer
8. Switch Lever Assembly and Spacer

When reassembling, replace each part in the reverse order of the paragraphs above. Refer to photographs and exploded view for the correct position of all parts.

Alarm and Switch Adjustments

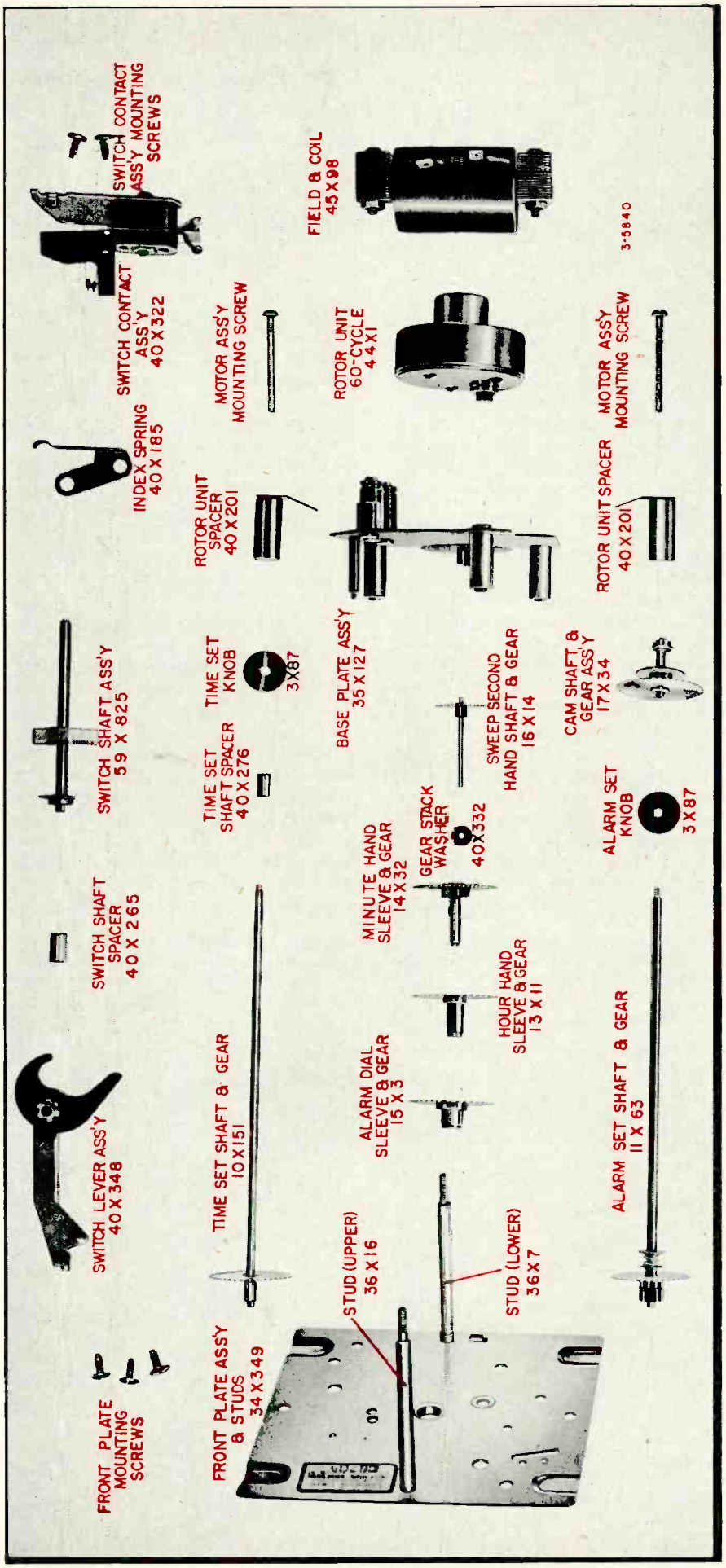
After reassembling the clock, use the following procedure to adjust the mechanism for proper alarm and switch action:

Turn the Switch Shaft to "AUTO" position, then slowly rotate Time Set Shaft in a clockwise direction until the contacts of the Switch Assembly just close. Set all hands to indicate 12 o'clock and set the Alarm Dial with its figure 12 indexed to the smaller pointer of the Hour Hand. Make certain all hands and alarm dial are tight on their respective shafts. Check alarm action as follows:

Turn the Alarm Set Knob to set the Alarm Dial for some other time of alarm. Turn Time Set Knob slowly in a clockwise direction—the switch contacts should close at the hour of alarm. Then turn Switch Shaft momentarily to "OFF" and return it to "AUTO"—this opens the switch contacts, preparing the mechanism for a new alarm cycle.

Clock Troubles

1. Clock will not operate—Defective field coil, defective rotor, binding of parts.
2. Clock loses time—Binding parts, too little friction on minute hand sleeve assembly, defective rotor. Clock time set shaft bends and rubs against hole in clock bracket.
3. Noisy clock—Rotor defective, alarm armature improperly adjusted, loose parts, or binding of moving parts.



Clock RZC-027—C87G5—Exploded View →

Servicing AC-DC Radios

Obscure Troubles in Midget Sets. Defects in I-F Transformers

By Michael Craig

• Many complaints of receivers being inoperative or noisy during hot, humid weather can be traced to defective intermediate-frequency transformers. Crackling, sputtering and frying noises emanate from the speaker and are sometimes difficult to locate. Most of these noises are due to disintegration of the fine wire with which the i-f transformers are wound; in at least 75% of the cases of transformer trouble, the 1st primary winding is at fault.

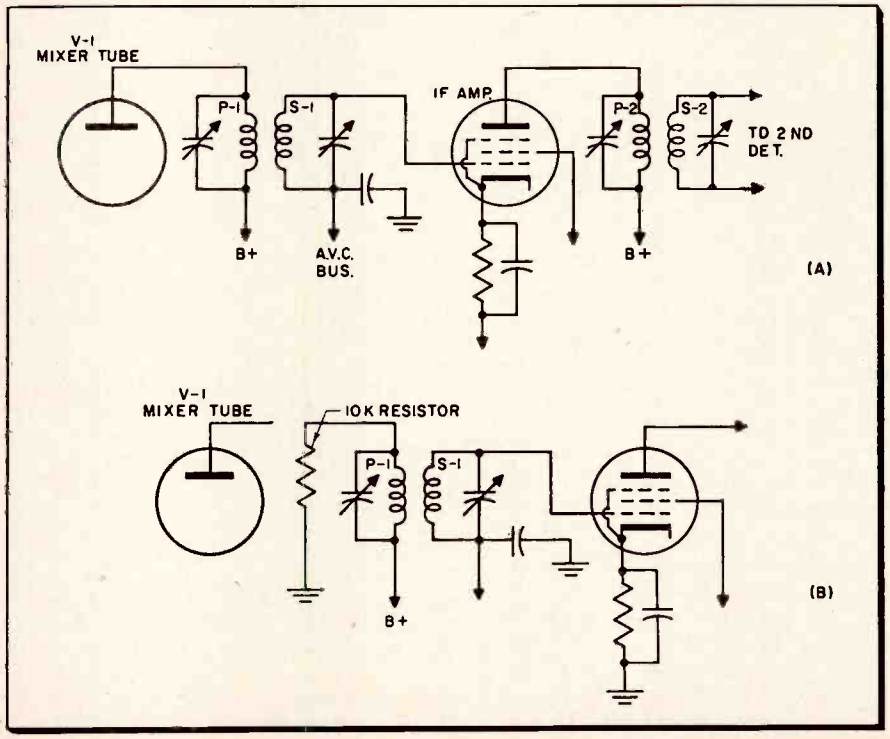
A quick, time-saving check can be made by substituting a dummy tube (one with all but the heater pins cut off) for the mixer (V-1 in Fig. 1). If the 1st transformer *is* the culprit, the noise will usually stop when this is done. Next, connect a 10,000-ohm, 1-watt resistor from the transformer plate lead to ground, as indicated in Fig. 1B. If the noise now reappears, the trouble is definitely in the primary winding, and a new transformer is needed.

The resistor replaces the plate circuit of the tube, permitting a nearly normal current to flow through the primary winding of the transformer. Often, if a 2,000-ohm, 2-watt resistor is momentarily connected from the "hot" side of the primary winding to ground, the additional current will cause the defective winding to open completely, something which will not occur if the winding is perfectly normal.

Many customers bring a small radio into the shop and say: "Just fix it so it runs. It's only for the maid, or the garage, and I don't want to spend much money on the repair." If one of the windings of the 1st i-f transformer is found bad under such circumstances, a simple repair that will produce almost the same output, but with slightly broader response, can be made in the following manner (see Figs. 2A, B, C):

Fig. 2A shows the normal mixer-1st i-f skeleton circuit, with a trimmer across each winding. Fig. 2B shows how a bad secondary winding is cut out and replaced by a 25 mmfd coupling capacitor and a 470k, ½-watt resistor. If the coil is left in the can, be sure to short it out; otherwise, cut through the winding with a sharp pair of side cutters and remove the secondary coil. Readjust the primary trimmer for maximum gain. If the primary is bad (refer to Fig. 2C) use the good secondary winding in place of the primary, and again insert the 25 mmfd capacitor and 470k resistor in the circuit.

Fig. 1A—Usual mixer and i-f circuit in ac-dc set. B—How to substitute 10k resistor for mixer tube. If noise persists with the resistor connected, the P-1 winding is breaking down.



Change Works Well

This circuit change works surprisingly well! It will cut the cost of the repair a couple of dollars, which may mean the difference between the customer having the set repaired, or taking it back home with him.

High humidity takes its toll of oscillator coils, especially since the two windings used are almost invariably wound one over the other, increasing the possibility of shorts and leaks between them. The simplest check for proper oscillator functioning, or lack of it, and one which tells much more than a check of the negative voltage at the grid of the oscillator tube, is to connect the unmodulated output from a signal generator between the oscillator tuning section stator terminal and circuit ground, and set the receiver's tuning dial to a strong local station between 1400 and 1600 kc. Now swing the signal generator dial slowly back and forth between 1800 and 2000 kc. If the station can be brought in at some generator setting between these two points, and can be sharply tuned in and out by suitable movement of the generator knob, it proves that the receiver trouble is due to an inoperative oscillator circuit (since substitution of the generator for the receiver oscillator is causing the set to function near normal).

If no signal is received when the above procedure is followed, on the other hand, the oscillator in the set is probably ok, and trouble should

be looked for elsewhere in the receiver. At this point, a negative voltage reading at the grid will double-check this conclusion.

Coming back to i-f troubles, an unusual case occurred in the earlier-model Setchell-Carlson table sets, in which the chassis hangs upside down inside the cabinet in its normal operating position. Most of the heat from the tubes collected near the top of the chassis and melted the wax from the i-f coils. The melted wax ran down onto the i-f trimmer plates; when the wax cooled, it forced the plates apart, detuning the associated circuits. Introduction of the wax dielectric caused further detuning of the circuits, resulting in an almost completely inoperative receiver. The cure lay in replacing the i-f transformers present with later types, which did not have such a readily-melted wax impregnation.

Sometimes a set will come into the shop in which three of the i-f trimmer screws will adjust perfectly, while the fourth must be turned all the way in (to maximum capacitance setting) and even then will not quite reach resonance.

If the first three trimmer screws just referred to are turned outward, and set to a frequency approximately 5 kc higher than originally called for, the fourth one will then probably just reach resonance, permitting maximum sensitivity to be obtained. The 5 kc difference in the i-f will have little effect on set operation, and what little difference is present will be more than compensated for by the increased efficiency obtained when all four circuits are in resonance.

Reversing Procedure

This procedure can also be used in reverse, when one of the trimmers must be turned all the way out (to minimum capacitance setting) and still does not quite reach resonance for peak operation. In this case, the other three trimmers must be adjusted to a frequency 5 kc *lower;* the fourth one is then turned inward (clockwise), to peak it with the others.

If the i-f coils are slug-tuned, and employ a slotted powdered-iron core for adjustment, be careful not to break the edges of these slots, and thus make further adjustment impossible. If the cores move stiffly or not at all, drop a *tiny* amount of fine oil at their edges. This lubrication will loosen the cores sufficiently to permit adjustments to be made on them without damage.

Aligning I-F Trimmers

When adjusting trimmers in i-f stages, it may be found that one trimmer tunes more broadly than the others. If this trimmer is the one in the 2nd detector or diode circuit, the condition is normal and is due to the loading effect of the diode circuit. If, however, the broadly-tuned circuit is in either the plate or grid circuit of the i-f stage, trouble is indicated at this point, especially when the tuning is so broad as to require a complete turn or more of the trimmer screw, to produce an appreciable difference in output.

The trouble may be due to a gassy tube, positive bias on the avc bus, shorted turns in an i-f transformer, leaky mica separators, dirt between trimmer plates, or any one of a number of other faults that tend to lower sensitivity and selectivity.

Localizing Obscure Distortion

Recently a Model 2175 Electronic Labs 6-tube ac-dc set came into the shop. The distortion present disappeared only when the volume control was set so low as to make reception barely audible. A "croaking" distortion was noted when speech was being received. The symptoms made me think capacitor C-1 in Fig. 3 was arcing over internally. A check indicated, however, that this was not the case. A new set of tubes was next tried, but no improvement resulted.

With new tubes in the set, tapping either the 12SK7 or 12SA7 tubes, i-f cans or tuning circuit components produced an aural effect similar to the one heard when a loose or poor ground somewhere in the r-f or oscillator section is jarred. The trouble was so pronounced that it could be picked up on another receiver six feet away. It was finally eliminated by grounding the speaker frame to the chassis. Some r-f, it seems, was sneaking through to the audio section, and was being amplified along with the audio signal; on modulation peaks, this r-f was being radiated by the speaker to the loop antenna, from where it was fed back to the set. Grounding the speaker as shown in Fig. 3 eliminated the trouble.

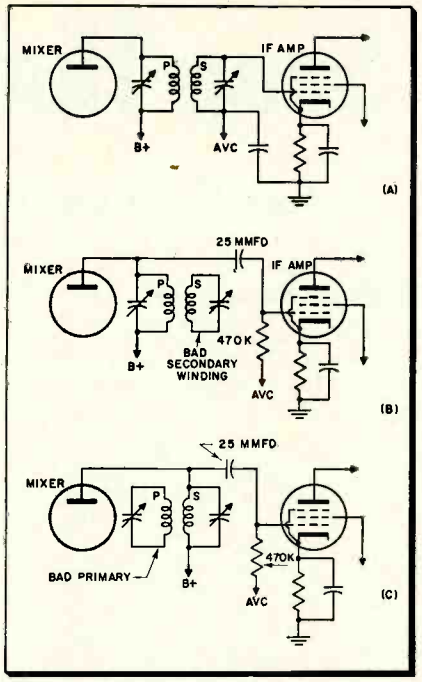


Fig. 2A—Normal i-f transformer connections. B—Tuned impedance coupling to eliminate defective secondary. C—Tuned impedance coupling to eliminate a faulty primary winding.

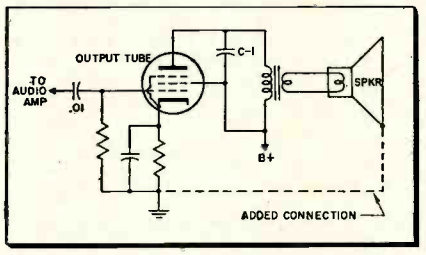


Fig. 3—Grounding speaker frame to eliminate r-f pickup. Speaker re-radiated these signals.

These days when TV servicemen have all the work they can handle and more, we may at times feel above working on a lowly ac-dc receiver. Many of us old-timers, however, remember the lean depression years when just to see one of these sets come into the store for repair was a joy to behold, and remembering, we feel a little humble. With printed circuits now coming into the picture, some small ac-dc receivers will again offer a challenge to even the most experienced technician, and new procedures will have to be learned to maintain them.

Home-made Cleaner Sprayer

To avoid the expense of continually buying contact and volume-control cleaner in costly pressurized cans, I make use of an empty plastic bottle, the kind that originally contained window spray fluid. By filling the bottle with contact cleaner, you can get the same results obtained with the pressurized cans at a fraction of the cost.—*Herbert A. Wahl, Redondo Beach, Calif.*

Handy Cleaning Tool

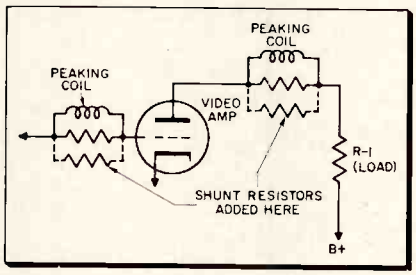
A few pipe cleaners are well worth carrying in the service kit. Put a little contact cleaner on the end of one, and you are set to reach into many places. Excessive application of cleaning fluid is avoided by the use of a pipe cleaner. *H. Leeper, Canton 3, Ohio.*

Shop Hints to Speed Servicing

Tips for Home and Bench Service Contributed by Readers

Ringing in the Picture

Whenever peaking coils are used as a means of increasing an amplifier's high-frequency response, the possibility of ringing or "echo effect" exists. This is the case with video amplifiers in TV receivers. The symptom is often mistaken for tuner or i-f misalignment, with the result that there are fruitless and time-wasting attempts to align and re-align the set. If ringing occurs in the video amplifier, a simple solution is to shunt resistors across the peaking coils or, if resistors are already there, to reduce their value.

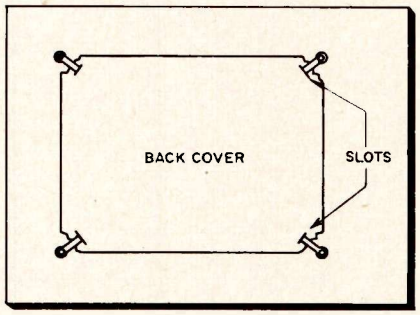


A good starting value is about 50k. This value may be lowered until the ringing is acceptably reduced. This method should be used when a test pattern is being received, so that the effect on high-frequency response can be noted. If high-frequency response must be reduced a great deal to eliminate the ringing, re-dress video amplifier leads so that they are as short as possible, and lower the value of the plate load resistor, R-1.—*F. S. Mattioli, Racine, Wisconsin.*

(Care should be taken in changing the value of the plate load resistor; reduction in the value of this resistor will lower the stage gain. The method may therefore be inadvisable where weak signals are being received.—Ed.)

Mounts for Receiver Backs

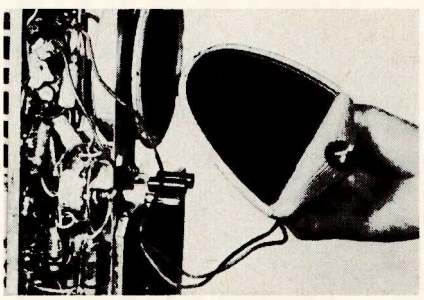
Cardboard backs may be refastened to table sets when the corners of these backs have been torn off, by using long solder lugs as metal mounting tabs. The long ends of the lugs (the ends opposite the "eyes") are pushed through slots made in the cardboard and bent into place. The "eyes" are then used to



mount the back to the cabinet.—*S. Sandler, Providence, R. I.*

Mirror-Lamp as Service Aid

Certain cars come equipped with a mirror (see photo); similar mirrors can be purchased at supply stores. It is only necessary to equip the mirror socket with a dial lamp of suitable voltage rating, and to clip the lamp's leads to that voltage source, to have a mirror for checking the values of parts. The voltage source may be in the receiver under examination. The mirror alone is



convenient in making TV receiver adjustments.—*H. Leeper, Canton, Ohio.*

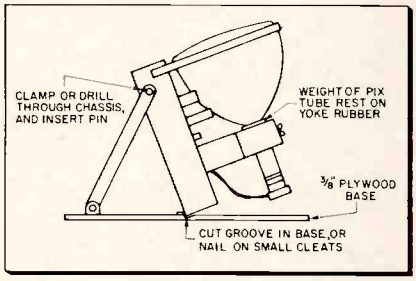
Jig for Large TV Chassis

The illustrated jig, which can be made up from a section of ⅜-in. plywood and a few simple, easily available parts, provides a means for safely handling that bulky TV chassis. Sideward movement of the chassis, with resultant strain on the neck of the picture tube, is avoided; otherwise, the entire set-up can easily be rotated or moved around on the bench. When using this mount, details of which are shown in the accompanying sketch, some care may be necessary to prevent damage to the neck of the picture

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. 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."

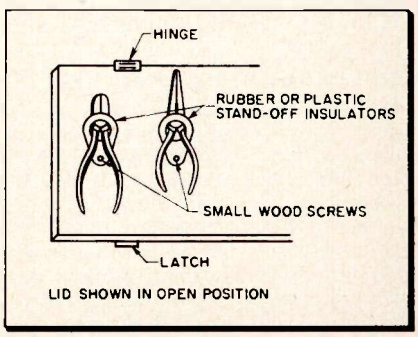
tube. Since the neck often projects beyond the back of the chassis, the mount must be adjusted so that the



base of the crt does not contact the mounting board.—*F. C. Hoffman, Kewaunee, Wisconsin.*

Tool Mounts in Tube Caddy

The service technician's tube caddy never has enough space for all the equipment required for home calls. The space on the removable lid in caddies of certain types is often overlooked as a possible place to mount hand tools. I find that rubber stand-off insulators provide a quick, easy method of holding long-nose pliers, diagonal cutters and similar tools in place on the lid. When the lid is up and the caddy is closed, these tools hang securely with their handles up and fit snugly into the openings of the standoffs. When the lid is open, as shown in sketch, the tools slip easily down and out of the holders.—*John Minster, Philadelphia, Pennsylvania.*



Can You Solve These?

If You Whiz Through This Quiz, Your IQ Is High-Q

Power Supply Enigma

Technicians can thank Philco engineer G. P. Rumble for this problem: A field engineer running a routine check of a power supply (see Fig. 1) found that even though

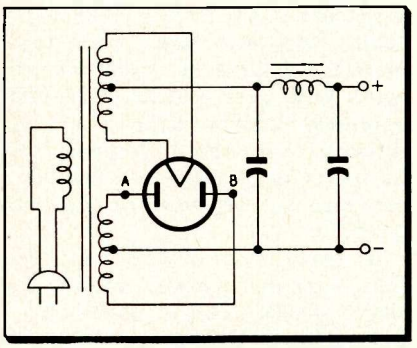


Fig. 1—Circuit in which dc output voltage was normal, even though no ac voltage could be measured across transformer secondary.

the dc output voltage was essentially normal, there was no ac voltage between the two rectifier plates (point *A* to point *B*). Since no overheating was in evidence, the field engineer concluded that one of the two halves of the high-voltage secondary winding was open. A resistance check, however, showed that the two halves of the secondary were ok.

What is wrong with the circuit? (*Answer on last column.*)

Portable Brain Teaser

The problem here was to change an all-wave (115 v, 60-cycle) Zenith portable so that it could be used in India. The rectifier present was a 117Z6-GT, with a 75 ma heater. A 50 ma current had to be supplied to the 1.4 v tube filaments. What to do?

A 2-1 transformer was ruled out as being too bulky for travel. Only thing that seemed practical was to install a series resistor. What size and where?

Meter *A* in Fig. 2 reads 50 ma; meter *B* would (if we had a suitable one) read 75 ma.

If we add the two currents together, we get a total of 125 ma, or .125 amperes. A 115 v drop is desired across the series resistance, which we tentatively assume will have to be inserted at point *X*. To determine the value of the resistor needed, we divide 115 by .125, obtaining 920 ohms. So we install a 920 ohm wire-wound resistor at point *X* and hook the set onto a 230 volt line. Result? Nothing happens! The 117Z6 tube lights, but no signal is heard. Something's wrong, but what?

Let's analyze the problem. Consider the half-cycle during which the plate of the rectifier is negative. No current flows thru meter *A* at this time. Current does, however, flow in the 117Z6 filament circuit. Let's see how much.

Since we have the set working on a 230-volt line, with 920 ohms in series with the 1533-ohm 117Z6 heater (115/.075, or a total of 2453 ohms) the current which can flow is 94 ma—enough to overload the 75 ma heater. Bear in mind that this amount of current flows during the negative half cycle *only*, when there is no current in the rectifier plate circuit.

When the cycle moves into positive territory, our headache gets even worse. Normally, we would have 50 ma, as registered by meter *A*. Since rectifier plate current can flow only during one-half the cycle, though, twice as much current, or 100 ma, must be passed in this active half-cycle, to keep the filter condensers charged and the filaments of the small tubes supplied with normal current during the non-conducting half-cycle.

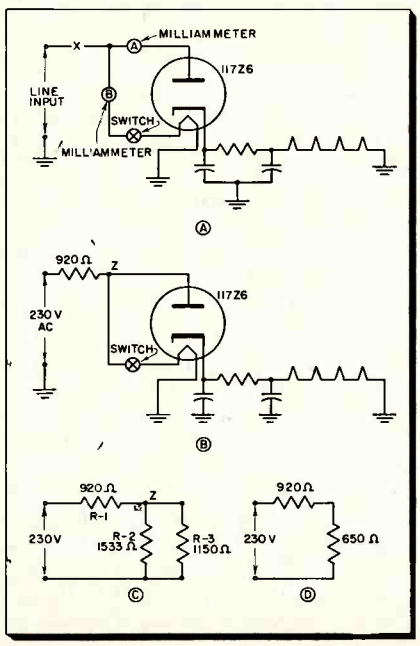
Thus, the rectifier plate circuit appears as a resistance of 115/.1 or 1150 ohms during the positive half-cycle, and is *in shunt* with the 117Z6 heater resistance of 1533 ohms, producing a net resistance of 650 ohms. This 650 ohm resistance, however, is *in series* with 920-ohm resistor *X*; a total of 1570 ohms thus appears across the 230-volt line.

The current that *should* flow under these conditions is 230/1570 or 146 ma. Theoretically, we need 100 plus 75 or 175 ma during the positive half of the cycle, to operate the set. Therefore the set will not work with only 146 ma.

We can't reduce the value of resistor *X* to boost the current since lowering *X's* value would burn out the 117Z6 heater (inasmuch as we already have 94 ma flowing during the negative half of the cycle).

How would *you* solve this problem? (*Answer on p. 60.*)

Fig. 2A—Simplified power supply and filament circuit of portable. B—Circuit change first proposed to dissipate 115 v of the 230 v line input voltage. C—Equivalent circuit of B. R-1 is the line dropping resistor; R-2 is the resistive equivalent of the 117Z6 filament; R-3 is the resistive equivalent of the 117Z6 plate circuit. Latter resistance is present only during the positive half-cycle of line input voltage. D—Equivalent circuit of C.



Solution to "Power Supply"

Since the circuit shown in the problem was not overheating, it is evident that no short-circuits are present. The only other possible cause of zero voltage between points *A* and *B* would be an in-phase condition between the two halves of the high-voltage secondary winding of the transformer.

In manufacture, the two halves of the secondary are wound as two

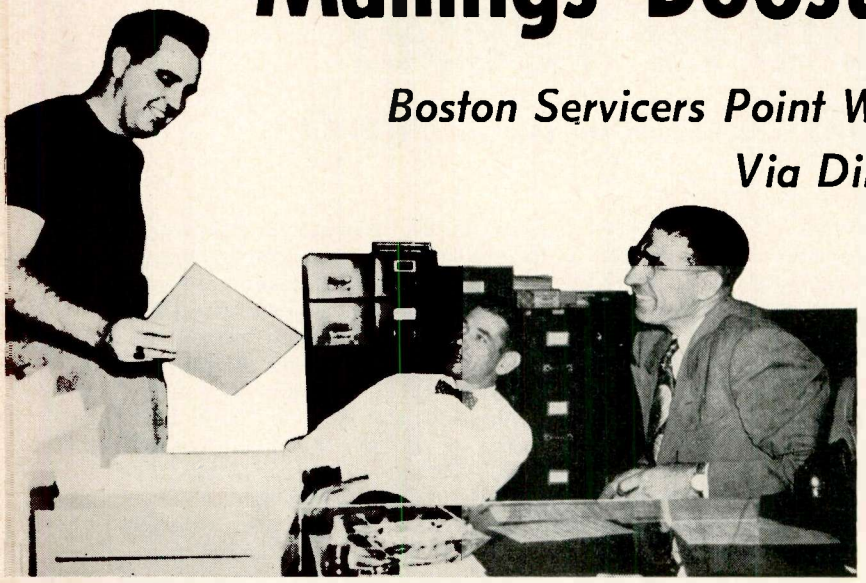
(*Continued on page 60*)

$ For Brain Teasers

Do you know any good technical "teasers" you've been using to stump other servicers? Write them up, together with the answers, and send them to "Tech-Quiz" Editor, TECHNICIAN, Caldwell-Clements, Inc., 480 Lexington Avenue, New York 17, N. Y. $5 each will be paid for accepted items. Unused material will be returned.

Mailings Boost TV Income

Boston Servicers Point Way Toward Increased Revenue Via Direct-Mail Ads



Paul S. Wagner, seated center, vice-president of Lake Service Corporation, and Fred S. Lakewitz, president (right) talk over plans for new direct mailing with W. G. Dwyer, the company's service manager.

By Irving Roberts

• Lake Service Corporation of 89 Brighton Avenue, in the Allston section of Boston, Mass., is using an effective technique to increase its television service business. The company, which specializes in TV installations and service, ties direct-mail advertising pieces to televised events of national interest.

Typical of Lake Service's special-event mailings is its pre-World Series check-up promotion, urging the prospect to have his set put in good order before the Series' opening. Another is its pre-fight check-up promotion, mailed just prior to top championship boxing matches.

Proof of the effectiveness of these special mailings is Lake Service's 18-months record of 8 to 10 percent returns on every mailing. Repeat business and contracts resulting from initial calls are an important bonus.

Lake Service was launched several years ago by Fred S. Lakewitz, William G. Dwyer, and Paul S. Wagner. The company started off rather modestly. Television servicing competition is tough in Boston, as elsewhere. Despite a sizable amount of local radio and newspaper advertising, new business from home-owners or apartment dwellers was slow to develop. Lake Service's three partners decided they needed something to stimulate volume.

Wagner, who is a hot baseball fan, conceived the idea of a World Series check-up. The time was early September and World Series fever was already in the air. "We decided to try a test mailing of 5,000 cards to 5,000 names taken from a street directory of the neighborhood," says Wagner. "It proved one of the best decisions we ever made."

Wagner, Dwyer and Lakewitz sat down and worked out a two-way card offering a complete pre-World Series TV check-up for a set price. The company guaranteed to put each set in perfect working order for the Series. The cards warned against operating failure or blackout during the games, and urged customers to get top enjoyment from their sets.

The Plan Worked

"The response was far better than we had hoped," says Fred Lakewitz. "By the first week in October, more than 500 cards had been returned, requesting our service man to call at the home. Many more customers phoned in for a checkup. It was amazing how many people suddenly decided it was time for a TV checkup."

Lake Service was quick to take the hint. The mailing had cost something over $160, of which $55 was for the printing of the cards, the rest for postage. Gross intake from resulting calls was well over $5,000.

Lakewitz, Dwyer and Wagner set about compiling a mailing list, first confining it to their immediate area, then spreading it to cover adjoining territories. No lists were bought because the partners wanted to set up their own test areas, while avoiding much-used names. Chief sources were the telephone book and the street directories.

Lake Services second special event mailing was a "Windy Season" antenna check-up in late February of 1951. Two-way cards were again mailed out to some 5,000 names—again with good results. "We didn't approach the first mailing in actual returns," says Paul Wagner, "But the percentage was good enough to convince us we were on the right track."

In early May of the same year, the company began mailing out some 10,000 cards promoting a Spring and Summer check. This time, after two weeks had elapsed, follow-up letters were sent out. Response was close to 1,000 new calls, with many new contacts made.

The summer of 1952 was a busy one for the company. First, a special-event card mailing was made about a month before the opening of the Republican and Democratic National Conventions. This was followed in September by a World Series mailing. In February 1953 came the "Windy Season" antenna mailing, this time to a new list. In early spring, another promotion was keyed to the second Walcott-Marciano fight. Other mailings were made in late '53 and early '54.

Mailings rarely cost more than $300 to $350; the exact amount depends on the number of cards sent and returned, and on whether a follow-up letter is used. Printing charges for 10,000 two-way cards average around $100, with postage accounting for the balance. Cost for mailing 5,000 cards is a little more than half the cost for 10,000. Figuring on 8 to 10 percent returns, averaging $10 or up per job, Lake Service has found that a mailing costs slightly more than 3 percent of total gross resulting from the mailing.

Mailings are generally scheduled well ahead, and are usually set up during January; the schedule is, however, kept flexible, to allow for unscheduled events. Lake Service's

(*Continued on page* 47)

COLOR SHORTS

HOW FAR COLOR WILL ADVANCE depends, to a great extent, on how far sponsoring advertisers will go in supporting it. The added cost of color broadcasting will definitely be a factor. An encouraging note is sounded by J. L. Van Volkenburg, president of CBS Television. When color TV reaches full maturity, he estimates, it will cost only 10 percent more to advertise in color than in monochrome. Wonder whether we'll ever be able to say the same thing about the cost of color receivers?

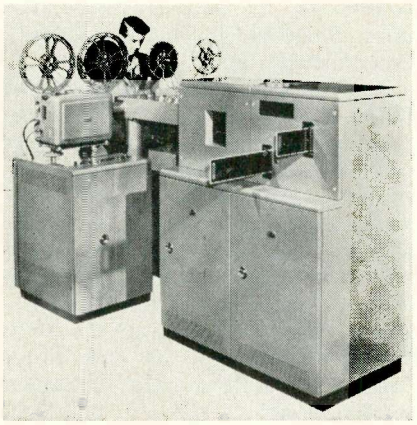
SOME INDUSTRY LEADERS want you to let your customers know that service will probably be required on color sets from the outset. They urge the sale of these receivers with service contracts. Reasoning behind the suggestion: glossing over the need for early servicing may undermine confidence in the industry.

THREE PIECES OF TEST EQUIPMENT for color, announced by RCA, will soon be available: color-bar generator WR-61A, which produces a test pattern of 10 color bars on the receiver screen, for use in adjusting phasing and matrixing circuits; portable dot-bar generator WR-36A, used in making all convergence adjustments; and dual-bandwidth oscilloscope WO-78A, for observing the color-burst signal and checking color-burst circuits. Prices and additional specifications will be announced when the instruments are released for distribution.

COLOR ONLY: New York City's 1st UHF channel will go into construction soon. This city-owned noncommercial station may transmit *exclusively* in color from its start.

RAYTHEON is actively distributing its version of the 15-in. 3-gun color tube, the 15GP22, from its recently built plant at Quincy, Mass. First delivery to a parts distributor was to American Television, Inc., New Haven, Conn. a distributor for Raytheon tubes. The new Quincy plant has been set up for mass production of monochrome and color pix tubes.

DU MONT'S COLOR MULTI-SCANNER for presenting color films on TV is said to be a boon to limited-budget telecasters. The device, which is expected to make about 80 percent of current 16-mm color film libraries immediately available for broadcast, in quality comparable to that of live color programs, opens a wide range of additional material for use when color TV goes into heavy operation.



Du Mont Color Multi-Scanner eliminates costly camera equipment in film presentations.

TRANSPARENT SLIDES, in addition to motion pictures, may be picked up and transmitted with the scanner. This possibility should be important in the presentation of still commercials. In addition to its usefulness with color films made by all popular processes, the device may be used for scanning black and white films. A special technique called *electronic masking* may make it possible to improve the quality of color films during TV presentation, since it permits adjustment of color saturation and overall brightness. If desired, skies can be made bluer and grass can be made greener. First public showing of the multi-scanner was at the NARTB convention in Chicago, May 23.

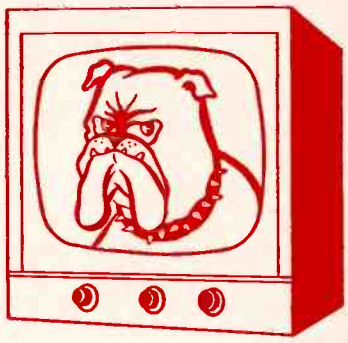
AS OF THIS WRITING, there will be four hours of color programs available from two leading networks this month. NBC and CBS each plan four half-hour shows during the month. ABC is adopting a wait-and-see attitude.

RECOMMENDATIONS RE THE TEST BURST GENERATOR introduced by RCA and discussed in last month's TECHNICIAN are being considered by the Radio-Electronics-Television Manufacturers Association. A subcommittee of the RETMA Service Committee is reporting on the color burst generator, which adds a yellow-green vertical stripe on the right-hand side of the raster when a monochrome test pattern or station-break identification pattern is being sent out. The stripe will be useful in installing a color set when no color broadcast is available, in adjustment of the set by the owner preceding a color program, and by the technician in checking for partial or complete loss of the subcarrier or other color information somewhere in the system.

ANOTHER RETMA DEVELOPMENT is a lecture program for service technicians. The lecture package, including text and slides, is being distributed to RETMA members at nominal cost. The first industry-approved explanation of NTSC color, it is designed to establish a basic and uniform level of technical know-how, from which individual manufacturers of receivers, components, test equipment and other products can plan their own technician training programs. Non-RETMA members and individual service technicians can procure this material from member companies.

THE LAWRENCE TUBE is the subject of a 19-page booklet recently released by Chromatic Television Laboratories, Inc. Essentially a non-technical treatment, the brochure (Reference Memorandum No. 1) nevertheless presents a skeleton explanation of how the single-gun tube works. Also discussed are such factors as picture size, price, associated receiver considerations, advantages believed to be inherent in the single-gun design, and the potential this tube type may have in the future of color TV . . . Another large crt manufacturer (Eitel-McCullough, Inc., San Bruno, Calif.) has joined the list of those who will be making single-gun Chromatrons.

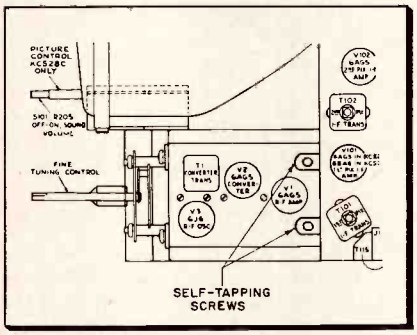
"Tough Dog" Corner



Difficult Service Jobs Described by Readers

Hum Trouble

Complaint on an RCA set using a KCS38 chassis was intermittent vertical rolling—intermittent to the point of not occurring for several days, and then starting again. Fortunately the symptom showed up while I was present, but I also noticed evidence of 60-cycle ac in pix and sound during the rolling. After all tubes were checked, the set was brought to the shop. Cooperatively enough, as soon as the set was put on the bench, the symptoms showed up. From here on, the cooperation ended. While checking capacitors in the vertical section, it was observed that the a-c symptoms sometimes disappeared, although the rolling continued, at least on Channel 6 (the set never did seem to roll on 3



Top viewer of tuner in KCS38 (courtesy, RCA).

or 10, the other Philadelphia stations). After half an hour, the trouble cleared up and no amount of channel switching or banging could make it recur.

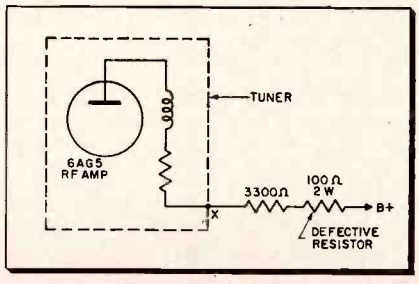
Three days later, after continuous trouble-free operation, I decided to give the set one more hammering before returning it to the customer. There were the symptoms again. I had to pound the chassis with a heavy wrench to keep the trouble present long enough for hooking up a scope. Sure enough, there was a 60-cycle sine wave at the vertical grid and plate as long as I kept the wrench busy. Incidentally, the amplitude of the sine wave varied with the degree of chassis flexing and hammering. With just a small sine wave, there was vertical rolling without the ac being evident in the pix and sound; as the sine wave increased, the pix and sound distortion became increasingly worse. The hum voltage was traced back along the B-plus clear through to the tuner.

With every tuner lead disconnected, except the filament leads, there was still a 60-cycle sine wave coming from the tuner. There was nothing left to do but to isolate the trouble to its source inside the tuner. Since the leads were already disconnected, the first step was to loosen the two self-tapping screws shown in the accompanying drawing. I noticed then that the two screws were already loosened—about half way out—left that way by some previous serviceman. Back went the leads, on went the scope, and I proceeded to tighten and loosen the screws. The ac disappeared and reappeared as the screws—the only ground connection for the tuner shield—were alternately tightened and loosened.

Not only could vibrations in the home open or partially open the ground connection, but even temperature changes could expand or contract the metal; a drier atmosphere could decrease the conductivity of the loose connection; accentuating the symptoms. All this was the result of someone's careless servicing.—*Ervin Bilsky, Woodbury, N.J.*

Intermittent Tuner

This set (Philco, model 1400) would operate satisfactorily for about two hours after being turned on; then sound and pix would fade out rapidly and come right back. The customer said he would have to readjust the fine tuning control at times to get the set back into operation. After the first two hours, the symptoms described would recur frequently.



Changing tubes provided no improvement. I turned my attention to two capacitors in series with the fine tuning control, believing that a change in capacitance in either one of them might cause the trouble. Each of these two was separately replaced, but with no effect. It was finally decided that the B+ voltage at the tuner input should be monitored, between point *X* in the illustration and ground.

After a half-hour wait, picture and sound faded and the meter reading dropped to nearly zero volts; then it came back to normal as the picture and sound came back. Fifteen minutes later, the B+ dropped to nearly half its original value. This time, to get the set working right, the fine tuning had to be readjusted. It was noted that the 100-ohm 2 w. resistor was slightly discolored. A check of the voltage drop across it showed an unsteady reading, with the meter needle flickering. When this resistor was temporarily shorted out, B+ remained normal and set operation continued to be fine. The resistor was replaced, after which the set operated fine.—*John L. Mancini, Winthrop, Mass.*

$ For Your "Tough Dog Story"

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

the **NEW**

PRECISION MODEL 120

Gives You
What You Wanted
in a

HIGH SENSITIVITY MULTI-RANGE TEST SET

20,000 OHMS PER VOLT D.C.
5,000 OHMS PER VOLT A.C.

You wanted...

MORE RANGES — The '120' gives you 44... which start lower and go higher... to outrange any professional V.O.M. of similar size or type.

AN EXTRA-LOW RESISTANCE RANGE — The '120' gives you a 2-ohm center scale range, powered by long-lived, internal 1.5 volt battery source.

AN EXTRA-LOW VOLTAGE RANGE — The '120' gives you 1.2 volts full scale, A.C. and D.C.

AN EXTENDED LOW CURRENT RANGE — The '120' gives you a 60 microampere first D.C. current range.

A LARGER AND EASIER READING SCALE FACE — The '120' gives you a new, extra-large 5¼" meter with full 4¾" extra-wide window for greater visibility.

SIMPLE, POSITIVE RANGE SELECTION — The '120' gives you an 18-position, positive-detenting, master range selector with low resistance, dependable, silver-plated contacts.

RUGGED, POSITIVE CONTACT JACKS and PLUGS — The '120' gives you specially designed, low resistance, solid brass, banana type plugs and jacks.

Compare These Wide-Spread Ranges and Special Features:

★ **8 DC VOLTAGE RANGES:** 20,000 ohms per volt. 0-1.2-3-12-60-300-600-1200-6000 volts.

★ **8 AC VOLTAGE RANGES:** 5,000 ohms per volt. 0-1.2-3-12-60-300-600-1200-6000 volts.

★ **8 AC OUTPUT RANGES:** same as AC volt ranges. With built-in 600 volts blocking capacitor.

★ **7 DC CURRENT RANGES:** 0-60-300 Microamperes. 0-1.2-12-120-600 Ma. 0-12 Amperes.

★ **5 RESISTANCE RANGES:** self-contained batteries. 0-200-2000-200,000 ohms. 0-2-20-megohms.

★ **8 DECIBEL RANGES:** from −20 to +77 DB. 0 DB = 1 Milliwatt, 600 ohms.

★ **EXTRA LARGE 5¼" RUGGED 'PACE' METER:** 40 microamperes sensitivity, 2% accuracy.

★ **1% MULTIPLIERS and SHUNTS:** wire-wound and high stability deposited-film types employed throughout.

★ **ONLY 2 PLUG-JACKS SERVE ALL STANDARD RANGES:** separately identified and isolated jacks provide for extra-high ranges.

★ **"TRANSIT" SAFETY POSITION:** on master range selector protects meter during transportation and storage.

★ **CUSTOM-MOLDED PHENOLIC CASE and PANEL:** set a new standard for compact, efficient, laboratory instrument styling. Deeply engraved panel characters afford maximum legibility throughout the life of the instrument.

MODEL 120: complete with internal ohmmeter batteries, banana-plug test leads and operating manual. Over-all case dimensions: 5⅜ x 7 x 3⅛"..... Net Price: **$39.95**

ACCESSORIES FOR THE MODEL 120

TV-2B — 30 kilovolt safety probe..... $14.75 net
LC-3 — Custom, leather instrument case 9.50 net
ST-1 — Snap-on foldaway tilt-stand..... 1.00 net

PRECISION TEST EQUIPMENT — standard of Accuracy

PRECISION Apparatus Company, Inc.
92-27 HORACE HARDING BLVD., ELMHURST 6, N. Y.

Export Division: 458 Broadway, New York 13, U.S.A. Cables: Morhanex
Canada: Atlas Radio Corp., Ltd., 560 King Street W., Toronto 2B

New Test Equipment

UHF and Color Signal Generators. Other Instruments

Hewlett-Packard VTVM

Model 400D measures voltages from 0.1 millivolts to 300 v, is accurate to within 2% up to 1 mc, and may be used at all frequencies from 10 cps to 4 mc. Front panel switch changes sensitivity in 10 db steps. This feature, plus calibration of the meter in db, means direct readings are available between —72 dbm and 52 dbm. Some applications: measurement of gain, response, output level, hum and noise; serves as an audio level meter and high-gain broad-band amplifier; detects nulls; monitors waveforms and measures coil Q, capacitance and resonance. Priced at $225. Hewlett-Packard Co., Dept. P, 395 Page Mill Road, Palo Alto, Calif.—TECHNICIAN

Trans-Tel UHF GEN. ADAPTER

Model 38 prevents obsolescence of VHF generators by adapting them to the UHF range. Cost is less than that required for purchase of separate UHF instruments. Some features: Converts output of VHF sweep generator, including built-in markers, to any UHF frequency with same sweep width as in original generator; Converts output of VHF oscillator to any UHF frequency; converts any UHF signal to a VHF channel (5 or 6); converts a VHF signal (falling in Channels 2 to 6) to any UHF channel. May also be used as a UHF converter with a receiver. Accuracy, 0.5%, depending on associated VHF generator. Blank logging chart provided for more accurate hand calibration. Cables and connectors included for match to 75 or 300 ohms. List price, $89.50. Trans-Tel Corp., 828 N. Highland Ave., Hollywood 38, Calif. —TECHNICIAN

Simpson METER HANDLE

The Adjust-A-Vue handle permits the technician to set his Simpson 260 meter at any convenient viewing angle while he is servicing. It is made of steel, coated with tough plastic. Simpson Electric Co., 5200 W. Kinzie Street, Chicago 44, Illinois—TECHNICIAN

Kay COLOR GENERATORS

Two signal generators for the presentation of NTSC standard colors are known as the Multi-Chrome Chromabar and the Uni-Chrome Chromabar. The former is for simultaneous multiple-color presentation, while the latter is for single-color presentation. The colors available are green, yellow, red, magenta, blue, cyan, white and black. Other colors, gray shades or I & Q signals may be added at additional cost. A switch on the Uni-Chrome selects any color. Black and white bars are provided simultaneously with each color, and a dot generator is built in to permit checks on convergence and linearity. Output at video frequency into 75-ohm load. Includes crystal controlled color sub-carrier and built-in horizontal sync generator. Kay Electric Co., Pine Brook, N.J.—TECHNICIAN

RCA UHF SWEEP GENERATOR

Model WR-86 A is a wide-range UHF sweep generator engineered for the requirements of both color and black-and-white UHF TV receivers, tuners, and converters. Features: wide frequency range, continuous from 300 to 950 mc; wide sweep range as high as 75 mc; flat output over the swept range; high output voltage (at least 0.6 v); 50 and 300-ohm outputs; phase blanking circuit, to provide reference base line; and shielding to minimize r-f leakage. Suggested list price, $275. RCA Victor Division, Harrison, N.J.—TECHNICIAN

EMC TUBE CHECKER

Model 208 checks all octal, loctal, miniature and noval base tubes for quality as well as shorts. Incorporated is a visual line voltage check. Controls for various elements are numbered according to pin number. Enables matching & balancing of Hi-Fi tubes such as 1614, KT66, and 5881. Complete with instruction book and tube-chart listings. Price, $24.90. Pix tube adaptor, $4.50. Electronics Measurements Corp., 280 Lafayette St., New York 12, N.Y.—TECHNICIAN

Telonic UHF GENERATORS

Model SM-2F provides sweep width from 0-50 mc in the range of 420-930 mc. Features: 2 built-in, tunable markers, zero base line, linear sweep, 300-ohm output. Price, $425.

Model MO-1 is intended for use with a sweep generator as a marker or UHF signal source. The inductively tuned oscillator operates on fundamentals. By individual calibration and by careful engraving and mounting, an accuracy of ±0.25% is obtained. Range: 420-930 mc. Price $100.00. Telonic Industries, 444 South Rural St., Indianapolis, Indiana—TECHNICIAN

Jackson COLOR & DOT GEN.

Designed to produce color bars, white dots, or a crosshatch pattern, model 712 provides a complete NTSC system color difference signal as well as required synchronizing signals. A 4.5 mc crystal controlled oscillator permits accurate adjustment of the color set's fine tuning control. A 3.58 mc crystal controlled burst oscillator and color lock control assure accurate locking with the color burst generator in the set. Output may be introduced either into front end or video channels of the set. Tunable from Channels 2 through 6. For video circuit introduction, the generator includes a variable attenuator and a polarity switch. Either single bars or a multibar pattern is available. In the "Multi" position, 5 simultaneous bars appear—orange (I signal), red (R-Y), white (multiple), magenta (Q signal), and blue (B-Y). Jackson Electrical Instrument Co., 16-18 S. Patterson Blvd., Dayton 2, Ohio. —TECHNICAN

Winslow DECADE BOXES

Accuracy of ±0.1 percent is combined with compact construction in a line of 27 resistance decade boxes. A measurement range from 1 ohm to 110 megohms is covered by the line. Each decade includes 10 precision wire-wound resistors. The Winslow Co., 9 Liberty St., Newark 2, N.J.—TECHNICIAN

Audio and Hi-Fi Products

Amplifiers; Phono, Tape and Speaker Accessories

Pickering PHONO ACCESSORIES

Model 190 pickup arm has been re-engineered to occupy less mounting space, while retaining low vertical mass, balance, lack of arm resonance, and low friction. This smaller arm is known as model 190D.

Model 132E Record Compensator has been re-designed to provide for recent developments in recording curves. A new position matches the Orthophonic-AES recording curve adopted by RCA-Victor, Columbia, Capitol, Decca, and others. Other

positions are: European 78; London 33-Old LP; Old Capitol-Old AES; Maximum Highs-Maximum Bass; and Noisy Records. The compensator, designed for use between pick-up and pre-amplifier, requires no power. Pickering Co., Oceanside, L.I., N.Y.—TECHNICIAN

Bell HI-FI AMPLIFIER

Model 2199-B, redesigned version of the 2199, features a 7-position equalization and selector switch to compensate for 5 type of records —78-rpm, Col-LP, RCA-AES-NARTB, FFRR and European—and for radio and tape. The loudness control is calibrated and continuously variable through the range from 0 to minus 40 db. Input is provided for ceramic and FM pickups. Output is 12 w at 0.5% distortion, with a peak of 20 w. These new features are combined with those formerly included in the 2199 amplifier. Bell Sound Systems, Inc., 555 Marion Road, Columbus 7, Ohio.—TECHNICIAN

Pentron TAPE RECORDER

Model PMD-1, a compact and portable tape recorder, consists of preamp HFP-1 and 9T-3M tape transport mechanism. Features include response from 50 to 12,000 cps ±3 db, VU recording meter, 2 tape speeds, and up to 2 hours recording or playback time. The motor is a four-shaded pole, self-starting induction type, balanced. Recording heads have removable pole pieces which may be replaced easily. The PMD-1 is priced at $134.50. Pentron Corp., 221 E. Collerton, Chicago, 16, Ill.—TECHNICIAN

Regency HI-FI AMPLIFIER

Model HF-150 is a complete Hi-Fi audio amplifier with pre-amp and power supply. Five controls are provided: bass, treble, loudness, level control and record compensation-input selector. Rated output is 12 watts; frequency response is 20 to 40,000 cps within ½ db. Net price, $99.50 Regency Division, I.D.E.A., 7900 Pendleton Pike, Indianapolis 26, Ind.—TECHNICIAN

Stephens COAXIAL SPEAKER

The 122AX, in 12-inch size, is designed for quality reproduction. Faithful performance down to 40 cps is claimed. Coupled through a 5000-cps high-pass filter network are a dural diaphragm and a 1-in. voice coil, providing smooth response up to 18,000 cps. Nominal impedance, 12 ohms. Power capacity, 20 watts. Net price, $54.00. Stephens Mfg. Corp., 8538 Warner Dr., Culver City, Calif.—TECHNICIAN

Capps HI-FI MICROPHONE

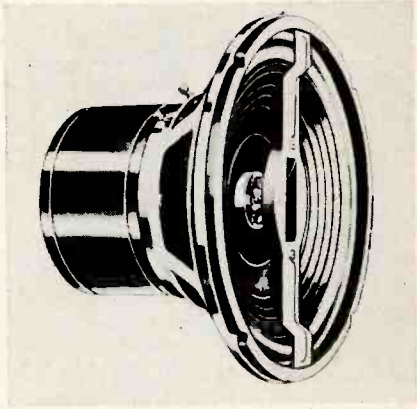
Condenser microphone model CM 2001 houses a self-contained preamplifier, but is only 6 in. long and weighs 12 oz. It has a frequency response of 30 to 15,000 cps ±3 db, is omni-directional, blast-proof and unaffected by moist atmospheres. Supplied with cable and power supply. Frank L. Capps & Co., Inc., 20 Addison Place, Valley Stream, N.Y. —TECHNICIAN

Walsco SPEAKER GRILLE

The Acousto-Grille uses a specially perforated fiber that needs no grille or grille cloth backing when used with a speaker. It is said to soften and filter tone to help produce a pleasing sound. The gold finish may be painted over. Walsco Electronics Corp., 3225 Exposition Pl., Los Angeles.—TECHNICIAN

E-V HI-FI 3-WAY SPEAKERS

These triaxial 3-way reproducers combine the Super-Sonax very high frequency driver, Radax treble propagator, and large bass cone in one concentric assembly. Adjustable brilliance control for remote mounting. Can be installed in direct-radiator cabinets or in E-V folded horn enclosures. Response is 30-15,000 cps in recommended enclosures. Model 12TRX: 12 in.; 16 ohms; $114, net price. Model 15TRX: 15 in.; 16 ohms; $135 net price.



Speakers include X36 crossover network and AT37 brilliance control. Electro-Voice, Inc., Buchanan, Michigan.—TECHNICIAN

Oxford REAR AUTO SPEAKER

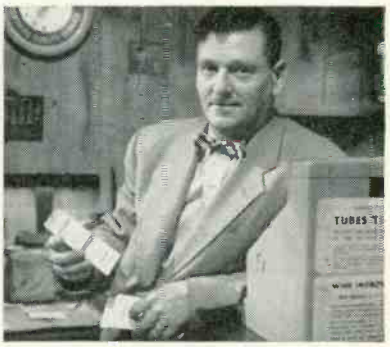
Rear deck speaker kits include 2 models: RD-69, which employs a 6 x 9 elliptical speaker, and RD-57, which has a 5 x 7 speaker. The kits are complete with all necessary hardware, and grille plates are finished in neutral grey to blend with car interiors. Oxford Electric Corp., 3911 S. Michigan Ave., Chicago, Ill. —TECHNICIAN

WILLIAM SCHOOLEY, owner
SCHOOLEY TELEVISION SALES & SERVICE
3019 W. 111th Street
Chicago, Illinois

"Here's proof the CQS Plan can really help your business"

"SEE HOW IT WORKS FOR ME . . ."

"CBS-Hytron is running advertisements like these in LIFE. Maybe you've seen them and noticed they really do a selling job for us service-dealers. Well, I'm one service-dealer who is cashing in on a plan that's *tailor-made* for me."



"So, I'm using the CQS Tags on *every* job. Many of my customers now ask for them. They like the Tag's lay-it-on-the-line certification. Since December, I've ordered three lots of Tags . . . 500, 1000 and 2000."

"I like my customers to know I'm the dependable CQS service-dealer they read about in the big magazines like LIFE and the POST. So I make sure they do . . . by using the CQS Clocks, Signs, Decals, etc., available to *any* service-dealer."

"Take my word for it. Here's a plan that's so simple . . . so sound that *any* service-dealer is missing a real bet, if he doesn't tie in . . . and cash in. The boost that CQS has given my business proves it."

"Look at the 'sell' of these new CQS Streamers! Get aboard this CQS plan. It can do just as fine a job for you as it is doing for me. Take a tip. Find out today the facts about CQS. *Prove* to yourself that CQS can build up *your* business, too."

GET YOUR *Certified* **QUALITY SERVICE TAGS** . . . imprinted with *your name and address.* Use them on every job. Get your big, new CQS CBS-Star Kit. It contains:

A. Six smashing, colorful CBS-Star streamers. Each features a different CBS-TV star: Benny . . . Burns and Allen . . . Gleason . . . Godfrey . . . Murrow . . . and Marie Wilson. Each streamer is a different size and shape. Each one sells the Star Performance of your *Certified* Quality Service.

B. New colorful inside/outside CQS decal.

C. Business Builders Catalog showing the many hard-hitting sales aids available to you.

CBS-STAR KIT IS *FREE* with your order for CQS Tags . . . Kit alone, 25¢.

Ask your distributor salesman for special offer. Or use coupon:

CBS HYTRON

Manufacturers of Receiving Tubes Since 1921

CBS-HYTRON Main Office: Danvers, Mass.

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

CBS-HYTRON, Danvers, Mass.

Please rush me:
A CBS-Star Kit free with . . . . . CQS Tags
(quantity)
@ $2.25, 250; $3.50, 500; $6.00, 1000
A CBS-Star Kit *only*
@ 25¢ (for handling and mailing)
I enclose $. . . . . to cover Tags and/or Kit.
(Please send cash, check, m.o. . . . no C.O.D.'s.)

HERE IS MY 3-LINE IMPRINT FOR TAGS
(please print name and address)

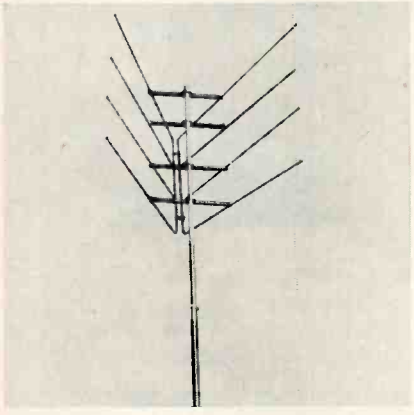
Name . . . . . .
Street . . . . . .
City . . . . . *State* . . . . . .
Signed . . . . . .

Antennas & Related Products

Units for UHF and VHF Reception; Roof Mounts

JFD UHF-VHF ANTENNAS

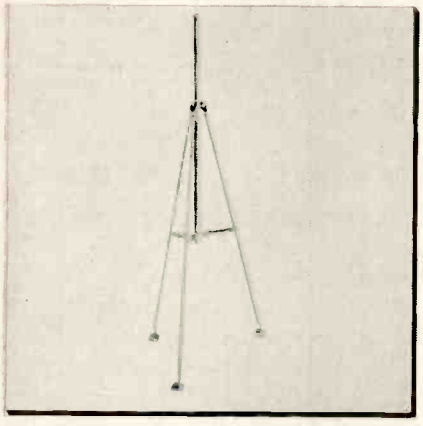
The Redwood series of stacked-V VHF-UHF antennas use redwood cross-arms for bracing. The Redwood 2-bay model UN102 ($4.20,



list) and 4-bay model UN104 ($8.75, list) offer complete Channel 2 through 83 reception without couplers or double lines. The angle of the V provides directive reception on all 3 bands. JFD Manufacturing Co., Inc., 6101 16th Ave., Brooklyn 4, N.Y.—TECHNICIAN

EZ TV ANTENNA MOUNT

The EZ Mount is a self-supporting, pre-assembled roof mount designed to save time while providing a quality installation. No additional hardware is required, as all parts,



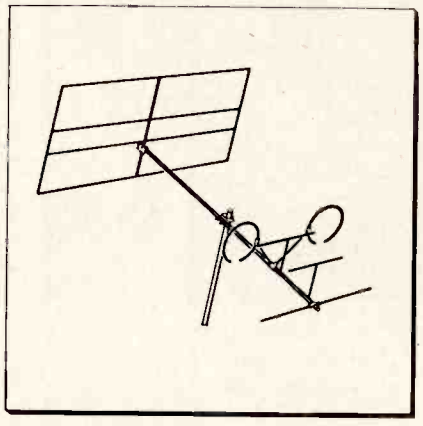
including mast, drive screws and a standoff, are included. Fretz, Gross Co., 22nd St. and Sedgley Ave., Philadelphia 32, Penna.—TECHNICIAN

Winegard VHF ANTENNA

The Interceptor combines the manufacturer's multi-resonant dipole design with a focusing system. The first 5 elements, designated the *Electro-Lens*, are said to intercept and focus signal onto the collecter elements, to produce very high gain and sharp directivity. The manufacturer recommends the antenna in areas where co-channel interference is a problem. The John Winegard Co., 3000 Scotten Boulevard, Burlington, Iowa—TECHNICIAN

Miller VHF ANTENNA

The Bi-Focal antenna with reflector screen, model BF200, is said to produce high gain on the VHF band, providing long-distance pickup in canyons and valleys. List price,



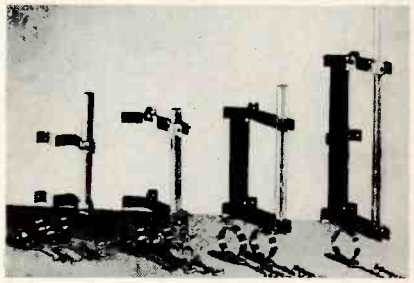
$35.95. Other Bi-Focal models without the screen are available for normal VHF areas. Miller Television Co., 2840 Naomi, Burbank, Calif.—TECHNICIAN

Ultra Hi ANTENNAS

Included in the manufacturer's line of antennas and accessories are the model UH-30 corner reflector and the UH-200 double bowtie with screen reflector (pre-assembled), both for UHF. Other types include 5- and 10-element yagis, folded dipoles, conical types and batwings. Accessories include a line of antenna mounts, standoffs, clamps and insulators. Ultra Hi TV Mfg. Corp., 23 Hudson St., Worcester, Mass.—TECHNICIAN

Commercial ROOF MOUNTS

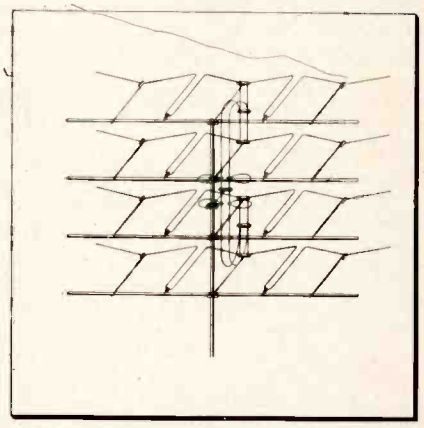
Four new models of chimney mounts with galvanized strapping, and six with stainless-steel strapping, include 1-strap, 2-strap, snap-



in and "Z" types. Both 2-strap and 1-strap mounts are supplied with 12-in. and 18-in. spaced brackets. All accommodate masts up to 1¾-in. diameter. All are zinc plated. Packaging includes all hardware, two 12-ft. lengths of ¾-in. strapping, sawtooth clamps and slide corner protectors. Commercial Products, 147 Main St., Toledo, Ohio—TECHNICIAN

Fretco UHF-VHF ANTENNA

The Fretaray Victoria receives all channels, 2 to 83. Gain averages 11.5 db on channels 2 to 5, and 12 db on channels 7 to 13. Front to back ratio is 20 to 1. No assembly is needed;

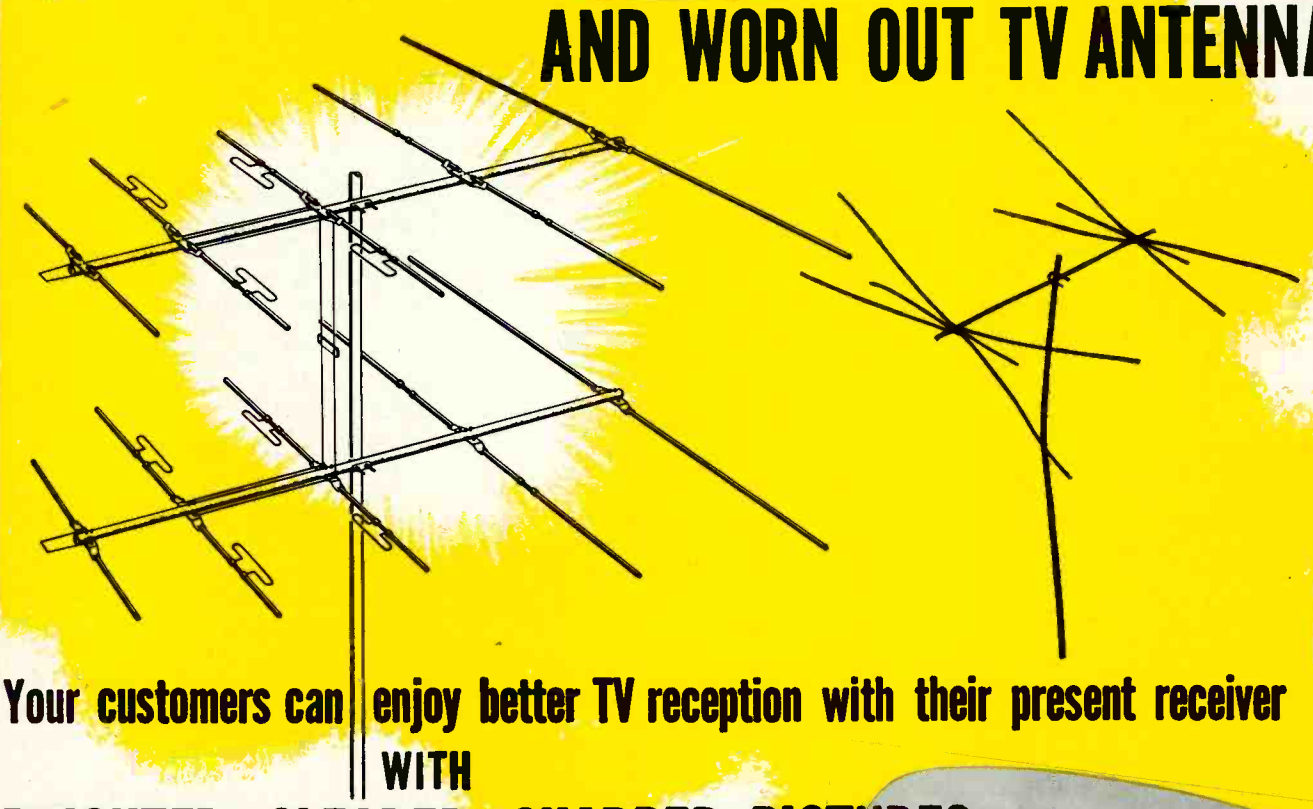


just fold out and tighten wing nuts. Fretco Inc., 406 North Craig St., Pittsburgh 13, Penna.—TECHNICIAN

More antennas on page 40

Right now

.....IS THE TIME TO REPLACE THAT OUT-MODED AND WORN OUT TV ANTENNA



Your customers can enjoy better TV reception with their present receiver WITH

BRIGHTER, CLEARER, SHARPER PICTURES

Provide your customer with greater enjoyment with his present TV receiver—put new life into the pictures on the screen—supply him with the equipment necessary to bring in all the available channels better, clearer...with the installation of a new Taco antenna.

We all know that there is a tremendous amount of replacement antenna and installation business to be had. The next few months will have a great effect on your overall business for the year.

SEE YOUR TACO DISTRIBUTOR—HE WILL TELL YOU WHAT TACO IS DOING FOR YOU.

Mr. Serviceman:

Postcards with your message directed to your customers and bearing your imprint and telephone number are available through your Taco distributor. Your customers will thank you for sending him this reminder that he needs television antenna service.

ESPECIALLY WITH A GENUINE

TACO

HIGH-GAIN ANTENNA

Technical Appliance Corporation, Sherburne, N. Y.

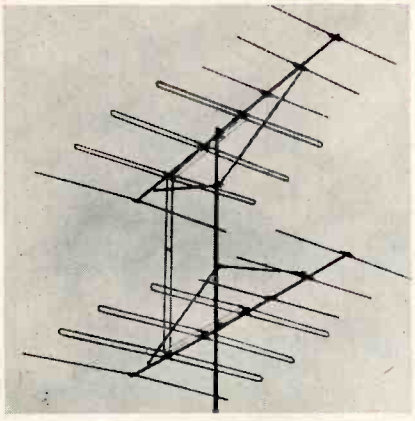
In Canada: Hackbusch Electronics, Ltd., Toronto 4, Ontario

Antennas & Related Products

Indoor and Outdoor Units; Lightning Arrestor; TV Set Coupler

Channel Master YAGIS

Challenger broad-band yagis are designed for areas served by two or more VHF stations on the same band. Model no. 1526 is a 7-element, low-band yagi featuring 3 driven dipoles, pre-assembled and braced for extra strength, said to cover Channel 2 through 6 with 6 to 7½ db gain and sharp directivity. List price: $27.78. Model no. 1573, a high-band yagi, provides fringe coverage of Channels 7 through 13. It uses 10 elements and is said to have flat response. Features snap-lock action, which permits assembly without hardware. List price: $14.58. Channel Master Corp., Ellenville. N. Y .—TECHNICIAN



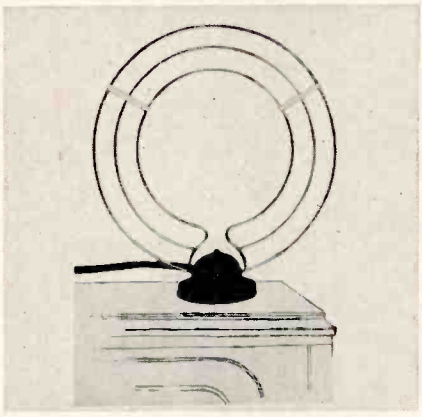
Telco ANTENNAS, MOUNTS

The Golden Halo indoor antenna, designed for UHF reception, is said to perform equally well on VHF. Gold-plated elements mount on plastic base. Cat. no. 9000. List price, $4.95.

The indoor UHF Can-Tenna with reflector screen is said to have 7 db gain at 680 mc, does not require critical positioning within the room for optimum results. Cat. no. A-350. List price, $7.75.

E-Z low-loss stand-offs are adaptable to a wide variety of transmission lines. A polyethylene insulator, rather than a metal ring, surrounds the wire.

New rooftop antenna mounts that require no guying include the No-Guy, cat. no. 9060, which can be mounted over the ridge of the roof or on a flat surface. Legs are adjustable to angle of roof. List price, $4.40. The Tri-Pod Tower, no. 9063,

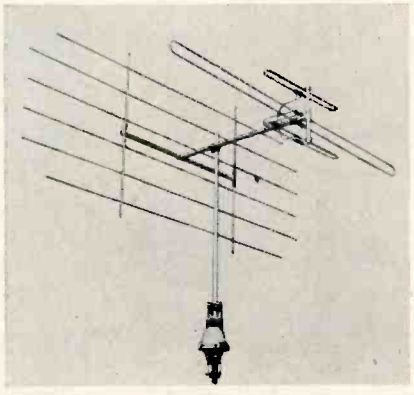


may also be used for masts taller than 10 ft. with guying. List price, $7.50. Television Hardware Mfg. Co., 919 Taylor Ave., Rockford, Ill.—TECHNICIAN

Radiart ANTENNAS

The Ultamatic is an all-channel VHF type designed with color reception in mind; response does not vary more than 3 db on any channel. Other features include: low standing-wave ratio, high front-to-back ratio.

Developed for one-man mounting, the Spee-Dee auto aerial is installed in 3 steps, none requiring work below the fender. Adjustable to fit all body and fender contours. The



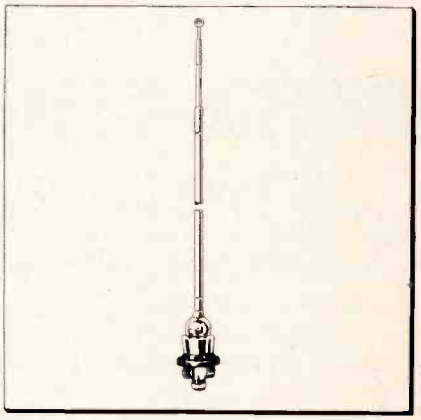
Spee-Dee measures 57¼ in. extended, has a 42-in. polyethylene lead-in. The Radiart Corp., 3455 Vega Avenue, Cleveland, Ohio—TECHNICIAN

Taco TV SET COUPLERS

These multi-set couplers may be installed in a few minutes, are available in 3 models. Cat. no. 820-2 divides signal to two receivers; 820-3 and 820-4, respectively, provide service to three or four receivers, as required. They also permit the use of less than maximum number of sets for which the units are designed, without loss of signal. In high signal areas, these units may be connected in multiple to feed a number of TV sets. Technical Appliance Corp., Sherburne, N.Y.—TECHNICIAN

Snyder AUTO ANTENNA

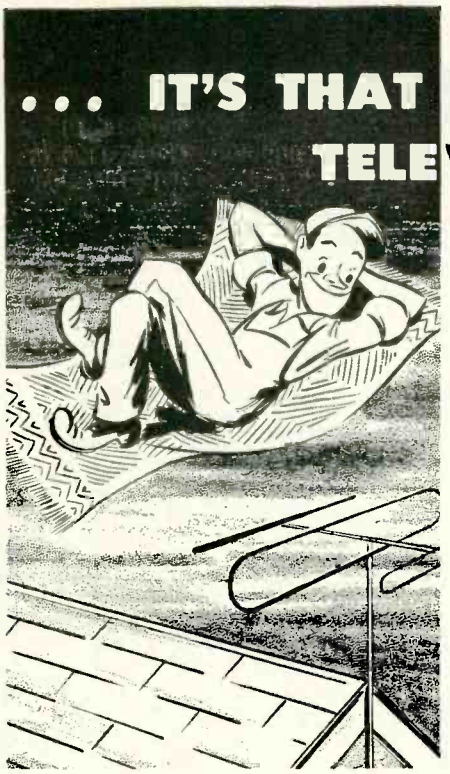
The TC-9 has a 3-section staff with a collapsed length of 23⅝ in. and an extended length of 56 in. It features a chrome static ball and bakelite insulators. Adjustable to any angle, it has a single hole mount for installation anywhere on top cowl or rear deck. Furnished with a 48-in. lead. Snyder Mfg. Co., 22nd and Ontario Sts., Philadelphia 40, Penna.—TECHNICIAN



Radion LIGHTNING ARRESTOR

The LA-75 arrestor handles all types of conventional lead-in—open, flat, jumbo, oval or perforated. The mounting strap is an integral part of the arrestor; no separate strap or bracket is required. Can be mounted on wall or any pipe up to 1½ in. Ground-wire grip eliminates the necessity of a ground screw or terminal. List price, $1.35. The Radion Corp., 1130 W. Wisconsin Ave., Chicago 14, Ill.—TECHNICIAN

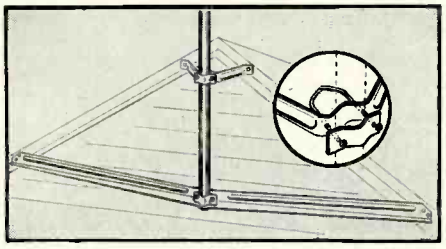
NOW ... IT'S THAT EASY TO INSTALL TELEVISION ANTENNAS



With SOUTH RIVER'S three NEW Antenna Mountings designed for faster, easier television antenna installations!

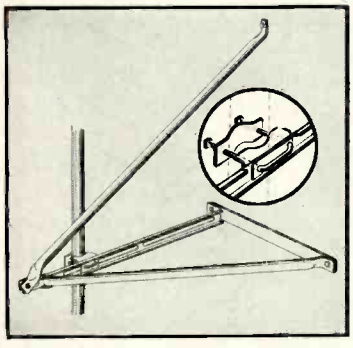
Oh for the life of a serviceman with SOUTH RIVER's brilliant new antenna mountings. YOU just name the kind of installation you're working with . . . SOUTH RIVER has the mounting to solve your problem!

EAVE MOUNT Model EM-48



Heavy-gauge embossed steel lower bracket with generous 48" spread permits secure, rugged installation of mast on homes with varied pitched roofs. Embossed 3" steel upper bracket permits ample clearance of roof edging. Hot-dip galvanized to prevent corrosion and for lasting rust-proof finish. Accommodates masts up to 1½" O.D. Complete with lag screws and mounting hardware.

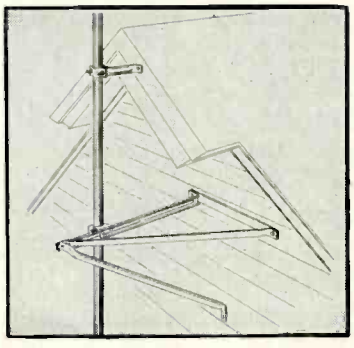
Also available with 60" lower bracket—EM-60.



ALL STEEL ADJUSTABLE WALL BRACKET

Model ST-18A

2 heavy-gauge embossed steel, fully adjustable, rugged braced brackets permit an 18" clearance under eave. Bottom bracket includes steel bracing leg. Features unique "U" bolt and plate sliding-type mast clamp. Hot-dip galvanized to prevent corrosion and rust-streaking. Hardware includes lag screws for mounting.



COMBINATION STEEL ADJUSTABLE WALL BRACKET

Model ST3-18A

Same lower bracket as Model ST-18A. Utilizes a rugged 3" embossed steel upper bracket. Useful in many applications where mounting is required under peak of a house. Complete with necessary hardware and lag screws.

South River
METAL PRODUCTS CO., INC.
South River, New Jersey
In Canada—A.T.R. Armstrong Ltd., Toronto

Write for your copy of South River's complete 1954 catalog.

PIONEER AND OUTSTANDING PRODUCER OF THE FINEST LINE OF ANTENNA MOUNTINGS

Shop Equipment

Parts Cabinets, Solder Irons, Tools, Cleaner, Flashlight

Akro-Mils PARTS CABINET

Small parts storage cabinets called Swing-Bins contain 6 drawers which swing out from a single

bracket. Only 2 screws mount the bracket to wall, table-top, underneath shelves or elsewhere. Clear plastic drawers swing out for accessibility. Pressure-seal labels may be stuck to sides of drawers. Compartment dividers are furnished. Drawers remove from bracket for cleaning; hold small tools, screws, nails, terminals, condensers, washers. Six-drawer model lists at $3.95. Also available in 12, 18 and 24 drawer models. Akro-Mils, Inc., 820 E. Market St., Akron 9, Ohio—TECHNICIAN

Insuline ALIGNMENT TOOLS

These five alignment tools were designed to expedite servicing. No. 6846 has a 1½ in. long plastic shank, ¼ in. in diameter, in the end of which is recessed a thin screwdriver blade. No. 6847 has a 10 in. long, ½ in. diameter plastic shank, terminating in an outside screwdriver blade. This tool, which can be bent around to 90 degrees, is useful for reaching alignment screws in crowded receivers. The 6848 is like the No. 6846, but has a 5½ in. shank. The No. 6849 has a thin metal body 3½ in. long, with a recessed blade in its end. The 6850 is a fibre screwdriver 4 in. long, for adjusting standard r-f and i-f transformers. All the tools have ribbed amber plastic handles 2½ in. long. Insuline Corp. of America, Long Island City 1, N. Y.—TECHNICIAN

Vaco PLIERS

This plier line includes a style for every use, including: Diagonal cutters in 4½, 5, 6, 7¼ and 7½-in. sizes; needle nose (with cutter) in 5, 6, 7-in. sizes; long nose in 6 and 7½-in. sizes; long, 6-in. flat nose with cutter, 7½-in. size without cutter; heavy-duty slip joint in 6½, 7½ and 8-in. sizes; adjustable plier wrench in 5, 6, 8 and 10-in. sizes; and linemen's side cutter in 6¼, 7½, 8¾-in. sizes. Vaco Products Co., 317 East Ontario St., Chicago 11, Ill.—TECHNICIAN

Wall SOLDER GUN

The Trig-R-Heat soldering gun provides heat-control action that is guaranteed for the life of the gun. This feature is said to adjust operating wattage of the iron automatically, depending on the heat requirement of the work being performed. Other features: built-in 7-watt bulb with separate switch; light weight; transformerless operation; quick

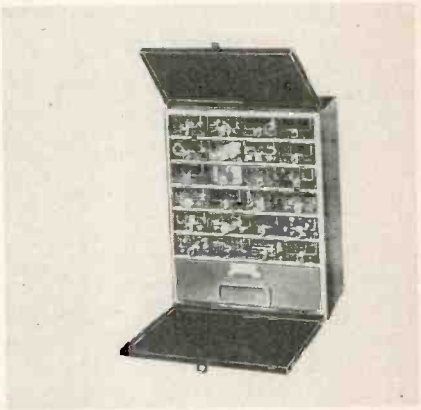
heating. Operates on 110-120 volts, ac or dc. Available in 2 models. 214LT ¼-in. tip, 150-400 w., lists for $11.95; model 212LT, ½-in. tip, 300-800 w., lists for $16.95. P. Wall Mfg. Co., P. O. Box 71, Grove City, Penna.—TECHNICIAN

Wedemeyer FLASHLITE

This flashlight has a rotatable head to adjust the beam for wide-angle or pin-point focusing. Two additional buttons change the light to red or green. Construction is all metal, with provisions for imprint by major users. Two models, 2-cell and 3-cell, list for $3.00 and $3.50 respectively. Eric Wedemeyer, Inc., 230 Fifth Avenue, New York 1, N.Y. —TECHNICIAN

GI SMALL-PARTS CABINET

Equipment, supplies and parts can be filed in the clear plastic drawers of these portable cabinets and con-



veniently carried to the job. They have non-slip handles and rigid all-steel construction. Front doors have padlock hasps. The steel backs have 4 keyholes for wall hanging. Model JC-32-SD (illustrated) has 24 plastic drawers and one large steel drawer. Dividers for the plastic drawers provide 72 adjustable compartments. Price, $15.95 postpaid. General Industrial Co., 5738 Elston Av., Chicago, Ill.—TECHNICIAN

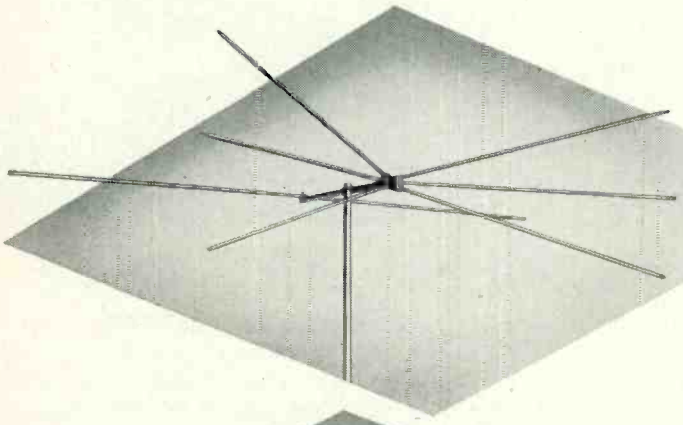
Workman CLEANER-LUBRICANT

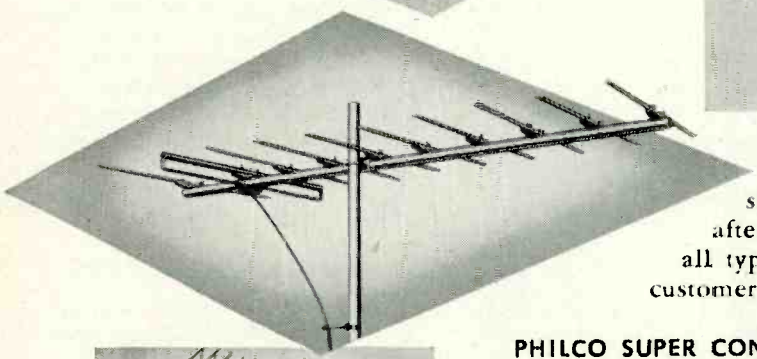
This electronic contact and tuner cleaner and lubricant is called "Wissh." It is said to eliminate noises and scratches due to bad contacts, restore carbon controls, and generally increase the efficiency of radio and TV equipment. Two refill bottles—a squeeze-type dispenser and a glass bottle with brush—both holding 2 oz. of chemical, are given away with each purchase of a one-quart refill can. The can is equipped with a refill spout. Workman TV, Teaneck, N.J.—TECHNICIAN

Drake SOLDER IRON

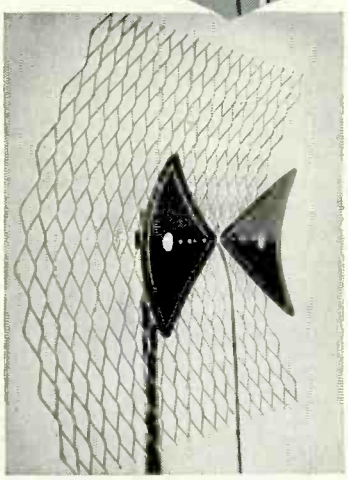
Designed to be carried in a tool kit while hot, the 403 soldering iron comes with an asbestos and metal-lined container. Rated at 80 w., the 403 weighs only 8 oz. and heats in 1 minute. Drake Electric Works, Inc., Dept. TNN, 3656 Lincoln Ave., Chicago 13, Ill.—TECHNICIAN

PHILCO announces 3 new super-performance TV antennas





The finest TV antennas in their class . . . designed by the world famous Philco Laboratories after thorough research into receiver requirements in all types of locations . . . designed to give complete customer satisfaction . . , to meet competition on any level!



PHILCO SUPER CONICAL UHF-VHF ALL-CHANNEL ANTENNA

Full 45" dowelled aluminum antenna elements and full 53" dowelled aluminum reflector assure strong signal pickup on VHF channels 2 through 13 . . . top quality performance on UHF channels 14 to 83. Single or stacked array Super Conicals produce new balanced performance . . . super picture quality plus high gain. All-aluminum construction in the Super Conical . . . it's easy to erect: Part No. 45-3096.

PHILCO SUPER YAGI VHF ANTENNAS

Quick-rig model with ten elements gives top fringe-performance on VHF channels 2 through 13. Excellent front to back ratio (6 to 1). This Super Yagi eliminates ghosts in strong signal areas . . . selects signals from adjacent weak area channels or co-channel stations. 10 db to 12 db gain depending on channel. Strong, all-aluminum: Part No. 45-3112. (Single channel 2 thru 13 and broadband 2 thru 6; 7 thru 13; 4, 5, 6).

PHILCO PARAFLECTOR ALL-CHANNEL UHF ANTENNA

Light weight pre-assembled all-channel UHF antenna. Outstanding performance in far-ftinge areas. High gain . . . 8 to 10 db. Exceeds gain of corner reflector of like dimensions. Impedance matched to 300 ohm line. Completely assembled, all-aluminum construction . . . can be mounted on existing masts for immediate use . . . all-channel paraflector weighs only 1½ lbs: Part No. 45-3071.

See them today at your Philco Distributor

PHILCO Famous for QUALITY the World Over

PHILCO CORPORATION

ACCESSORY DIVISION

"A" and Allegheny Ave., Philadelphia 34, Pa.

New Components

Switches, Condensers, Resistors, Batteries. Other Items

Shallcross SWITCHES

Instrument push-button switches molded of moisture-resistant phenolic, designed for use where extremely low contact resistance is desired. Types 10057 (SPST) and 10058 (DPST) can be used as both momentary contact and turn-to-lock switches. Also available without locking feature as types 10059 (SPST) and 10060 (DPST). All contacts are normally open. Switches mount in a ⅜ in. hole on panels. Shallcross Mfg. Co., Collingdale, Penna.—TECHNICIAN

International SELENIUMS

Miniature selenium rectifiers for equipment (such as TV boosters and UHF converters) requiring a load current of 50 ma or less are available. CR series rectifiers are rated for maximum rms input of 130 v and 160 v, are intended for operation into a capacitative load and have a dc output current from 10 ma to 50 ma. Dept. 4NR, International Rectifier Corp., El Segundo, Calif.—TECHNICIAN

Erie CAPACITORS

These temperature-compensating ceramicons cover a wide range of capacity values and are available in three temperature coefficients: NPO, N330, and N750. Close tolerance units are offered in non-insulated, molded-insulated, and dipped phenolic-insulated styles. One purpose of the 3 coefficients is to permit various parallel combinations, to obtain intermediate temperature coefficients. Formulae for computing these values, as well as a graph for quick computations, appear in available service data. Distributor Div., Erie Resistor Corp., Erie, Pa.—TECHNICIAN

Burgess FLASHLIGHT BATTERY

The Burgess size N flashlight battery, designed for use in toys and miniature novelty lights, has a nine-month shelf life. A polyethylene seal prevents power loss and assures long life. Retail price, 2 for 15¢. Burgess Battery Co., Freeport, Ill.—TECHNICIAN

Halldorson WIDTH-LIN. COIL

RF800, a dual-winding, permeability-tuned coil, is useful in many TV applications. One winding has a range of 3.5-31 mh; the other 2-8.5 mh, center-tapped. The coil can combine in one unit the width control and agc and/or horizontal-phase detection functions. In addition, many horizontal-width or linearity-control applications may be satisfied by one or the other of the two inductance ranges. Unit is insulated for 5000 v. Halldorson Transformer Co., 4500 N. Ravenswood Ave., Chicago 40, Ill.—TECHNICIAN

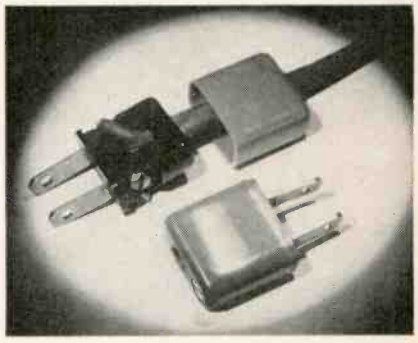
Eveready FLASHLIGHT CELL

Designed not to swell, stick, leak or jam in the user's flashlight, the

D99 is made to sell for a price slightly higher than standard general-purpose batteries. The zinc electrode of the cell is on the inside, while the carbon is on the outside. This reverses the design of standard flash batteries. As a result, consumption of zinc during use goes on inside the cell. Manufacturer guarantees free replacement of flashlight, if it is damaged by the use of this long-life cell. National Carbon Co., 30 E. 42nd St., New York 17, N.Y.—TECHNICIAN

ID LINE CORD PLUG

Originally developed for military applications, a new commercial line cord plug features ruggedness and compactness. The plug (Cat. no. 1420) is made of nylon and has molded-in strain relief for the line cord. Miniaturized design is about ⅔ the size of current popular types. Housing is available in a variety of



colors. Industrial Devices, Inc., Edgewater, N. J.—TECHNICIAN

IRC MINIATURE RESISTORS

High-frequency miniature resistors, type HFR. These ¼ w. units are for use in circuits requiring excellent frequency response over a wide band, or where low shunt capacitance is desirable. Standard tolerance ±20%; ±10% and ±5%, available in values from 20 ohms to 1 meg. International Resistance Co., 401 N. Broad Street, Philadelphia 8, Penna.—TECHNICIAN

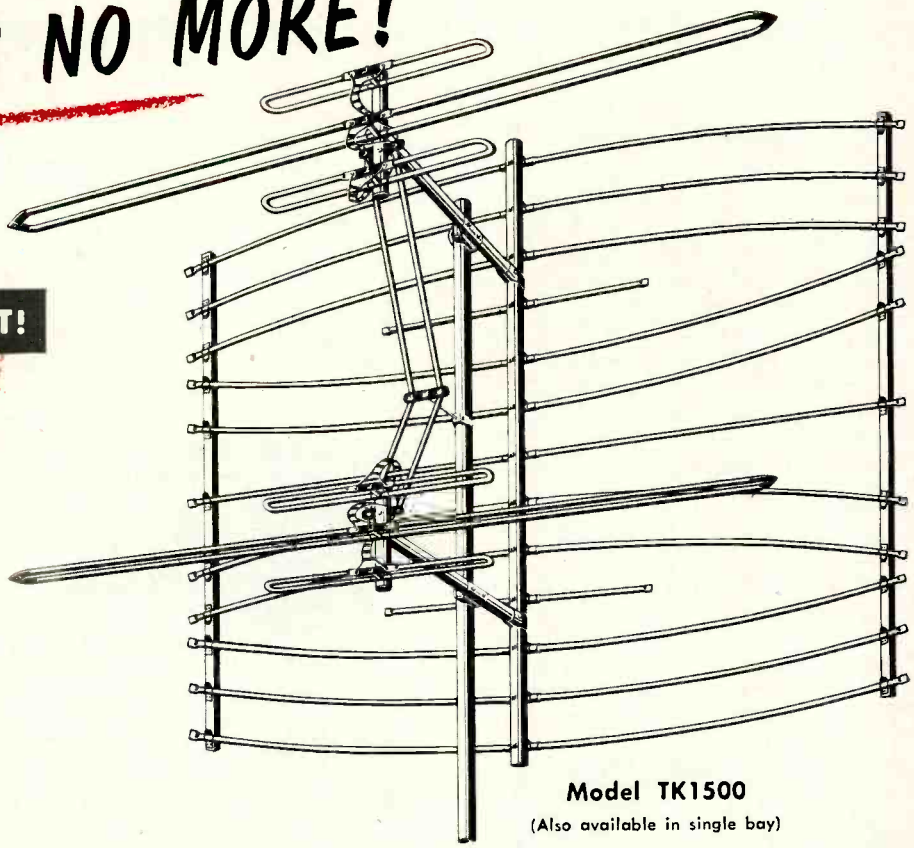
Centralab HV CAPACITORS

High-voltage capacitors designed so that terminals will not twist out or break off. Available in 20,000 v dc, 500 mmfd. Heavy threads lock the terminal tightly into the Hi-Vo-Kap. Internal corona is prevented by seating the terminal at the bottom of the capacitor tap to avoid any air gap. Attachable-terminal Hi-Vo-Kaps are available singly or in packs of 5. Terminals are packaged 5 to an envelope, 25 to a carton. Centralab,

900 East Keefe Avenue, Department E43, Milwaukee 1, Wisconsin.—TECHNICIAN

SUPER-PERFORMANCE

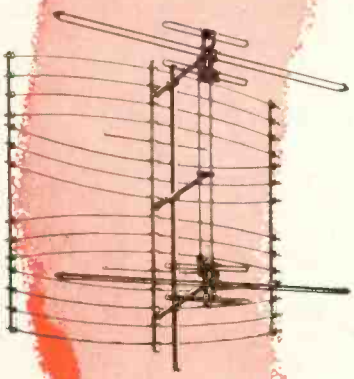
...THAT COSTS NO MORE!



Model TK1500
(Also available in single bay)

MAKE THE SCREEN TEST!

1. Measure the space between reflector elements of any other big screen antenna.
2. Note that the TRI-KING has closer spacing between reflector elements for improved performance. The TRI-KING's element spacing is the proven maximum for a full 1/10 wave length.



SUPER TRI-KING Model TK1800

WIND TUNNEL TESTED to exacting aircraft standards. Test results *prove* that a full size TRI-KING antenna can withstand 30% higher wind velocities than any other large screen antenna.

ORDER NOW - IMMEDIATE DELIVERY!

CLEAR BEAM PRICES	
Model TRI-KING	List Price
TK1500	$44.50
Super TK1800	$52.95

CLEAR BEAM'S TRI-KING
Patent Applied For

POSITIVE GHOST REJECTION! Clear Beam proudly announces the new TRI-KING, combining for the first time a Radar-type reflector screen with the improved TRI-KING dipole assembly. A real champion with many Clear Beam features including rugged, quality construction and Quik-Rig assembly that outsells all other big screen antennas. Sold on a money back guarantee.

WRITE FOR COMPLETE INFORMATION TODAY

Clear Beam Antenna Corp.

100 PROSPECT AVENUE • BURBANK, CALIFORNIA
THornwall 2-4886 • Victoria 9-2141

WAREHOUSES IN: San Francisco • Portland • Seattle • Chicago • Kansas City • Detroit • Dallas • Baltimore

New Audio Products

Speaker, Mike, Amplifiers, Baffle, Phono Pickup, Headphone Set

Philco AUXILIARY SPEAKER

This 10-in. hi-fi radio-phono speaker can operate as an auxiliary speaker in combination with any of Philco's current line of radio-phono console combinations. Speaker is the same model used in Philco's Phonorama combination and has the "acoustic lens" to disperse sound throughout the listening area. There is a 30-foot extension cord attached. List price, $69.00. Philco Corp., Tioga & C Sts., Phila. 34, Penna.—TECHNICIAN

Altec Lansing MICROPHONE

The M20 Lipstik, a condenser-type microphone, measures 3 in. in length. For broadcast, TV and public address use on the lapel, in a breast pocket, clipped to manuscript, in hand, or on the stand. Flat within 3

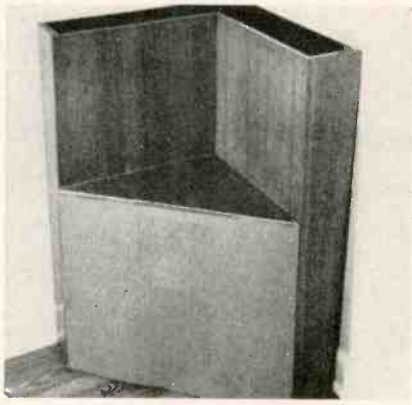
db from 15 to 15,000 cps, the M20 system provides output level of —48 dbm, and can be operated into any impedance from 30 ohms to a high impedance. Altec Lansing Corp., 161 Sixth Ave., New York 13, N.Y.—TECHNICIAN

Hartley AUDIO CONTROL

The Hartley Audio Control Amplifier is designed for use in quality systems with phono pickups, tuners, tape recorders, and other audio signal sources. Separate bass and treble controls are continuously variable, and permit up to 36 db boost at 40 cycles; 13 db boost and 16 db attenuation at 10,000 cycles. These enable compensation for all record characteristics. With controls level, response is flat from 20 to 50,000 cps. Distortion content is less than 0.1%. The input selector switch provides 4 positions. Cathode follower output permits long leads without frequency discrimination. Requires external power supply. H. A. Hartley Co., Inc., 521 E. 162nd St., Bronx 51, N.Y.—TECHNICIAN

PDR CORNER HORN

Designed for a 12-in. speaker with space for a tweeter, this ex-



ponential corner horn is small enough for Hi-Fi reproduction in the home. Unit exhausts through a top opening, instead of side openings, to take advantage of unobstructed wall space. Constructed of half-inch plywood, with speaker sections enclosed by a grille. Product Development & Research, 2365 Le Forge Road, Ypsilanti, Mich.—TECHNICIAN

MV PHONO AMPLIFIER

Designed for the audio hobbyist, model XC 101 is an ac-dc push-pull phonograph amplifier with inputs for crystal or magnetic cartridges. The compact 4-tube unit provides the following features: essentially flat response 40-20,000 cps; bass, treble and volume controls; built-in preamp; 8-watt output; output impedance match to 8 or 16 ohms. Marine View Electronics, 744 E. 138th St., New York 54, N.Y.—TECHNICIAN

EC 5-WATT AMPLIFIER

Model RL-5 is a 5-watt ac amplifier with a built-in pre-amp for use with reluctance or crystal type phonographs. The compact unit may be used for paging systems, intercoms, record players or other sound systems. It consists of three tubes (6X5, 6V6GT, and 6SL7), and features an auxiliary power outlet and connection for a 3.2-ohm speaker voice coil. List price, $29.95. Electronic Crafts Co., 74 Cortlandt St., New York, N. Y.—TECHNICIAN

Telex HEADPHONE SET

Fidelity and light weight are features of the Dynaset, dynamic headphone unit, which uses a miniature dynamic speaker ¾ in. in diameter. This under-the-chin headset has exchangeable ear tips, aluminum tone arms and flexible tubing. Sensitivity is 105 db above 0.000204 dynes per sq. centimeter for one milliwatt input; frequency range is from 50 to 8,000 cps or better. Dept KP, Telex, Inc., Telex Park, St. Paul, Minn.—TECHNICIAN

Sonex HI-FI AMPLIFIER

Model U-L-601, at output levels normal in the home, introduces less than 0.1% intermodulation distortion and has smooth bandpass ±1 db from 2 cps to 200 kc. It is rated to deliver 60 watts ±1 db with less than 0.5% distortion at any frequency in the range of 20 cps to 20 kc. The amplifier uses ultra-linear circuitry and features ac receptacles, power take-off for pre-amplifier, and provision for remote on-off switching. Sonex, Inc., 245 Sansom St., Upper Darby, Penna.—TECHNICIAN

E-S HI-FI PHONO PICKUP

This electrodynamic-type phono pickup is designed for high-fidelity sound systems, and has flat output from 20 to 10,000 cps, with a slight rising characteristic to 20,000 cps, depending on the record material. Spurious responses due to resonance effects and other causes are said to be completely absent below 20,000 cps. The stylii are permanently fixed. With a sapphire unit, the pickup is priced at $14.95; with a diamond one, at $29.95. Electro-Sonic Laboratories, Inc., 3215 36th Ave., Long Island City 1, N.Y.—TECHNICIAN

Mailings Boost TV Income

(*Continued from page* 30)

regular list includes the "Windy Season" check-up in February and March, a Spring and Summer check-up in May and June, the World Series, and a Fall and Winter check-up in late October. Non-regular mailings in the recent past have included the presidential nominating conventions, the Coronation, and the Marciano-Walcott fight.

Most mailings are written and designed by one or more of the partners, sometimes with the help of one or two salesmen. Rough layouts and copy are given over to a local printer. Today, cards are addressed on a new Addresso-Graph, which the company recently purchased. Before the addressing machine was bought, clerical help was hired to take care of the mailings.

Mailing List Details

Lake Service's mailing list, painstakingly acquired, is carefully kept up-to-date. The company's secretary sees to it that duplication is avoided, and that names of unresponsive prospects are dropped after several tests. The names of non-contract customers who have done business with Lake Service are kept in a special section. So are new and untried names from selected areas. When promotion time approaches, names are selected alphabetically or by area.

Some mailings prove inexplicably more successful than others. One such was the political convention mailing in the summer of '52.

"We sent out 10,000 cards altogether—5,000 before each convention," says Paul Wagner, "and we received close to 1,500 returns, along with many telephone calls. It proved to us how politically-conscious the average television owner has become."

Cards in this case were illustrated with the familiar donkey and elephant, symbolic of each political party. Copy urged the reader to "Tune In for the Battle of the Century." A check-up for a specified fee was offered, exclusive of the cost of major components.

Lake Service feels it has worked out a good formula for picking up new service business. It will send out its fourth World Series mailing soon, and figures on many more to come.

Improving TV

Increasing Noise Immunity

Flashes in the picture, accompanied by unstable sync in the presence of noise, is a common trouble in many of the older TV receivers. These symptoms can be minimized in sets using a relatively small value of capacitance for interstage coupling between video amplifier stages. The input to the second video stage must have a positive-going sync signal, for the method to be effective.

The unstable sync and picture flashing are caused by the long time constant of C-1 and R-1 (see Fig. 1).

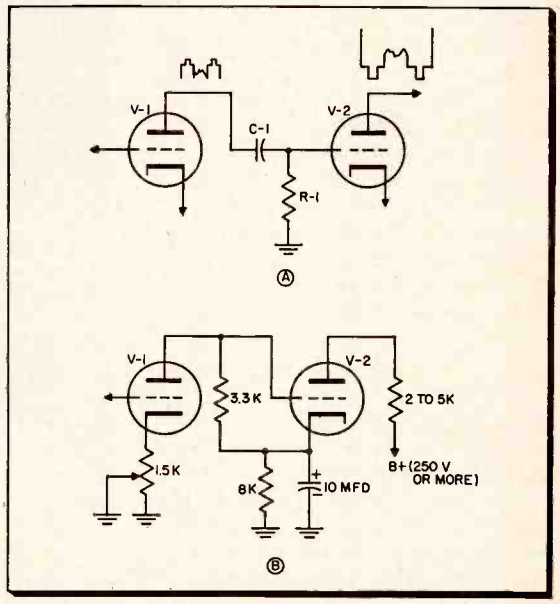


Fig. 1A—Simplified sketch of 2-stage video amplifier. R-1's value is generally some value between 270k and 1 meg; C-1's value may fall between .01 and .22 mfd. B—Direct-coupling video amp stages is one way of reducing noise effects. Circuit values shown apply to 12AU7 or 12BH7 tubes. Other suitable values will have to be chosen when different tubes are used as video amplifiers.

When a noise pulse, such as that produced by a car's ignition system, is received, C-1 charges up and holds the charge for a number of microseconds, thus cutting off any video or sync present at the time at the grid of V-2. These signals are cut off not merely while the noise is present at the input, but for an appreciable time after the noise has come and gone.

(The noise pulses are very much greater in amplitude than the video and sync signals. When they ride in, they drive the grid sharply positive, causing grid current flow. C-1 is charged, and a negative voltage is developed between grid and ground, by this grid current flow. The resultant increase in bias is large enough to cut the tube off. Some time elapses before C-1's discharge through R-1 has reduced the bias to below cut-off level. Video and sync signals are cut off during this time.—Ed.)

One way to eliminate the condition is by direct-coupling the two video amp stages (see Fig. 1B). The difficulty with direct coupling, however, is that a high B+ voltage feed to the second video amp. stage is needed, to produce a plate voltage at the first stage large enough to provide adequate gain.

Another method of dealing with the problem is to increase C-1 and reduce R-1 to the point where the time constant does not produce the noise effects previously described. I have found that changing C-1 to 4 mfd, and

Set Performance

R-1 to 3k, is effective in minimizing noise symptoms.—*F. S. Mattioli, Madison, Wisconsin.*

(While the author's idea is good, we don't agree on the changes in value of C-1 and R-1 that he recommends. The problem present, we feel. reduces itself to the following: grid current produced by the positive-going noise pulse must be reduced to a point where the grid voltage developed by the noise has a negligible value. The second video amplifier will, in such a case, no longer be cut off in the presence of noise, and the effects of noise on the picture will be shortened to the time that the noise pulse is actually present. The desired effect can be achieved by reducing the value of R-1. The reduction in R-1's value necessitates a corresponding reduction in the reactance of C-1 (i.e., an increase in C-1's capacitance) to prevent the excessive attenuation of low-frequency signals.

C-1 should not, in our opinion, be increased beyond .25 mfd, nor should R-1 be reduced to a value below 30k. Excessive C-1 capacitance will increase the shunt capacitance to ground, and reduce the video high-frequency response; too small a value of R-1 will cut down the gain of V-1, since R-1 is in parallel with the plate load curcuit of V-1.

Direct coupling, while it has its disadvantages, will reduce noice because it dispenses with the coupling condenser, permitting the value of the grid resistor to be made as low 3.3k.—Ed.)

Improving Sync

When sync signals are taken off at the plate of the first video amplifier (in a two-stage video amplifier circuit), and the contrast control is in the cathode circuit of the first video stage, twisting and weaving of the picture with the contrast control turned up for normal viewing may be seen in some sets. Loss of vertical sync

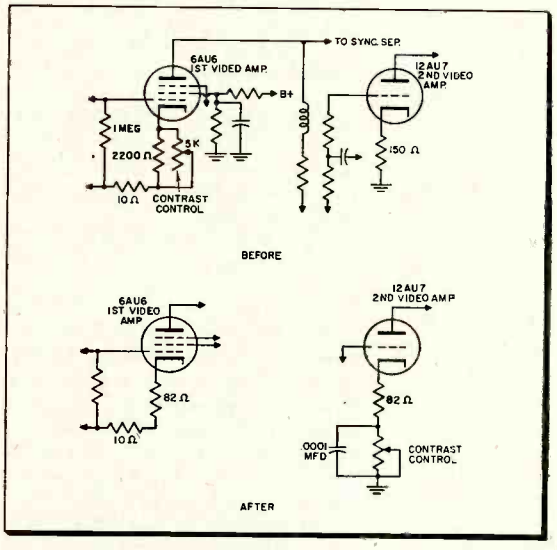


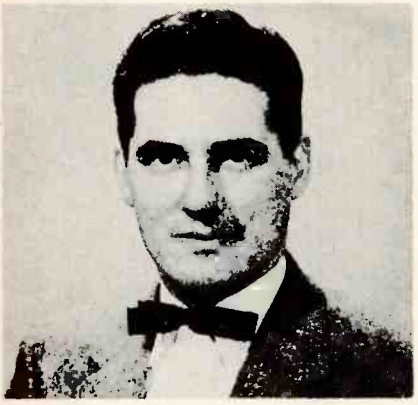
Fig. 2—Changes made to improve sync in circuits where the contrast control is in the first stage of a 2-stage video amplifier.

at low contrast settings may also accompany this symptom. The remedy is to move the contrast control to the 2nd video amp cathode circuit, making the re-wiring and component changes indicated in Fig. 3. Since the gain of the first video amplifier is now constant, and the tube operates at full output at all times, insufficient sync at low (or normal) contrast settings is avoided.—*Michael Craig, St. Paul, Minn.*

NEWS of the TRADE

Du Mont Post to Hatchwell

Joseph A. Hatchwell, mid-Atlantic regional sales manager for Allen B. Du Mont Laboratories' Television Receiver Division, has been promoted to Director of Service, it was announced today by Dan D. Halpin, general sales manager.



Mr. Hatchwell's new responsibilities include the administration, supervision, and direction of the technical activities of the Division's Service Department on a national basis. The new director, a graduate of the Moore School of Electrical Engineering at the University of Pennsylvania, has a 14-year record in the establishment of TV service concerns, and in television and electronic sales.

Salami-Sliced Tubes

Slicing glass vacuum tubes just like salami—to make sure they'll perform right in radios and TV sets—is all in a day's work for GE engineers in Owensboro, Ky. The technique has solved a problem in the tube-checking program. Engineers needed a way to inspect a tube's inner parts without disturbing them. Breaking open the glass and cutting out the parts for study could move or distort them and spoil the test. Then one engineer suggested the slicing procedure.

First, the tube is immersed in clear, liquid plastic. Then its submerged glass tip is cracked off. Since there's a vacuum inside, atmospheric pressure forces the liquid plastic into the tube, filling it completely. The plastic is hardened in about two hours, with the tube parts undisturbed. Engineers then crack away the glass exterior and slice the plastic-encased parts into quarter-inch-thick sections, for study under a microscope.

Antenna Standards

A standard recently released by the Radio-Electronics-Television Manufacturers Association (RETMA Standard REC-141) may help in clearing up some of the confusion surrounding VHF antenna peformance claims. This confusion has been a major source of irritation to service technicians, who often find a customer's good will depends on the ability to evaluate and recommend suitable antennas for individual installations.

Performance data to be presented for all VHF antennas include the directivity pattern, relative gain and the voltage standing-wave ratio and/or impedance. For multiple-channel antennas, the horizontal pattern is to be shown on each channel for which coverage is claimed. Standard dipoles for Channels 2 to 13, used as a reference, are described; the gain of other antennas is compared to these dipoles. The methods by which tests are to be conducted and readings taken are also discussed.

Recorded Tape and Player

The trend toward pre-recorded tapes is gaining added impetus. E. M. C. Recordings Corp (Educational—Musical—Cultural), St. Paul, Minn., announces the availability of pre-recorded educational tapes for use by schools. Later this fall, the company expects to make its initial offering of pre-recorded musical tapes. While this project is not the first of its kind, another venture being planned by the organization may have some effect on the popular acceptance of the tape medium. A tape playback unit, without recording facilities, will be offered at a list price of less than $40. The availability of such a device may place tape and tape players in direct competition with recorded discs and disc players.

INDUSTRY KEYHOLE

ETCHED-CIRCUIT PREAMPLIFIER, used in the new Crestwood tape recorder, model 303, is stated by the manufacturer to mark the first application of etching techniques in this field. Response of the 2-speed player is said to be 50-10,000 cps. . . . **SYLVANIA ELECTRIC PRODUCTS,** Radio & TV Div., has appointed a new distributor in S. Carolina: Merit Distributing Co. of Spartanburg . . . **COMMITTEE FOR THE WEST-COAST AUDIO FAIR,** scheduled for 1955, takes on 4 new members: G. Yarbrough (American Microphone Co.), B. Berlant (Berlant Associates), J. B. Thomas (James B. Lansing Sound Co.) and B. Newcomb (Newcomb Audio Products Co.)

CLOSED-CIRCUIT TV was used as a method of instruction at a service meeting conducted in Wichita Falls, Tex., by Bob Middleton of the Simpson Electric Co. A TV camera was trained on demonstration equipment. TV sets spotted all around the large meeting hall brought close-ups of the demonstrations to all observers . . . **AMERICAN SCREEN PRODUCTS CO.** of Miami, Fla., has added sales representatives for its line of antennas and other products: Arthur E. Akeroyd Co., Boston, Mass. (Conn. Me., Mass., N. H., R. I. and Vt.); Tom Cox, Green Lane, Penna. (Eastern Penna., Southern N. J., Dela., Md. and D. C.); Dave Kubrick Co., New York City (N. Y. metropolitan area and Northern N. J.)

HARD-GLASS ELECTRON TUBES, designed to withstand extreme heat and stress conditions, are being mass-produced for military and commercial aircraft applications at the Eatontown, N. J. plant of Bendix Aviation Corp. Tube life in excess of 1,000 hours is said to be achieved even when the temperature of the tube's glass bulb during operation goes up to 572 degrees F. . . . **THE MAGNAVOX CO.** has appointed Ralph Mathews as general sales counsel for its high fidelity division.

CONSUMER EDUCATION on the role of the service technician is currently being plugged by GE. Spots on the Garroway morning TV shows are being used to get the message across . . . **WARD PRODUCTS DIV.,** The Gabriel Co., Cleveland, Ohio, has a new gen. mgr. He is C. Chandler Cole . . . **AN ENVELOPE STUFFER** telling all about its 4-D Directronic portable TV antenna has been made available to the trade by Snyder Mfg. Co., Philadelphia 40, Penna.

TRANSMITTER-RECEIVER COMBINATIONS to operate in the band between 450 and 470 mc have been announced by GE. Expected to be most useful in big-city police and fire depts., taxicabs, and in some industrial applications, these 2-way mobile units will function from either 6- or 12-volt batteries. . . **MIRYAM SIMPSON** of Masco, mfrs. of PA and Hi-Fi equipment, has been elected head of Music Artists, Inc. The group is sponsoring a series of 10 "pop" concerts in Carnegie Hall, N. Y.

(*Continued on page* 57)

BEG PARDON

Two typographical errors were present in *Focus Circuit Problems,* April TECHNICIAN. At the bottom of column 2, p. 22, the sentence should have read "when *correct* focus is approached" (not *current* focus). Also, the letter Y next to the Z in Fig. 8C (p. 24) should have been a *V*.

Antenna Reflection Problems

(*Continued from page* 19)

array installed.

Familiarity with the characteristics of reflected and direct signals is not only useful in educating customers, but also in solving various antenna problems. Let's cite an example.

Five years ago the author was located next door to the Leland Hotel in St. Paul. The only place a decent signal could be obtained from the shop antenna was when it was positioned in front of the wash basin at the rear of the one-story building which housed my store. Locating this optimum point was neither accidental nor due to hit-or-miss fumbling, but was the result of a bit of deduction and experimentation on the part of the writer.

Reception Mystery

Several customers in the hotel next door, I learned, were getting pretty good reception with rabbit-ear antenna units, whereas my roof antenna was providing only a mediocre signal, due to the presence of the largest buildings in town half a block up the street. Why, then, were the hotel's indoor antennas working fairly well, whereas the same type of antenna was worthless in my store—either at the bench, or at the front of the store (where I had several TV sets on display)?

After some further sleuthing, I came to the conclusion that the block-long Great Northern building (largest railroad building in the world) was acting as a huge mirror (see Fig. 3), and reflecting a very strong signal directly at the hotel. The reflection, I reasoned, was just missing my store.

By running a long 300-ohm lead out the back door to the parking lot in the rear, it was discovered that the signal was fairly strong at the extreme corner of the store building. A rabbit-ear antenna was therefore fastened directly over and forward of the wash basin, and reception came in fine. The alley between the hotel and store building is only 8 feet wide, and a large metal fire escape was directly opposite the only point on the shop roof which might be expected to receive some of the reflected signal mentioned above. This accounted for the fact that the outdoor antenna did not

(*Continued on page* 55)

SERVICE ASS'N REPORTS

Happy Birthday to RETMA

At its annual convention in Chicago this month (June 15-17), the Radio-Electronics-Television Manufacturers Association will blow out 30 candles on its birthday cake. Actually chartered on *April* 16, 1924, RETMA has held up the celebration until this month's convention. Organized by 46 manufacturers in the infant industry, the association's membership exceeds 370 today. Both of the National Television System Committees (the 1941 NTSC, which led to the standardization of present-day monochrome TV, and the 1953 NTSC, which developed color standards) were sponsored by RETMA.

There have been many other landmarks and signs of growth in the organization's 30-year history—changes in the association's name, for instance. Known as the RMA in its first year (Radio Manufacturers' Association), it added television to the title in 1950, to become the RTMA. Reflecting the broadened scope of the expanding industry, it became RETMA last year.

RETMA has just released a list of servicemen organizations which was compiled by committee members.

TEA Sponsors Clinic

The Texas Electronics Assoc., 1616 Eighth St., Fort Worth, is going to sponsor another clinic to be held August 27-28-29 at the Adolphus Hotel, Dallas, Texas. This association is the statewide organization of the local service dealers' organizations in the principal cities of the state. Subjects to be covered will include color TV, UHF, transistors, UHF and VHF antennas, fair charges for TV service, and credits and collections.

LIETA Joins Other Assns.

The Long Island Electronic Technicians Association, Oceanside, New York, and the Radio & Television Technicians Association of New York City, 52 East 19th St., N.Y., have affiliated, each retaining its own autonomy. They have also joined the Eastern Television Service Conference, 25 Church St., Paterson, New Jersey, as charter members.

LIETA has set in operation the "LIETA Service-Bank," through which any member who becomes sick and is unable to work can have all his repair jobs taken care of by the group's technical committee. LIETA has also agreed to guarantee its members' repair jobs (to customers), for which a responsibility fund has been set up.

TSG Elects New Officers & Starts Credit List

In the recent election of the Television Service Guild, 4011 N. Main St., Dayton, Ohio the following officers were elected: Stanley Copp, Pres.; Albert Houser, First VP; Alfred Redolfi, Second VP; Ralph Snyder, Treas. and Marshall Rankin, Secy.

TSG has established a "List" (bad credit risks) which it distributes to members. Servicemen fill out a card on each call and mail it in to the secretary, who makes up a credit report on each customer. The report in turn is mailed out periodically to all members. This automatically flags the slow-paying or non-paying customers and cautions the serviceman to make it a C.O.D. call. TSG is also trying to find out who is selling tubes to drug stores.

TISA Offers Help to Needy

Members of the Television Installation Service Assoc. realize that time lies heavy for such people as orphans, cripples and the aged. Therefore, the members of this association are prepared to render service on institution-owned TV sets for those institutions where the inmate is not charged for entrance or services.

An organization wishing to take advantage of this offer is asked to write, on its letterhead, to the office of the Television Installation Service Association (TISA), Frank J. Moch, President, at 5908 S. Troy St., Chicago 29, Illinois, registering its sets by giving the make, model and serial number. Service can then be requested by phoning TISA headquarters at GRovehill 6-6363.

NCTA Convention

The National Community Television Assoc., Inc., Box 184, Pottsville, Pennsylvania, is sending out invitations to its 3rd Annual Convention and Show, which will be held in New York City, June 14, 15 and 16 at the Park Sheraton Hotel.

Manufacturers and distributors of community television equipment will exhibit and demonstrate their products on these dates. Technical clinics will also be held. The clinic panels will be headed by outstanding men in each phase of community television problems. In addition, there will be general sessions covering administrative, promotion, telecasting, legal and tax matters. Outside of the business meetings, all functions are open to members and non-members alike. Reservations can be made direct with the Park Sheraton Hotel or by writing to the NCTA. The charge for the entire convention, $15.00 per person, will include the following: Exhibits and displays, technical clinics, educational sessions, general sessions, cocktail party and annual banquet.

RTG Offers Helping Hand

In a recent issue of The *Guild News*, published by the Radio Television Guild of Long Island in Bethpage, there is a directory of members who are expert on particular brands of TV receivers. Any time a member gets stuck with a tough dog, he can call someone from the list to get advice.

ARTSDA News

At the last meeting of the Associated Radio-Television Service Dealers Association, 2552 N. High St., Columbus, Ohio, Jim Cumbow, Treasurer, reported a balance of over $1,000.

All members were urged to try to attend the forthcoming 1954 NATESA Convention in Chicago (Sept. 24-26, Hotel Morrison).

Reprints of the ARTSDA Certified Emblem and a quantity of small emblems for tube caddies were authorized by membership vote.

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.

Making the Most of Your Test Equipment

(*Continued from page 23*)

Surprising as it might appear at first glance, the frequency range will only change about 10 per cent or less from the latter figure, whether one coil is used with the other shorted out, or both coils are connected in parallel, as shown in Fig. 1C and 1D; the external circuit "sees" a single coil with two capacitors across it in the two last-named cases.

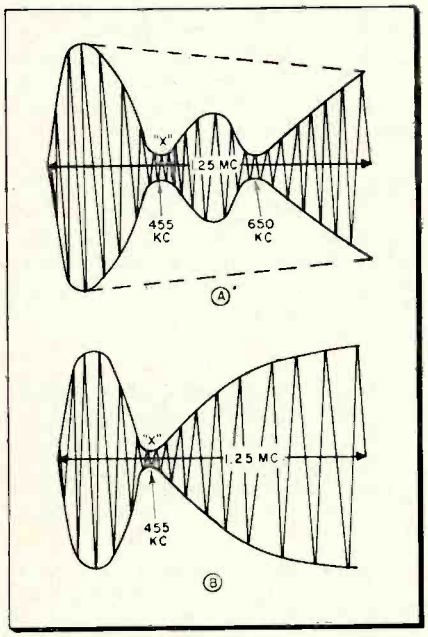


Fig. 2A—Double dip in response, when traps are tuned to different frequencies. B—Single dip when traps are tuned to same frequency.

Fig. 2A shows how the two traps put "crimps" in the frequency response when a sweep generator is substituted for the AM generator, and connected to the scope, with the two coils arranged as in Fig. 1E (and in series with the 25 mmfd capacitor). The traps shown were adjusted to 455 and 650 kc, respectively. When both traps were tuned to the *same* frequency, the curve in 2B resulted. Note the additional attenuation at point "X" in Fig. 2B. The dotted lines in Fig. 2A show the response obtained with a 1.25 mc sweep before the traps were inserted. This response will, of course, vary with the scope used and the linearity of the sweep generator output.

Technical new products on pgs. 34, 36, 38, 40, 42, 44, 46

MFRS' Catalogs & Bulletins

EXIDE BATTERY BOOKLET: Storage battery maintenance, including blank check-up charts, is covered in *Seven Rules for Maintaining Your Exide Battery, Form 5063*, 8 pp. Pocket-size pamphlet available from Electric Storage Battery Co., Box 8109, Philadelphia 1, Penna.

COLUMBIA WIRE DATA: Manufacturer's complete line of wire and accessories, including new items, is covered in a 36-page catalog. Columbia Wire & Supply Co., 2850 Irving Park Rd., Chicago 18, Ill.

EPR RESISTOR BROCHURE: Engineering data on precision wire-wound resistors and descriptions of standard available types appear in a 16-page brochure. Eastern Precision Resistor Corp., 130-11 90th Ave., Richmond Hill 18, N. Y.

MILLER ANTENNA & ACCESSORY CATALOG: Over 400 antennas of all types and more than 100 accessory items, including many new models, are covered in the manufacturer's catalog. A new crt tester-reactivator is introduced. Miller Television Co., 2840 Naomi, Burbank, Calif.

RADIO RECEPTOR SELENIUM HANDBOOK: Voltage curves, circuitry, tabular matter and applications are covered in a new catalog, *Selectron Selenium Rectifiers*, 24 pp. Special and standard units in radio-TV and industrial types are covered. Available on mail request. Radio Receptor Co., Sales Dept., 251 W. 19th St., New York 11, N. Y.

STANDARD XFORMER REPLACEMENT GUIDE: Replacement transformers for over 6800 TV models and chassis from 115 manufacturers are listed. Cross-refence parts number charts for other replacement manufacturers. Most are stated to be exact physical and electrical replacements. Changes, where needed, are described in this *Stancor 1954 TV Replacement Guide & Transformer Catalog*. 36 pp. Sales Mgr., Standard Div., Chicago Standard Transformer Corp., Addison & Elston, Chicago 18, Ill.

DRAKE TVI FILTER LEAFLET: High-pass, low-pass and tunable band-rejection filters for TV antenna systems, a UHF-VHF antenna crossover network, a power line filter and a filter for amateur use are described and illustrated. Prices are given. R. L. Drake Co., 18 E. Central Ave., Miamisburg, Ohio.

JAMES VIBRATOR REPLACEMENT LISTING: Complete post-war cross reference data for auto replacement, communications and aircraft vibrators, 1954 edition. James Vibrapowr Co., 4036 N. Rockwell St., Chicago 18, Ill.

CLOUGH-BRENGLE INSTRUMENT CATALOG: Specifications, descriptions and illustrations of test equipment line, including sweep, r-f and audio generators and an R-C-L bridge. *Catalog No. 54-A*, 12 pp. Available on mail request to Clough-Brengle Co., Dept. TR, 6014 Broadway, Chicago 40, Ill.

SARKES-TARZIAN SELENIUM HANDBOOK: In addition to sections on 4 main types of selenium rectifiers, there are circuit applications, engineering data and a replacement guide. *Selenium Rectifier Handbook, cat. no. 666*, 72 pp. Price, $1.00. Sarkes Tarzian, Inc., Rectifier Div., 415 N. College Ave., Bloomington, Ind.

SHURE AUDIO INDEX: Reference data and illustrations on microphones and mike accessories; tape and wire recording heads (with replacement chart); phono cartridges (with replacement chart) and phono needles. *General Catalog No. 44B*, Shure Bros., 225 W. Huron St., Chicago 10, Ill.

FEILER TEST EQUIP. FOLDER: 8-page fold-out brochure gives specifications, descriptions, illustrations, prices on 6 items of test equipment, including signal tracers, tester, vtvm and scope. Feiler Engineering & Mfg. Co., 8026 N. Monticello Ave., Skokie, Ill.

BUSS FUSE REPLACEMENT CHART: Alphabetically indexed by mfr., this wall or pocket reference list includes fuse replacements for TV sets and auto radios. Sales Mgr., Bussmann Mfg. Co., University at Jefferson, St. Louis 7, Mo.

ERIE COMPONENT DATA: Latest edition covers new line of temperature compensating tubular ceramics and disc ceramics along with standard items. *Catalog D-54*, 16 pp. Erie Resistor Corp., Dept. S, Erie, Penna.

ALLIED SUPPLEMENT: Recently added items and price changes appear in Allied *Supplement No. 139*, 56 pp., to be used in conjunction with 1954 main catalog, no. 135. Radio, TV and audio products and components. Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.

MALLORY RADIO-TV REPLACEMENT GUIDE: Cross-reference listing of components uses manufacturers' part numbers. Four main sections cover dry electrolytic capacitors, controls, selenium rectifiers and vibrators. Write to P. R. Mallory & Co., Distributor Div., P.O. Box 1558, Indianapolis, Ind.

MAGNAVOX SERVICE MANUAL BINDER: Loose-leaf binder for Vol. II of manufacturer's service data includes index for re-filing material in proper order in Vols. I & II; $3.75. Vol. II binder available with contents; $4.95. Vol. I binder with contents still available; $9.75. C. C. Kayhart, The Magnavox Co., Bueter Rd., Ft. Wayne 4, Ind.

NEW BOOKS

APPLIED ELECTRONICS, 2nd Ed. *By Truman S. Gray. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. 881 pages; $9.00, hard cover.*

Comprehensive coverage of electron tubes and associated circuits is presented in this advanced textbook. Radio and TV per se are given only incidental attention. Technical discussions center about such subjects as electrical conduction through vacuum, gases and vapor; rectifier circuits; cascade amplifiers; modulation and demodulation; and semiconductor devices.

HOW TO INSTALL AND SERVICE AUTO RADIOS. *By Jack Darr. Published by John F. Rider Publisher, Inc., 480 Canal St., New York 13, N.Y. 128 pages; $1.80, paperbound.*

The practical aspects of installing and repairing auto radio systems are discussed in this volume. Servicing tips are given on remote controls, noise elimination, parts replacement, antennas, power supplies, speakers, and preventative maintenance. Helpful information on equipment and operation of the auto radio service shop is offered.

TRANSISTORS—THEORY AND PRACTICE. *By Rufus P. Turner. Published by Gernsback Publications, Inc., 25 West Broadway, New York 7, N.Y. 144 pages; $2.00, paperbound.*

In compact form, this book examines the operating characteristics and structure of transistors, and circuits associated with the latter. It shows how measurements are made to determine current gain, resistance, input and output impedances, and frequency response. There is a section on practical circuits, including amplifiers, oscillators, receivers, frequency standard, phone monitor, and various meters. Semiconductor theory and equivalent circuits, so necessary to achieve a full understanding of transistors, are explained.

SPECIALIZED AUTO RADIO MANUAL, VOL. 1-A. *Edited and published by John F. Rider Publisher, Inc., 480 Canal St., New York 13, N.Y. 182 pages; $3.00, paperbound.*

Schematics, parts lists, and service data for radios in Ford, Lincoln and Mercury cars, 1950 to 1954, are presented. This comprises units made by four different radio manufacturers.

RADIO RECEIVER DESIGN, 2nd Ed. *By K. R. Sturley. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N.Y. 667 pages; $4.75, hard cover.*

This technical study of radio receivers is Part I of a series. It covers r-f amplification and detection, and contains considerable analytical mathematics. Therefore, the text as a whole would normally appeal only to advanced radio technicians. The nonmathematical parts of the book are clear and interesting, and offer valuable reference information.

TV FIELD SERVICE MANUAL, VOL. 1. *Edited by Harold Alsberg. Published by John F. Rider Publisher, Inc., 480 Canal St., New York 13, N.Y. 128 pages; $2.10, paperbound.*

Intended to provide TV technicians with a handy guide to spotting receiver troubles in the customer's home, this manual lists the model numbers of nine manufacturers (from Admiral to Automatic), together with chassis layouts. A number of causes of faulty operation with resulting picture symptoms are noted. For each of the TV models, the sources of trouble likely to produce each symptom are pointed out.

SERVICING TV VERTICAL & HORIZONTAL OUTPUT SYSTEMS. *By Harry E. Thomas. Published by John F. Rider Publisher, Inc., 480 Canal St., New York 13, N. Y. 176 pages; $2.40, paperbound.*

This book presents the fundamentals of horizontal and vertical output systems, and describes associated circuitry, component construction and waveforms. It shows how the output section of the TV receiver functions, and pays attention to the mechanical, as well as electrical, aspects of operation. The final chapter, covering faults in sweep output systems, illustrates improper waveforms and resulting pictures which may be expected from these conditions.

Problems
Antenna Reflection

(*Continued from page* 51)

function well on the roof, where only the weak direct signal was present!

Before this experience, I had another one which illustrates how theory helps service. I was called in to check a receiver for the only person in the hotel using an outdoor antenna. The unit faced the direction of the single station on the air at the time—Channel 5. Reception was fair but ghosty, with the effect shown in Fig. 1B present.

Since the direct signal had to be the one at the left, the reflection was obviously stronger than the direct wave—in spite of the fact that the antenna was oriented directly toward the station.

Why not try pointing the antenna at the source of the reflection and eliminate the direct signal, leaving the reflected one to be viewed alone? I did this, aiming the antenna at the Great Northern Building, and was rewarded with a beautiful signal which had only a faint trace of a ghost in it.

Technician's Lighter Side

with Sol Heller

VOLTMETERS AND KISSES. Story goes that a distributor, at a party given for servicemen, offered a free vacuum-tube voltmeter to the technician who could stand up and swear he had never kissed any women except his wife during his marriage. No one got to his feet. A technician-dealer's wife, hearing about the proceedings the next day, asked her husband why he hadn't stood up.

"Gosh, Mabel," replied the dealer heatedly, "I don't need no vtvm—I already got two in the shop."

CROOK'S NEW LOOK. Philly police officials are going to use as evidence, films made by a TV station of the apprehension and confession of two suspected criminals. I can't help visualizing the scene—the TV cameras set up, the suspects squirming in their seats under the hot lights, firm in their protestations of innocence. Suddenly one crook breaks down. "I'll tell all," he cries, "if you get my suit pressed, and promise to send my confession over Channel 5."

SOME SERVICE. Telephone company in Vienna really provides its customers with service. You can call up to get football and racing results. Another department sounds an "A," when a musician requests it. Housewives can get recipes, kiddies are told fairytales, and astronomy students can learn when the next eclipse will take place.

Wouldn't it be nice if we had a phone service here like that? Maybe one where you dial the TV operator, tell her your problem, and have her answer, in a low, throaty, charming voice:

"Replace C-131 in the agc circuit, and your troubles will be over."

PROBLEMS OF A QUAKER SERVICEMAN. A Pennsylvania technician who had recently become a Quaker was disturbed from time to time by the emotional outbursts of one of the TV servicemen who worked for him. One day, the serviceman picked up an ac-dc TV chassis while standing under the metal shade of a lamp. A second later he dropped it and began swearing profusely.

"No need for thee to swear," the dealer rebuked him. "There is no need for strong language at any time. Why canst thee not service thy receivers calmly and quietly? Let me show thee how . . . " And he picked up the same chassis with one hand, while adjusting the metal lamp shade with the other. An instant later the dealer dropped the chassis, yelling: "Why the blazes didst thee not tell me this lamp was shorted, thee blasted idiot, thou?"

LETTERS
To the Editors

More on CRT Implosions

EDITORS, TECHNICIAN:

I wish to report an implosion "without cause." The implosion occurred in the home of our customer, a home without children, on a lazy afternoon as our customer was resting and the TV was turned off. The TV in question was a 21-in. console, sold August 24, 1953. It had been serviced for small tube failure about three times. On October 20, the set owner called us to report that her TV had "exploded." When we checked, we found glass everywhere, and the customer scared past help. She said the TV had been turned off and no one was near it. We do not know the cause, but have given the woman a new set.

L. E. LEONHARDT, JR.
Leonhardt Appliances
Louisville, Kentucky

EDITORS, TECHNICIAN:

Owner said receiver was a 1954 set, about a month old, floor model; original tube (21 in.) replaced about three weeks before implosion. Says room is warm where receiver was located, and was warm when implosion occurred. Set is near window, but no draft exists. Safety glass did not shatter, but tops were broken off 4 or 5 other tubes. I was unable to identify make of pix tube.

MARLON H. THURMOND
Hagerstown, Maryland

Test Equipment Digests?

EDITORS, TECHNICIAN:

. . . An occasional schematic on test instruments that TV servicemen use in their work would be in order and appreciated by TV servicemen.

ANDREW ANTOSH
New York, N. Y.

Hint-Book Motion Seconded

EDITORS, TECHNICIAN:

I'll go along with Joseph Amorose's letter (April, 1954) favoring a book on Shop Hints, together with articles that appeared in the "Tough Dog" Corner.

BILL RAGIM
Jamaica, N. Y.

•*How about it, readers? Would you like to see Shop Hints in book form? —Ed.*

Mfrs: Be Nice to Servicers

EDITORS, TECHNICIAN:

Let's get those manufacturers on the ball. We want them to keep the serviceman in mind. Stop placing cheap design in hard-to-get-at places. We would like a mount for all large pix tubes so we can carry them to the shop for servicing.

HAROLD B. WRIGHT
Plainwell, Michigan

"So Much" and Service Fees

EDITORS, TECHNICIAN:

The servicemen here in Utah are confronted with the biggest headache of the industry, "Cut Rate Prices," and if information such as your chart ("So Much for So Little") was released to the public we are sure it would help cut down this sort of practice. Somewhere, someone, somehow, must soon come up with a solution to educate the servicemen as to how to operate a successful and profitable business. But as an old adage goes "Servicemen are the poorest business men."

D. R. SMITH
Secretary-Treasurer
Utah Association of Radio and Television Servicemen, Inc.
Salt Lake City, Utah

"Dry" Cells, Not Wet

EDITORS, TECHNICIAN:

In your article "Battery Data for Technicians" (April, page 40), under the heading of *Storage*, you recommended storing against outside wall without going into the possibility of said wall sweating. Dampness can ruin a lot of batteries.

J. HERSCHLAG
Pleasantville Music Center
Pleasantville, N. Y.

•*Last paragraph of article mentions "cool, dry basement." We should have stressed the point more, though. Thanks for telling us.—Ed.*

Editors, TECHNICIAN:

I think that the "Shop Hints" section is one of the best parts of your magazine and wish that you would expand it.

JOHN KAFAFIAN
1544 Union St.,
San Francisco 23, Calif.

INDUSTRY KEYHOLE

(*Continued from page* 50)

AUDIO ENGINEERING SOCIETY will continue to sponsor the N. Y. Audio Fair for 1954 and '55, according to a renewed sponsorship agreement . . . **INSULINE CORP. OF AMERICA** has appointed Herman J. Schorle as works mgr. of its new plant in Manchester, N. H. . . . **G. J. ESPOSITO** joins the executive staff of Pyramid Electric Co., N. Bergen, N. J.

MISLEADING RETAIL ADVERTISING involving the new vest-pocket indoor antennas has been the subject of censure by New York's Better Business Bureau. . . . **"THE REPRESENTATIVES"** of Electronic Product Mfrs. has increased its Board of Governors from 7 to 9 members. The change reflects the growing size of the organization . . . **SIDNEY PARISER**, prexy of RMS, N. Y., has announced the appointment of Gordon Le May as Asst. Sales Mgr.

Thank you Mr. Serviceman!
—for preferring TECHNICIAN

Servicemen from coast to coast are reacting enthusiastically to the winning combination of editorial and technical excellence, and practical treatment of the service technician's major problems and needs . . . a combination that has placed TECHNICIAN at the very top over all service trade publications.

Voted 1st by servicemen in manufacturers' surveys of 11 major cities

All television servicemen listed in the classified telephone directories for Chicago; Detroit; Milwaukee; Boston; San Francisco; Passaic County, New Jersey; St. Louis; Dallas; Minneapolis; Philadelphia; and Kansas City have been independently polled by radio-TV manufacturers to determine the serviceman's preferred publication.

Each manufacturer prepared and mailed his own questionnaire to servicemen. All questionnaires were *returned to the manufacturer* and *tabulated by the manufacturer*. The results? TECHNICIAN WON IN EVERY CITY—WITHOUT EXCEPTION!

Question asked was: What Radio-TV publication do you prefer for technical servicing information?, with the following results:

% of total vote

PUBLICATION	Detroit Milwaukee	Boston San Francisco Passaic County	Chicago	St. Louis Dallas Minneapolis	Philadelphia	Kansas City
TECHNICIAN	22.12%	25.75%	32%	21.15%	23.28%	28.26%
RADIO & TV NEWS	16.59%	16.16%	17%	17.95%	16.43%	23.91%
RADIO-ELECTRONICS	15.21%	17.67%	13%	12.18%	10.96%	21.74%
RADIO-TV SERVICE DEALER	13.82%	15.60%	12.5%	16.03%	13.70%	17.40%
PF INDEX	12.44%	7.57%	4.0%	12.82%	6.85%	8.69%
SERVICE	11.52%	13.13%	12.0%	8.33%	12.32%	.00%
MISCELLANEOUS	8.30%	4.40%	9.5%	11.54%	16.43%	.00%
TOTAL VOTES	217	198	93	156	73	46

(Lists used by the manufacturers in making these surveys are public property, available to any manufacturer or publisher.)

The publishers of TECHNICIAN will welcome a further survey in cooperation with any service publication . . . the loser to pay the complete cost and the winner to have the right to publish results. Only one condition required. Surveys must be made to members of the service trade who have places of business and telephones.

***TECHNICIAN*, though only eight months old, has applied for an official circulation audit. Pending completion of the audit, post office receipts and sworn statements are available.**

TECHNICIAN

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

Servicing Convergence Trouble

(*Continued from page 17*)

convergence control is readjusted, to *converge* the whole row of dots.

It may be necessary to go through the procedure described more than once. If it is found that one part of the row improves in convergence while the other gets worse, when the dc convergence control is adjusted, an incorrect shape adjustment is indicated.

The horizontal correction controls and adjustment procedure are similar except that an additional adjustment is needed. (The counterpart of the vertical convergence shape control is the horizontal convergence phase control.) In order to obtain a horizontal correction voltage of sufficient amplitude, a tank circuit is used. This is simply tuned for maximum output—that is, the horizontal convergence amplitude control is turned up, and the tank circuit, (also called the convergence output coil) is adjusted for maximum misconvergence of the horizontal center row of dots. Then the horizontal convergence phase and amplitude are adjusted, in a manner similar to the adjustment of the corresponding vertical controls, except that now, of course, attention is paid to the *horizontal* center line of dots alone. Finally, the dc convergence is readjusted once more.

When all the adjustments described have been made, the picture should be converged at all parts of the screen. A slight degree of misconvergence may be seen at the very edge of the screen, or at the corners; this will necessitate some compromise adjustment, or may have to be disregarded. It is expected that as color tube manufacturers acquire more experience, these misconvergence errors will become very rare; possibly the system in current use may be simplified in future tube designs. It should be remembered that our comments apply only to three-gun tubes.

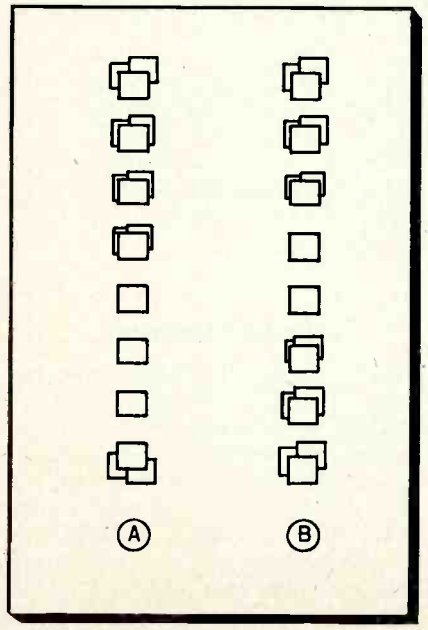
What convergence troubles can the serviceman expect? First of all, the crt may be defective. The guns may, for instance, be too far out of line, making it impossible for convergence to be achieved. This trouble will usually be encountered in new tubes only, since a shock severe enough to cause such misalignment during the service life of a tube would probably cause the crt to implode.

If misconvergence is present and the crt is good, the convergence voltage may be incorrect. Since this is a high voltage, all the usual high-voltage troubles—such as corona, dirt accumulation, etc.—should be suspected and checked for.

It should be remembered that in electron lenses (such as the one in the color crt on which convergence depends), the *voltage difference* between electrodes is the important factor. Convergence is achieved by the difference in voltage between the ultor (2nd anode) voltage and the convergence voltage; also by the difference between the convergence and focus voltages. Trouble, thus, with the ultor voltage (about 19 kv, normally) or the focus voltage (app. 4 kv) will make it impossible to converge the electron beams, besides introducing the symptoms that such defects produce in a black and white tube.

Trouble with the dynamic convergence voltages can be lumped into two basic categories: 1—Either there is trouble in the deflection circuit that supplies the correction waveshape or 2—Trouble exists in the convergence amplifier or its associated circuit. As is usual when waveshapes are involved, the scope will be extremely useful in pinpointing the source of trouble.

Fig. 4—The appearance of the vertical row of dots shown in *A* indicates that the vertical convergence shape control is incorrectly adjusted. This control is shown correctly adjusted in *B*, as indicated by equal misconvergence at top and bottom. In both cases, the vertical convergence amplitude control has been advanced to maximum, to make the misconvergence present more noticeable.



Can You Solve These?

(*Continued from page 29*)

separate windings and the two are joined when the leads are attached. It is conceivable that one winding might be connected in reverse, thus converting the circuit to a half-wave rectifier with the two diodes conducting simultaneously. Since the two secondary voltages are in the same phase, they will buck each other with respect to points *A* and *B*. (*courtesy Philco Tech. Rep.*)

Solution to "Portable Brain Teaser" (*Problem on page 29*)

The solution to this problem is simple, when you think of it! Just insert a wire-wound resistor of 1500 ohms (this approximates 1533 ohms well enough) in series with the 117Z6 filament, and another wire-wound resistor in series with the 117Z6 plate (see Fig. 3), making the latter's value such that normal current will flow through the 50-mil filaments; a reading of 1.4 volts across one of these filaments will indicate when the current through them is correct.

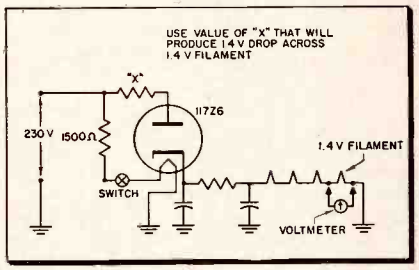


Fig. 3—Set-up for producing correct voltage feed to portable. Determine 'X' experimentally.

We have treated peak, rms and average values of current as if they were all the same; actually they aren't, of course, but the error introduced by equating them is very small.—*Michael Craig, St. Paul, Minn.*

Selenium Shortage

Government stockpiling of selenium, in case of emergency, is cutting into the already limited supply. To ease the situation, Sarkes Tarzian, Inc., Bloomington, Ind., is buying up discarded rectifiers for reclamation purposes. Distributors are being authorized to credit service technicians who return defective units.

Complete Index of

ALL "CIRCUIT DIGESTS" TO DATE

Including Current Issue. CIRCUIT DIGEST NOS. 131 to 133 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 222DX15 **15**

Chassis 22A3, 22A3Z: Models 122DX12, 222DX-15B, 222DX16B, 222DX17B, 222UDX15, 222UDX16, 222UDX17, 222DX27B, 322DX16A, 322-UDX16 **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**

Chassis TE 373-UHF: Model 9245 **128**

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, 8F212-BA, 9F212MA, 11W212MA, 1C213M, 2F213F, 3C213M, 4T213M, 4T213B, 5H213M, 8F213B **37**

CBS-COLUMBIA

Chassis 817: Model 17T18, 17M18, 17C18. Chassis 820: Models 20T18, 20M18, 20M28 **14**

Chassis 1027: Models 27C11, 27C21 **77**

Chassis 750-3: Models 17MO6, 22CO6, 22C38 **95**

COLUMBIA RECORDS

360 Phono Amplifier **43**

CROSLEY

Chassis 380: Models EU-17COM, 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, 30COBU **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, F24CDBH, Chassis 412-1: Models F-24CDMU, F-24CDBU, Chassis 416: Models F-27COMH, F-27COBH, Chassis 416-1: Models F-27COMU, F-27COBU **106**

Chassis 426: Models G-17TOMH, G-17TOBH, G-17TOWH **126**

DE WALD

Models ET-140R, 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, Shelbourne, 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, Westhrook 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, RA-301-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**

Chassis 120182-D: Models 741F, 757D, 758F. Chassis 120196-B: Model 781A. Chassis 120206-D: Models 792D, 781E. Chassis 120197-B: Models 784E, 784K. Chassis 120197-D: Model 784G. Chassis 120195-D: Models 785K, 759C. Chassis 120211-D: Model 784M **121**

ESPEY

513-C AM-FM Tuner **70**

HOW TO FIND MONTH in which any CIRCUIT DIGEST APPEARED

Circuit Digest Numbers

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
121-125	Apr. 1954
126-130	May 1954
131-133	June 1954

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

Circuit Digest No.

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**

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 P1200D: 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**

Chassis 406-21: Models 21M160, 21B161, 21M333, 21B334 **130**

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**

Series 106C: Models CT 381C, CU 381C & CMU 381C **129**

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 62)

Circuit Digest Index

(*Continued from page 61*)

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

PACIFIC MERCURY

Chassis 201 Series 124

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-R 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

Chassis 24T3: Models C-2401A, C-2402A 125

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

Circuit Digest No.

UHF Selector Model U2: Chassis KCS79 55

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; Chassis KCS84E: Models 24-T-420U, 24-T-435U 119

Chassis CTC2: Model CT-100 (color) 131

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-1532, 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

Chassis 1-509-1, 1-509-2: Models 187B, BU, M, MU 41

UHF Converter Models C31M, C32M, C33M 87

Circuit Digest No.

Chassis 1-518-1, -2, -3: Models 175-18, 872, 373, 375, 376, 377 97

Chassis 1-514-1, -3, -4: Models All 105-14, 300 series

Chassis 1-520-1, -3, -4, -7, -8: Models All 120-20, series

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

WELLS-GARDNER

Models: 321MS31-35A6-386-1, 2321MS31-35A6-388-1 123

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

Chassis Assembly V-2263: Models H-830K21, H-831K21 127

ZENITH

Chassis 19K22: Models K1812E, K1812R. Chassis 19K20: Models K1815E, K1815R, 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

Chassis 19L26: Models L1820E or R; L1812E or R. Chassis 19L28: Models L1846E or R; L2229E or R; L2235E or R; L2236E or R; L2237E or R; L2250E or R; L2258E or R; L2262C; L2262R; L2281 or E; L2281R; L2285 R. Chassis 19L30: Models L2237EU or RU. Chassis 19L33: Models L2228R. Chassis 19L34: Models L1800R 122

Chassis 20M20, 20M20U: Models M2237R, M-2260R, M2261E, M2267Y 133

BASIC ALIGNMENT DATA 8

ADVERTISERS INDEX
JUNE, 1954

American Phenolic Corp. 53
Astatic Corp. 47
Astron Corp. 35

Bullet Electronics Corp. 4

CBS-Hytron Div., Columbia Broadcasting System, Inc. 37
Caldwell-Clements, Inc. 58
Century Electronics Co. 51
Channel Master Corp. 12
Clear Beam Antenna Corp. 45
Cornell Dubilier Electric Corp. 51
Crosley Div., Avco Manufacturing Corp. 6

Erie Resistor Corp. 56

General Electric Co. 9
General Industries Co. 53

International Rectifier Corp. 54
International Resistance Co. ... Cover 2

Jensen Manufacturing Co. 2

Karyall Body, Inc. 56
Kester Solder Co. 60

Madisco, Inc. 63
Magnavox Co. 63
Mallory & Co., Inc., P. R. 10
Miller Sales, Ken 56
Moss Electronic Distributing Co., Inc. 60

Philco Corp. 43
Precision Apparatus Co., Inc. 33

Radiart Corp. 8
Radio Corp. of America 5, 55, 57, 59, Cover 4
Raytheon Manufacturing Co. 3

South River Metal Products Co., Inc. 41
Sprague Products Co. ..... Cover 3
Sylvania Electric Products Inc. 11, Section Two, pp. 2 & 8

Technical Appliance Corp. 39
Telrex, Inc. 64
Tung-Sol Electric Inc. 48, 49

Walsco Electronics Corp. 7

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.

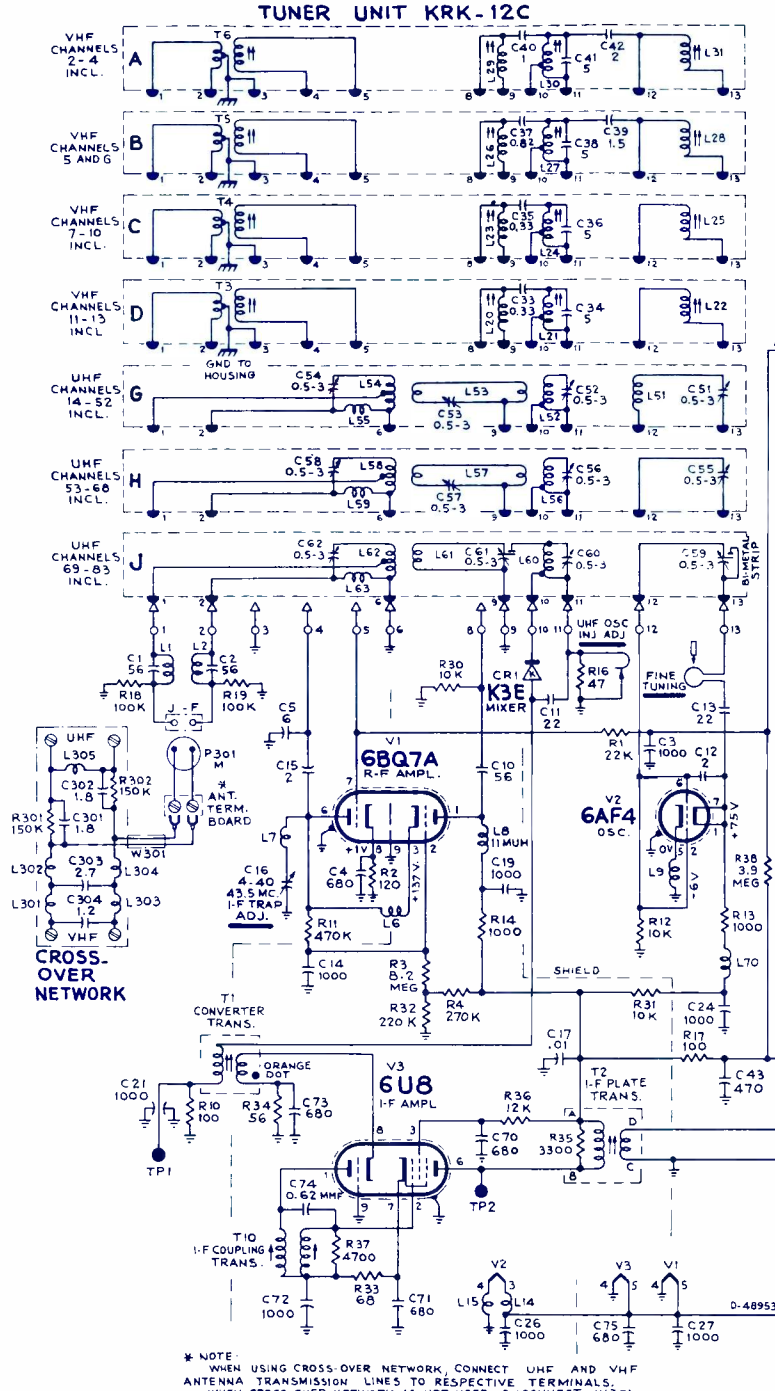
Senco UHF BOOSTER

This booster provides high UHF gain by using 2 6AN4 tubes in a push-pull, grounded-grid, neutralized circuit. Models cover approximately ⅛ of UHF band; matched to the channels available in areas where installed. Uses capacity tuning. $49.50 list price. Service Instruments Co., 422 S. Dearborn St., Chicago 5, Ill.—TECHNICIAN

TECHNICIAN ★★★★
COLOR CIRCUIT DIGESTS

TUNER SCHEMATIC

Figure 46—KRK12C Schematic Diagram



CHASSIS CIRCUIT SCHEMATIC DIAGRAM

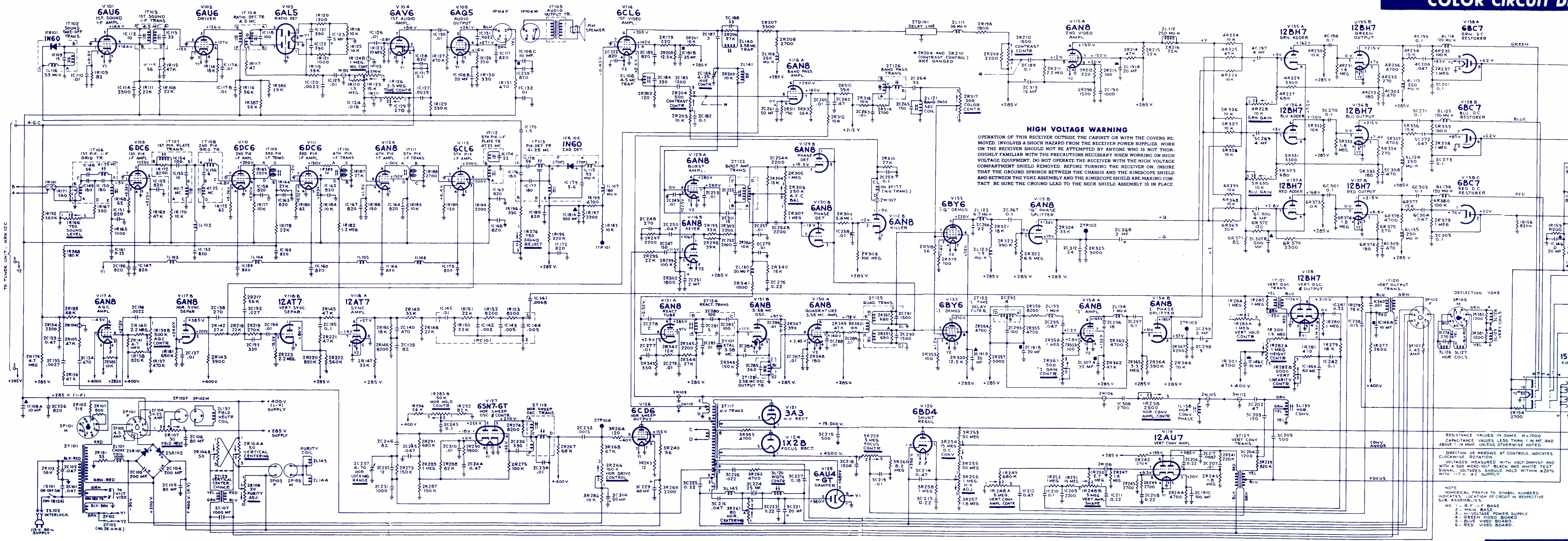


Figure 47—Circuit Schematic Diagram Model CT-100

GENERAL DESCRIPTION

Model CT-100 is a "15 inch" color television receiver, capable of reception of either black and white or color programs. The receiver employs the RCA shadow mask, three gun, directly viewed, 15 inch glass envelope type Tricolor Kinescope.

The receiver features: 12 channel VHF coverage plus any 4 UHF channels desired; intercarrier FM sound system, high level second detector operation for maximum linearity; stabilized horizontal AFC; electrostatic convergence and focus with dynamic modulation of the convergence and focus anodes; crystal controlled AFC color synchronization; low level color demodulation employing quadrature techniques; kinescope grid drive with D.C. restoration, and a color "killer" circuit to disable the color circuits during black and white reception.

Additional features include: a removable top panel to facilitate servicing and adjustment, and the location of most of the functional controls at the receiver front. These controls are located under the tilt-down control cover or behind the removable panel directly below the control cover.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

PICTURE SIZE. Approx. 100 sq. in. on a 15GP22 Kinescope	
TELEVISION R-F FREQUENCY RANGE	
Any of 70 UHF channels	470 mc. to 890 mc.
Any of 12 VHF channels, 54 mc. to 88 mc., 174 mc. to 216 mc. (Any desired combination of 16 UHF and/or VHF channels may be used.)	
INTERMEDIATE FREQUENCIES	
Picture I.F. Carrier Frequency	45.75 mc
Sound I.F. Carrier Frequency	41.25 mc
Color Sub-Carrier Frequency (Nominal)	42.17 mc.
POWER RATING	115 V. A.C., 60 Cy., 475 watts
AUDIO POWER OUTPUT RATING	4 watts
SWEEP DEFLECTION	Magnetic
FOCUS	Electrostatic
CONVERGENCE	Electrostatic

ANTENNA INPUT IMPEDANCE
UHF—300 ohms balanced.
VHF—300 ohms balanced.

RCA TUBE COMPLEMENT

Tube Used	Function
(1) RCA 6AQ7A	R-F Amplifier (VHF Only)
(2) RCA 6AF4	R-F Oscillator
(3) RCA 6U8	I-F Amplifier
1 X 21E Crystal is used on a mixer.	
(4) RCA 6DC6	1st Picture I-F Amplifier
(5) RCA 6DC6	2nd Picture I-F Amplifier
(6) RCA 6DC6	3rd Picture I-F Amplifier
(7) RCA 6AN8	4th Picture I-F Amplifier and Killer
(8) RCA 6CL6	5th Picture I-F Amplifier
A 1N60 Crystal is used as the picture 2nd Detector	
(9) RCA 6CL6	1st Video Amplifier

SCANNING	Interlaced, 525 line
HORIZONTAL SCANNING FREQUENCY	15,750 cps (Nominal)
VERTICAL SCANNING FREQUENCY	60 cps (Nominal)
FRAME FREQUENCY (Picture Repetition Rate)	30 cps

OPERATING CONTROLS (FRONT)

Channel Selector	Dual Control Knobs
Fine Tuning	
Brightness	Dual Control Knobs
Sound Volume and On-Off Switch	
Picture Horizontal Hold	Dual Control (Knurled)
Picture Vertical Hold	
Contrast	Single Control Knob
Hue	Single Control Knob
Color	Single Control Knob
Tone	Single Control Knob

(LEFT SIDE)

Convergence	Upper Control Knob
Focus	Lower Control Knob

NON-OPERATING CONTROLS (REAR)

Purifying	Single Control
Field Neutralizing	Single Control
High Voltage	Screwdriver Control
Width	Screwdriver Adjustment
Horizontal Centering	Single Control
Vertical Centering	Single Control

NON-OPERATING CONTROLS (FRONT)

Vert. Converg. Amplitude	Screwdriver Adjustment
Vert. Converg. Shape	Screwdriver Adjustment
Blue Background	Screwdriver Adjustment
Green Background	Screwdriver Adjustment
(Behind removable panel)	
Height	Screwdriver Adjustment
Vert. Linearity	Screwdriver Adjustment
Video Blue Gain	Screwdriver Adjustment
Video Green Gain	Screwdriver Adjustment
Horiz. Converg. Amplitude	Screwdriver Adjustment
Horiz. Converg. Phase	Screwdriver Adjustment
Blue Screen	Screwdriver Adjustment
Green Screen	Screwdriver Adjustment
Red Screen	Screwdriver Adjustment
AGC	Screwdriver Adjustment
Sound Level	Screwdriver Adjustment

NON-OPERATING CONTROLS (TOP OF CHASSIS)

AFC Balance	Single Control
"I" Gain	Single Control
Horizontal Drive	Single Control
Horiz. Locking Range	Screwdriver Adjustment
Horiz. Convergence	Screwdriver Adjustment
Tuner I-F Trap	Screwdriver Adjustment
FM Trap	Screwdriver (on Antenna lead)
Sound Reject	Screwdriver Adjustment

All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted. All resistance values in ohms. K=1000.

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "VoltOhmyst" and with a 500 μV black and white test signal. Voltages should hold within ± 20% with 117 v. a-c supply.

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RCA
Chassis CTC2
Color Receiver

Technician
CIRCUIT DIGEST
131

Chassis CTC2:
Model CT-100

SPECIAL ★★★★ CIRCUIT DIGEST
Schematic & Service Data on RCA's Color Receiver Model CT-100

CIRCUIT DESCRIPTION

TUNER UNIT—The Tuner Unit is a KRK-12C UHF-VHF Tuner and is designed for 82-channel UHF-VHF coverage, although any combination of 16 VHF and/or UHF channels may be used. This coverage is made possible by tuned inserts which are placed within a drum assembly in the tuner. Four different types of inserts, marked "A", "B", "C" and "D", are used to cover channels 2 through 4, 5 and 6, 7 through 10, and 11 through 13, respectively.

Three different types of inserts, marked "G", "H" and "I", are used to cover channels 14 through 52, 53 through 68, and 69 through 83, respectively. Channel selection is performed by rotating the drum assembly to the position where the tuned insert for that channel is connected into the tuner circuits.

The stages in the KRK-12C include an R-F amplifier (V1) for VHF signals which uses a type 6BQ7A in a driven grounded-grid amplifier circuit. Tuned circuits at the input and output of the amplifier stage are mounted on each VHF insert. A triple-tuned preselector circuit, which precedes the mixer stage, is mounted on each UHF insert. The secondary of the preselector circuit forms the tuned input circuit of the mixer stage.

A type 1N82 silicon crystal diode (CR1) is used in the mixer circuit for either VHF or UHF operation. The VHF oscillator voltage is injected into the mixer circuit capacitively on channels 2 through 6 and inductively on channels 7 through 13. The UHF oscillator voltage is injected into the mixer circuit through an adjustable inductance.

The oscillator stage (V2) uses a type 6AF4 in a modified Colpitts circuit and provides oscillator signals at a fundamental frequency for all VHF and UHF channels. [illegible]

The first I-F amplifier stage (V3) following the mixer stage uses a type 6CB6 in a triode-pentode circuit with a low noise, grounded-grid input and a driven-cathode output. The I-F output of the tuner is in the 40 mc range.

PICTURE I-F CHANNEL—The picture I-F amplifier is designed for a 45.75 mc. picture carrier, a 42.17 mc. color sub-carrier, and a 41.25 mc. sound carrier. [illegible]

In order to reduce cross-modulation, the sound carrier is attenuated as soon as possible in the I-F amplifier by the Sound Level control 1R166 in the grid circuit of the first picture I-F amplifier V109 (6DC6). The output of V109 uses a bridged-T, m-derived, bandpass circuit with rejection traps for skirt selectivity (40.7 mc.) and adjacent sound (47.25 mc.).

The second, third, and fourth picture I-F amplifiers (V110, V111, and V112A) form a staggered, triple-tuned circuit with the second and fourth stages tuned, respectively, to the high and low frequency sides of the bandpass. The third stage is tuned to approximately the center of the band.

The fifth picture I-F amplifier (V113) uses a bridged-T, M-derived, bandpass circuit and a mutually coupled absorption trap. The rejection traps are tuned for accompanying sound (41.25 mc.) and adjacent picture (47.25 mc.).

The picture second detector (CR102) uses a 1N60 crystal diode.

DEFLECTION SYNCHRONIZATION—Sync signal is obtained from the plate circuit of the first video amplifier V114 and is DC coupled to the grid of the horizontal sync separator V117 (6AN8-triode section) and is also AC coupled to the grid of the vertical sync separator V118B (12AT7).

Horizontal and vertical sync are [illegible] in the grid circuit of V118A (12AT7) which serves the functions of sync amplifier and clipper. Variable clipping with signal strength is obtained by returning the grid resistor of the sync amplifier to the third picture I-F screen grid.

Improved vertical noise immunity is obtained by coupling negative noise pulses from the screen of the fifth picture I-F amplifier into the grid of the vertical sync separator. The output of the sync amplifier is used for both horizontal and vertical sync information. Vertical sync is coupled through a printed integrator circuit for proper shaping before it is applied to the vertical oscillator grid. Horizontal sync is capacitively coupled to the grid of the horizontal oscillator control tube.

AGC—The AGC amplifier V117B (6AN8-pentode section) derives its control voltage from the cathode of the horizontal sync separator. The control voltage acts as a bias on the AGC amplifier and is varied in amplitude with the AGC Control 1R168. Plate voltage for the amplifier is obtained from the horizontal kickback pulses taken from the high voltage transformer 3T117.

Negative bias voltage is obtained by charging the plate capacitor 2C133 and is applied to the first, second, and third picture I-F and the R-F amplifier grids. The diodes of V104 serve as a clamp on the R-F bias which delays the rise of R-F bias for improved signal-to-noise ratio.

HORIZONTAL DEFLECTION AND HIGH VOLTAGE—The horizontal oscillator and control V127 (6SN7-GT) is a "synchroguide" circuit, the output of which is used to drive the horizontal output V126 (6CD6). [illegible]

The ultor voltage is supplied by the high-voltage rectifier V121 (3A3) which rectifies the kickback pulses. Regulation of the high voltage is effected by the shunt regulator V120 (6BD4). Bias on V120 and thus high voltage output is controlled by the high-voltage adjust control 3R256. In order to keep the convergence voltage a fixed part of the ultor voltage, the DC convergence control 3R254 is used as part of the high-voltage bleeder.

The focus voltage is supplied by the focus rectifier V124 (1X2B). Plate voltage for V124 is taken from a tap on the high-voltage transformer. The focus control 3R259, part of the rectifier bleeder network, controls an adjustable modulated DC voltage applied to the focus electrodes from a tap on the convergence transformer.

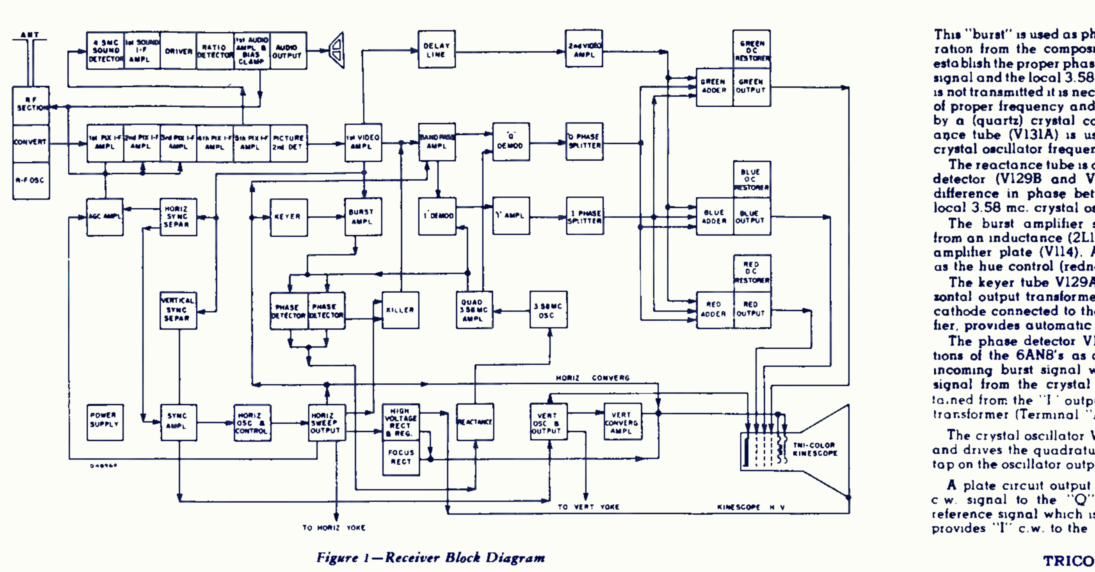

Figure 1—Receiver Block Diagram

Two separate windings on the high-voltage transformer provide kickback voltages for "killer" bias rectification, bandpass keying, burst keying, and horizontal dynamic convergence operation. Taps on the high-voltage secondary supply deflection pulses to the horizontal deflection coils. Electrical centering is provided by the horizontal centering control 3R261 which applies an adjustable DC voltage across the horizontal deflection coils.

VERTICAL DEFLECTION—The vertical oscillator and output V128 (12BH7) incorporates a blocking oscillator circuit, the output of which is amplified in the output stage, which in turn drives the vertical deflection coils through the vertical output transformer 2T121. Electrical centering is provided through the vertical centering control 2R104 which applies an adjustable DC voltage across the vertical deflection coils.

SOUND I-F AND AUDIO CHANNEL—The sound information is taken off at the plate of the fifth picture I-F amplifier and is detected by CR103, a 1N60 crystal diode. The resultant 4.5 mc. sound I-F signal is coupled through the first sound I-F amplifier V101 (6AU6) and the driver V102 (6AU6) before it is applied to the ratio detector V103 (6AL5). The audio output of V103 is amplified by the first audio amplifier V104 (6AV6) and the audio output stage V105 (6AQ5) before it is applied to the speaker. The volume control and the tone control 1R148 are connected into the grid circuit of the first audio amplifier stage.

VIDEO

The video section of the receiver incorporates three separate functions. The luminance, or brightness channel, the chrominance, or color channel and a function called matrixing, which combines the two channels.

The luminance channel (luminance is designated by the symbol "Y") can be compared with the video section of a black and white television receiver since it deals only with information denoting the brightness values in the picture. It amplifies the brightness (black to white) information to a level satisfactory for application to the kinescope [illegible] is applied through the matrix instead of directly to the kinescope.

The chrominance channel recovers the information contained in the color sub-carrier sidebands. Two independent signals are recovered from the color sub-carrier sidebands by a process known as "synchronous" detection [illegible] and the "Q" quadrature phase (90° out of phase) signal.

In accordance with approved signal specifications the "I" channel passes information in a bandwidth limited to 1.5 mc. and the "Q" channel passes information in a bandwidth limited to .5 mc. ("I" and "Q" channel bandwidths are referenced to the color sub-carrier frequency.) Band limiting, which is done to prevent cross-modulation, makes necessary a delay time between the "I" and "Q" signals so that they arrive simultaneously at the matrix for processing before application to the kinescope.

The matrix combines pre-determined proportions of "Y", "I" and "Q" information into simultaneous green, red and blue signals for application to the kinescope grids (Note: "I", "Y", and "Q" are not symbols for green, red and blue. Their proper designations are noted above.)

LUMINANCE CHANNEL

The first video amplifier, a 6CL6, has both positive and negative video output polarities. Also sound present in the video signal is attenuated by a 4.5 mc. trap (2L108, 2C184) in the cathode output circuit. To prevent chrominance information from combining with luminance information before entering the matrix a 3.58 mc. color sub-carrier frequency trap (2L140, 2C188) is located in the plate circuit of the 6CL6 first video amplifier.

The sync and wideband video present at the plate of the 6CL6 provide the "Y" channel signal, burst (color sync), and horizontal and vertical sync information. "Y" information is fed through the delay line (2TD101) to a potentiometer in the grid circuit of the second video amplifier V115A (6AN8 pentode section). The potentiometer (2R204) is mechanically ganged with the potentiometer (2R210) in the grid circuit of V116A (6AN8 pentode section) the bandpass amplifier, and acts as the picture (contrast) control, maintaining a constant ratio between luminance and chrominance for all control settings.

Burst (color sync) is removed by a tuned circuit (2L141, 2C186) coupled to the color sub-carrier trap (2L140, 2C188). Sync information (horizontal and vertical) is removed at the junction of 2R207 and 2R206 and is fed to the horizontal and vertical sync separator V117B (6AN8, triode section) and V118B (½ 12AT7).

The second video amplifier V115A (6AN8 pentode section) amplifies the "Y" (brightness) information to a level suitable for application to the matrix section.

CHROMINANCE CHANNEL

The signal removed from the cathode of V114, the first video amplifier, is fed to the grid of V116A (6AN8, pentode section), the bandpass amplifier, which removes the low frequency components of the signal with the bandpass filter (2T126) and retains the region of the color sub-carrier and its sidebands. The bandpass filter terminates in a control (2R317) which adjusts the saturation of color (vivid red, pale red) by controlling the chroma voltage input to the "I" and "Q" demodulators.

The bandpass amplifier is inoperative during the burst interval at which time it is keyed "off" by a negative pulse derived from horizontal deflection (Terminal "E" on HV transformer 3T117) applied to the screen of V116A. This prevents the DC restorers from clamping on demodulated burst instead of on top of sync, thereby avoiding background unbalance in the kinescope.

Also, when no burst is present (black and white picture reception), the color-killer tube V112B (6AN8, triode section) conducts, and biases the grid of the bandpass amplifier to cut-off. This prevents signal information from entering the matrix circuits via the "I" and "Q" demodulator circuits, and ensures that only "Y" (brightness) information reaches the kinescope grids.

During burst the color-killer does not conduct, since it is held at cut-off by the negative DC voltage developed by the burst phase detector (V130B).

Demodulation (detection) of the chroma signal ("I" and "Q") is accomplished by the synchronous detectors V132 (6BY6) and V133 (6BY6) operating in quadrature. With the demodulators operating in quadrature the "I" signal is detected in phase with the color sub-carrier and the "Q" signal is detected 90° out of phase from the color sub-carrier.

The detected "I" signal appears at the plate of V132 ("I" demodulator) and is fed through the band-limiting filter 2T123 to the "I" amplifier V134A (6AN8, pentode section) then to the "I" phase splitter V134B (6AN8, triode section) which supplies positive and negative "I" signals required in the matrix section. The band-limiting filter also provides the time delay required to match "Q" signal time delay.

The detected "Q" signal appears at the plate of the "Q" demodulator V133 and is fed through a band-limiting filter (2L122, 2C266, 2L123) to the "Q" phase splitter V115B (6AN8, triode section) where positive and negative signals are present at the output for application to the matrix section of the receiver.

The proper amplitude ratio of "I" to "Q" signals is maintained by adjustment of the "I" gain control 2R361 in the cathode of the "I" signal amplifier V134A (6AN8, pentode section).

MATRIX AND OUTPUT

The matrix is the section of the receiver where the "Y", "I", and "Q" signals are mixed in proper proportions to provide output voltages for application to the kinescope control grids. The resultant brightness, hue and saturation of colors in the transmitted picture will be reproduced properly on the kinescope.

The signals are fed to the adder stages V135A, V136A, V137A, through fixed resistances, where the "Y", "I" and "Q" signals are combined in correct proportion.

Negative feedback from the cathodes of the output sections of the 12BH7 tubes V135B, V136B, V137B, is applied to the grids of the adder tubes for stabilization, to prevent undesirable color shift. The resulting low impedance input provides effective isolation of "Y", "I" and "Q".

Since the operation of the kinescope requires specific ratios of drive to produce a black and white picture (proper proportions of green, red and blue produce white) gain controls are provided for the green and blue channels. No gain control is provided for the red channel, because the red phosphor dots are least efficient and require maximum excitation. DC restoration is provided by V138A, V138B, V138C, a triple diode tube, type 6BC7.

The plate return circuits of the DC restorers are adjusted to provide proper biasing of the three kinescope grid bias values throughout the range of the master brightness control (1R124A).

COLOR SYNCHRONIZATION

The color synchronizing channel consists of a "keyer" tube V116B (6AN8, triode section), a burst amplifier stage V129A (6AN8, pentode section), a phase detector V129B and V130B (6AN8, triode sections), a reactance control tube V131A (6AN8, pentode section), a quartz crystal oscillator operating at 3.58 mc. V131B (6AN8, triode section) and a quadrature amplifier V130A (6AN8, pentode section).

To provide color synchronization information in the N.T.S.C. type signal, a "burst" of approximately 8 cycles of the color sub-carrier frequency is transmitted following each horizontal sync pulse in the composite color video signal and appears on the "back porch" of the horizontal blanking pedestal.

This "burst" is used as phase reference information, after separation from the composite color video signal, and serves to establish the proper phase relationship between the transmitted signal and the local 3.58 mc sub-carrier. Since the sub-carrier is not transmitted it is necessary to generate a local sub-carrier of proper frequency and phase. The sub-carrier is generated by a (quartz) crystal controlled oscillator (V131B). A reactance tube (V131A) is used to maintain correct control of the crystal oscillator frequency.

The reactance tube is controlled by a voltage from the phase detector (V129B and V130B) which is proportional to the difference in phase between the transmitted burst and the local 3.58 mc. crystal oscillator output.

The burst amplifier stage amplifies the signal supplied from an inductance (2L141) which is coupled to the first video amplifier plate (V114). A trimmer capacitor (2C186) is used as the hue control (redness, blueness, greenness).

The keyer tube V129A, is driven by a pulse from the horizontal output transformer (Terminal "F" 3T117) and with its cathode connected to the cathode of V129A, the burst amplifier, provides automatic keying level adjustment.

The phase detector V129B and V130B, uses the triode sections of the 6AN8's as diodes, to compare the phase of the incoming burst signal with the phase of the 3.58 mc c-w signal from the crystal oscillator V131B. This signal is obtained from the "I" output of the quadrature amplifier transformer (Terminal "A" 2T125).

The crystal oscillator V131B operates as a cathode follower and drives the quadrature 3.58 mc amplifier V130A, from a tap on the oscillator output transformer (Terminal "B" 2T128).

A plate circuit output (Terminal "F" 2T125) provides "Q" c.w. signal to the "Q" demodulator V133. The 3.58 mc reference signal which is supplied to the phase detector also provides "I" c.w. to the "I" demodulator V132.

TRICOLOR KINESCOPE

The type 15GP22 tricolor kinescope, as used in this receiver, is a directly-viewed picture tube capable of producing either a full color or a black and white picture 11½ inches wide and 8⅝ inches high with rounded sides.

Three electron guns are mounted at the base end of the tube with their axial centers parallel to the central axis of the tube and spaced 120° apart with respect to each other.

Enclosed within the glass tube envelope, at the viewing end of the tube, is an assembly consisting of an aperture mask, the phosphor dot viewing screen and a decorative mask.

The focus electrode potential is adjusted so that the beam from each of the three electron guns comes to focus at the phosphor dot viewing screen.

By means of a convergence electrode all three beams are made to converge at any given point at the plane of the aperture mask. (See figures 3 and 4.)

The tricolor phosphor dot plate (the viewing screen) has printed on its rear surface an orderly array of small, closely spaced phosphor dots, arranged in triangular groups of three which are called "trios". Each trio consists of a green light emitting dot, a red light emitting dot and a blue light-emitting dot.

The phosphor dot plate has approximately 195,000 dot trios or a total of 585,000 dots. Aluminization of the surface, after the dot trios have been printed, effectively increases the light output from the viewing screen and eliminates the need for an ion trap.

The aperture mask, a thin metal plate positioned a short distance behind the phosphor dot plate, contains round holes equal in number to and centered with respect to the dot trios (one hole for each dot trio).

A mumetal shield is placed around the glass bell end of the tube envelope to prevent stray magnetic fields from affecting tube operation.

Another mumetal shield, positioned around the neck of the tube, prevents extraneous magnetic fields from interfering with the low velocity beams in the neck section. It also supports the beam-positioning magnets which are spaced 120° apart to correspond with the positions of the electron guns in the neck of the tube. The beam-positioning magnets are adjustable to provide accurate positioning of their associated beams in a direction perpendicular to the change in beam direction produced by the electrostatic convergence element in the kinescope.

The purifying coil is made adjustable to provide accurate alignment of the axes of the three beams so that their common axis coincides with the axis of the kinescope. As a result, when the beams are focused, converged and deflected, they approach each hole in the aperture mask at the proper angle to strike the centers of their respective color dots and produce color purity. (See figure 5.)

The field-neutralizing coil placed around the faceplate end of the kinescope produces a uniform magnetic field which can be varied to neutralize extraneous magnetic fields which may cause displacement of the beams from their color centers.

The high voltage (ultor) connection is part of the peripheral faceplate tube envelope seal.

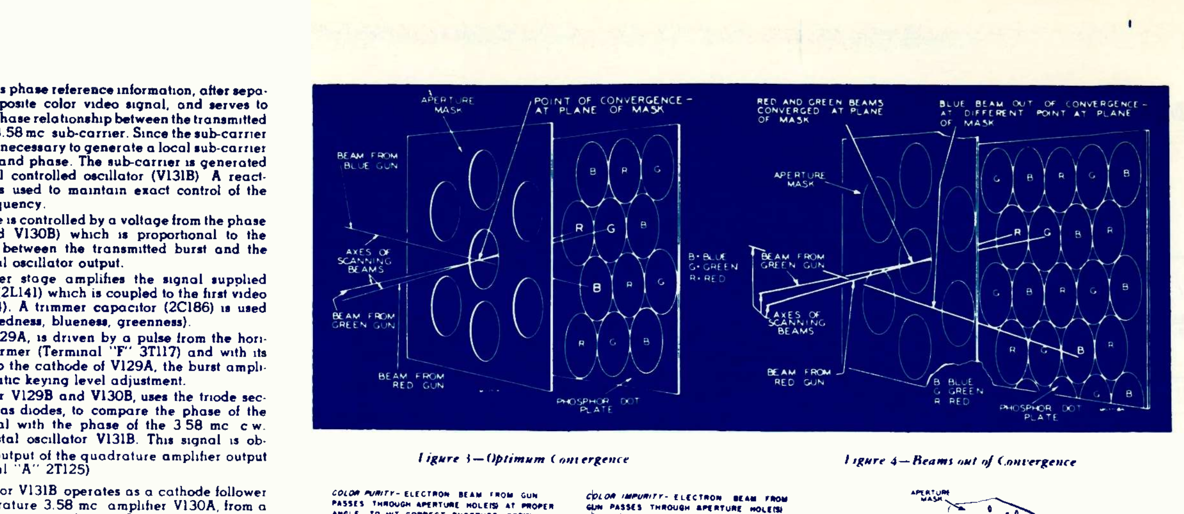

Figure 3—Optimum Convergence

Figure 4—Beams out of Convergence

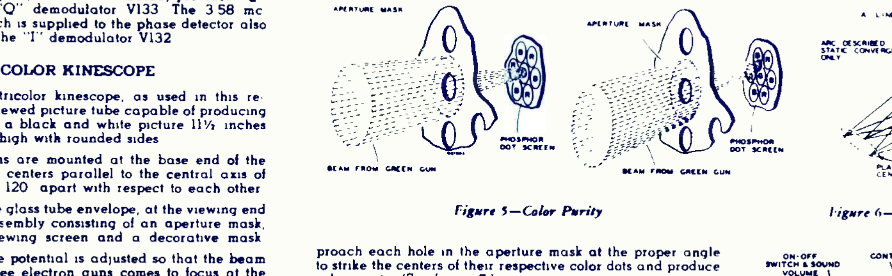

Figure 5—Color Purity

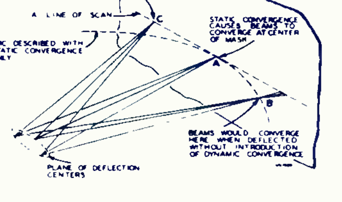

Figure 6—Effect of Dynamic Convergence

DC (STATIC) CONVERGENCE

Converging the three beams at the center of the face of the tube is accomplished by adjusting the DC convergence control (3R254) for the best super-positioning of the beams. The three beam-positioning magnets are adjusted individually to correct inaccuracies which may result due to mechanical mis-alignment of the electron guns. (See figure 6.)

DYNAMIC CONVERGENCE

Because the aperture mask and the phosphor dot screen are flat, the beam must travel a greater distance from the center of deflection as it scans the edges of the screen than it does when scanning the center of the screen.

If the DC convergence voltage, which was required to achieve center convergence, remained unchanged, the three beams when scanning the edges of the screen, would become mis-converged and the result would be color fringing at the edges of the picture. To correct this condition the DC potential on the convergence electrode is modulated in such a manner as to produce a larger convergence electrode voltage as the deflection angle increases (as the edges of the picture are scanned more DC convergence voltage is applied). The same condition also exists with respect to focus. (Refer to figure 6.)

The vertical dynamic convergence amplifier circuit (using a 12AU7-V119) combines, shapes and amplifies the parabola and saw-tooth waveforms, derived from the vertical deflection circuit. They are then combined with the sinewave horizontal waveform, which is derived from the two series tuned circuits, 1L138 and 3L139 connected to the horizontal kickback (terminal "E" of 3T117). This combined waveform is used for modulation of the DC convergence and focus voltages applied to the kinescope.

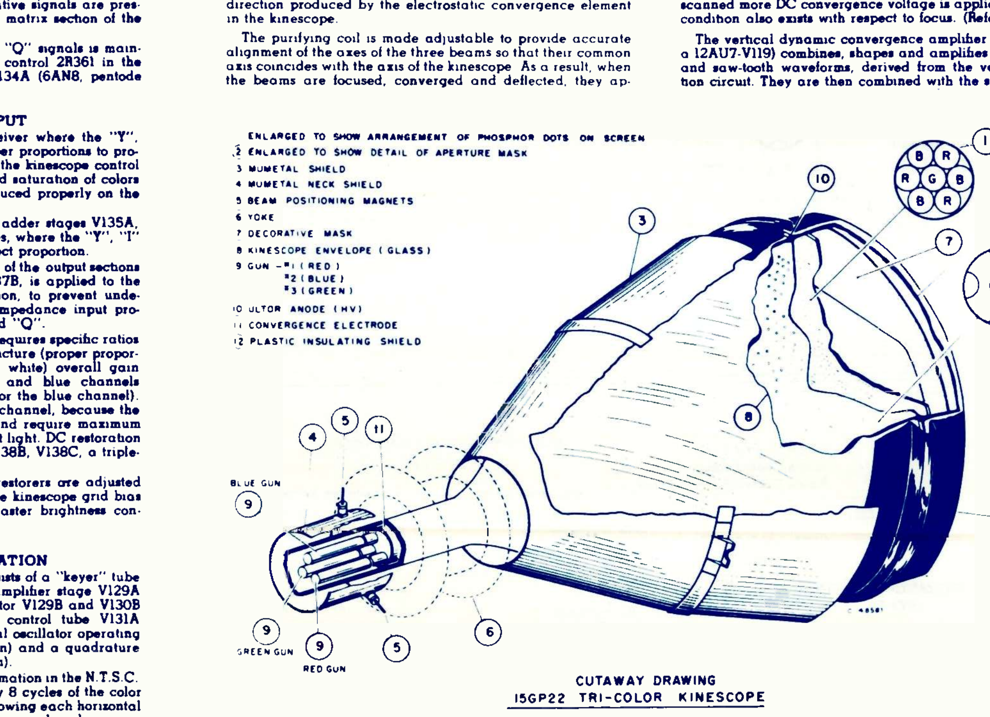

Figure 2—Tricolor Kinescope

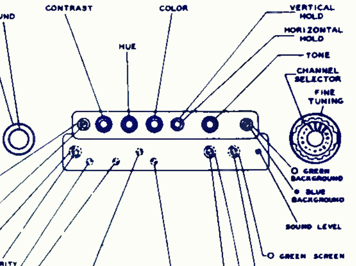

Figure 7—Operating Controls and Front Adjustments

Performance of the "COMPLETE SET-UP PROCEDURE" should *only* be necessary when kinescope replacement is required or a definite determination has been made that such complete adjustment is required.

COMPLETE SET-UP PROCEDURE

Prior to making any picture adjustments, it is essential to have 19,500 volts applied to the ultor anode of the kinescope (see HIGH VOLTAGE ADJUSTMENT . . . .). A conventional black and white test pattern, if available, is useful for making initial adjustments. A dot pattern should be provided for convergence adjustments.

COLOR PURITY ADJUSTMENTS.—Turn the Contrast Control 2R204/2R210 to minimum (fully counter-clockwise). . . . Turn the Brightness Control 1R124A to an average brightness position. Any color impurity will best be seen on a red display (blue and green screens, turned down). Therefore, set the Red Screen Control 1R139A to its maximum position. Set the Blue Screen Control 1R155B and the Green Screen Control 1R155A to their minimum positions (fully counter-clockwise). Remove the plug of the field neutralizing coil, 2P102M, or set the control, 2R107, to the center of its range. (See figure 13.)

To produce a small central area on the raster on which purity adjustments can be observed, the deflection yoke is moved approximately one inch toward the rear of the kinescope until a multi-color raster is seen. This is done by loosening the four screws at the top of the yoke cradle and sliding the yoke and cradle to the rear. (Refer to figure 12.) In this position the red area appears to cover, at the center of the raster, about one-third of the total raster area. With this arrangement, a minimum of purity coil correction will be necessary. The purifying coil and the purifying current control 2R106 are now adjusted alternately to give the best red rendition at the center area of the raster. The coil is adjusted by grasping the edge at the front of the neck shield and rotating it about the neck. The Purifying Control 2R106 is adjusted to give more or less coil current which causes more or less of a shift of the position of the red field. The final position of the control should be as near as possible to the extreme counter-clockwise position, so that minimum current will flow through the coil. A lower value of current will produce a weaker magnetic field, which has, therefore, less inter-action with other magnetic fields about the kinescope.

Advance the deflection yoke forward until an all red raster is produced. Be sure the grounding springs are making contact with the kinescope shield. Replace the plug 2P102M if previously removed. Adjust the field neutralizing control 2R107, to give best raster edge purity. Since the adjustment of the deflection

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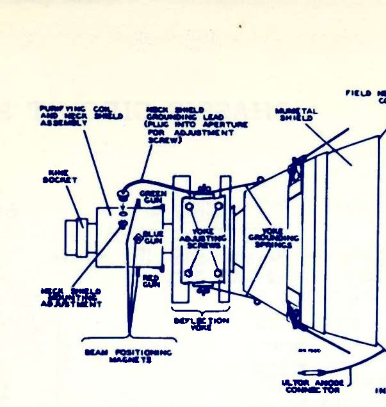

Figure 12—Purity Coil, Yoke and Beam Magnet Adjustments

yoke may affect purity, a slight readjustment of the purifying coil and control may be necessary. Also, purifying coil adjustments will affect centering. If necessary, re-set the centering controls. In general, if good red field purity is obtained, green and blue fields will be satisfactory. To check the green field, turn the Red Screen Control 1R139A to minimum and advance the Green Screen Control 1R155A to maximum. Note the green field purity. Next, turn the Green Screen Control 1R155A to minimum and advance the Blue Screen Control 1R155B to maximum. Note the blue field purity. If either the green or blue or both fields are not satisfactory, a compromise must be reached for all three fields on the setting of the purity adjustments. Slight readjustments may be necessary to give best simultaneous red, green, and blue fields.

Set the brightness control to maximum. Turn up all three screen controls to give the best low level grey raster. If color shading occurs in one or more hues, either the screen controls for those hues must be turned down or those which do not give shading must be turned up.

INITIAL ADJUSTMENTS.—Adjust the receiver, as outlined in the "OPERATING INSTRUCTIONS", for a black and white picture.

If the Horizontal Oscillator and AGC system are operating properly, it should be possible to sync the picture at this point. However, if the AGC control is misadjusted, and the receiver is overloading, it may be impossible to sync the picture.

If the receiver is overloading it will be necessary to adjust the AGC control.

Remove the metal control cover box and the snap-in cabinet panel below the cover box. To do this, remove the four knobs under the control cover by grasping each firmly to pull out. Remove the two round-head screws holding the cover box in place. Carefully slide the cover box assembly outward.

Grasp the top of the removable cabinet panel and pull the panel away from its snap mounts. The front service adjustments will now be accessible.

Turn the AGC control counter-clockwise until the receiver operates normally and the picture can be synchronized. (Refer to figure 7 for adjustment location.)

It should be noted here that only the adjustment of the AGC control should be made at this time.

Adjustment of the other controls accessible under the removable panel should be made only after an understanding of their functions has been acquired. The proper adjustment of each control is explained in later sections of this publication.

With the conventional black and white test pattern or picture tuned in, the Convergence Control 3R253 (top control on the left side of the cabinet) should be adjusted for the best convergence of objects in the center of the picture. Best convergence is obtained when there is minimum color fringing around the objects.

The Focus Control 3R259 (bottom control on the left side of the cabinet) should be adjusted for best definition.

At this point it is necessary to adjust the horizontal oscillator and to make the conventional adjustments of height, vertical linearity, horizontal linearity, width, drive, and electrical centering if such adjustments are found necessary.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT.—Turn the horizontal hold control to the extreme counter-clockwise position. The picture should remain in horizontal sync. Momentarily remove the signal by switching off channel then back. Normally the picture will be out of sync. Turn the control clockwise slowly. The number of diagonal black bars will be gradually reduced and when only 2 or 3 bars sloping downward to the left are obtained, the picture will pull into sync upon slight additional clockwise rotation of the control. Pull-in should occur before the control has been turned 70 degrees from the extreme counter-clockwise position. The picture should remain in sync for the balance of additional clockwise rotation of the control. At the extreme clockwise position, the picture should remain in sync and should not show a black bar in the picture.

When the receiver passes the above checks and the picture is normal and stable, the horizontal oscillator is properly aligned.

CENTERING ADJUSTMENT

Centering is accomplished by adjustment of the two electrical centering controls located on the rear of the chassis as shown in figure 13.

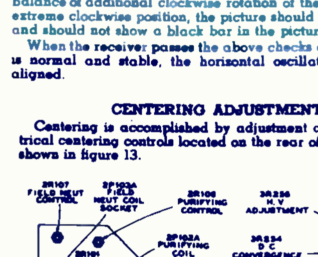

Figure 13—Rear Chassis Adjustments

Adjust the vertical centering control 2R104A-B and the horizontal centering control 3R261 to center the picture within the mask of the kinescope. If the picture does not fully cover the masked area of the kinescope, adjust the positioning for equal distribution of blank area at top and bottom and at each side.

WIDTH AND HORIZONTAL DRIVE ADJUSTMENTS

Pre-set the Horizontal Drive Control 2R266 on top of the receiver chassis . . . . to the point where the vertical white fold-over line, which appears approximately three inches from the left edge of the screen, just disappears from the picture.

Adjust the Width Control 3L120 on the rear of the HV compartment, as shown in figure 13, to overscan the masking area by approximately one-quarter inch at each side.

Advance the Horizontal Drive Control 2R266 to as high a position as possible without white fold-over appearing in the picture.

If it is impossible to fill the mask by the above adjustments, it will be necessary to follow the procedure outlined under HV ADJUSTMENT.

HEIGHT AND VERTICAL LINEARITY ADJUSTMENTS.—Adjust the height control 1R282A and the Vertical Linearity Control 1R282B (controls under cabinet front panel —see figure 7), until the picture or test pattern is symmetrical from top to bottom. Make the final adjustment to overscan the mask by one-quarter inch at both top and bottom. Recheck the horizontal and vertical centering for correct positioning of the picture with respect to the mask.

DC CONVERGENCE ADJUSTMENTS.—The dot signal generator should be connected to the receiver to provide a dot pattern on the kinescope for making convergence adjustments.

To do this, clip the "horizontal lead" from the dot generator to the insulation of the green lead from pin 2 of yoke plug, 3P105B, near its termination on the right side of the yoke.

Clip the "vertical lead" from the dot generator to the insulation of the lead to pin 19 of the kinescope socket near the 2700 ohm resistor. (Or wrap the lead around the top of V128, the vertical oscillator tube.)

For generators with internal vertical sync. omit this connection.

Connect the "ground lead" to the receiver chassis and the "output lead" to the Delay Line 2TD101, at the terminal board and near V115. CAUTION.—Do not short to chassis, this point is at +B potential.

Set the receiver to obtain a signal from some channel. This will provide sync. pulses to the dot generator.

NOTE:—Dot generators which provide an RF output should be connected to the antenna terminals of the receiver.

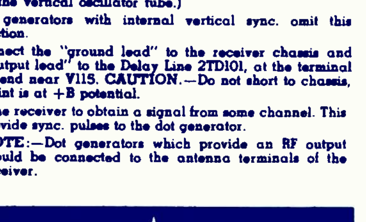

Figure 14—Dot Convergence Pattern

Adjust the DC Convergence Control (top knob on left side of cabinet) until the three dots appear separately and in a triangular arrangement in the center of the raster. (The dot triangle may be inverted by adjusting the DC Convergence Control from one extreme to the other.) If necessary, readjust the focus control. If each dot group does not form a small equilateral triangle, as shown in figure 14, it will be necessary to adjust the beam positioning magnets on the neck of the kinescope. Carefully note which of the three dots (red, green or blue) appears to be out of line. Then, adjust the beam positioning magnet, corresponding to that color, to correct the position of that dot. Adjustment is made by loosening the knurled nut which locks the magnet in position. Each magnet is slotted for screwdriver adjustment. Some knowledge of the effect of each magnet adjustment will be helpful. As shown in figure 14, the dots with "R", "G", and "B" inscribed denote the position of the red, green, and blue dots. The dashed lines indicate the direction of dot movement produced when the DC Convergence Control is adjusted. All three dots move simultaneously. The solid lines represent the direction of dot movement when the associated beam positioning magnet is adjusted. Each magnet has a slight effect on the two beams other than the one it is designed to control. It is essential, therefore, to use the minimum amount of magnet adjustment to correct each dot position. Minimum adjustment will also cause the least amount of de-focusing. This means that the magnet adjustment should be set to the point nearest the extreme counter-clockwise position where correct beam positioning is obtained.

If it appears that only one dot is out of line and the associated magnet does not have the range of adjustment to correct the dot position, it is possible to alter the range of the adjustment by removing the magnet from the neck shield, turning it end-for-end, and re-inserting it in the neck shield. One end of each magnet is color coded in red. Each magnet is slotted at both ends so that adjustment can be made with either end projecting through the shield. If a single dot position cannot be corrected by reversing the magnet, return the magnet to its original position. Then correct the position of the opposite two dots with respect to the first dot by adjusting the magnets associated with those dots.

When the equilateral triangle is obtained, it will be possible to obtain satisfactory convergence of the three dots by adjusting the DC Convergence Control. Complete convergence is obtained at the center of the raster when the three dots are superimposed to give a single white dot with no color fringing around the edge of the white dot.

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DYNAMIC-CONVERGENCE ADJUSTMENTS—Although the same amplifier circuit applies both dynamic focus and dynamic convergence voltages to the kinescope, when the dynamic convergence adjustment is correct, the dynamic focus is satisfactory also. In adjusting dynamic convergence, it will be helpful to frequently vary the DC Convergence Control for optimum convergence on various parts of the screen.

With the dot signal generator connected to the Delay Line at the terminal board near V115, adjust the Vertical Convergence Amplitude Control 1R248A (see figure 7) so that dots along a vertical center line show the same dot displacement at the top, center, and bottom of the picture. Then, readjust the Focus Control. If the displacement is not the same, adjust the Vertical Convergence Shape Control 1R248B (see figure 7) to obtain the most uniform displacement. It may be necessary to readjust the Vertical Convergence Amplitude Control. Readjust the DC Convergence Control so that the vertical line converges. Keep the dots in focus. Slight re-adjustment of the Vertical Amplitude and Shaping controls may be necessary to obtain the best top-to-bottom convergence.

The next step is to adjust the horizontal dynamic convergence. Advance the Horizontal Convergence Amplitude Control 1R238 (see figure 7) so that dots along a horizontal center line show the same displacement at right, center, and left areas of the picture. If the displacement is not the same, adjust the Horizontal Phase Control 1L138 to obtain the most uniform displacement. A slight re-adjustment of the amplitude control may be required. Re-adjust the DC Convergence Control so that the horizontal line converges. Keep the dots in focus. Slight re-adjustment of the horizontal amplitude and phase controls may be necessary to obtain the best side-to-side convergence.

The picture should now be converged over its entire area. If any area does not appear to be converged, and it can be converged by re-adjusting the DC Convergence Control, the dynamic convergence adjustments are not at optimum setting. Touch-up adjustments should be made after it is determined what correction is needed.

LOWLIGHT, MID-RANGE, AND HIGHLIGHT ADJUSTMENTS—At this point, color purity and convergence adjustments must be completed. Connect an antenna to the receiver and tune the receiver for reception of a black and white program. If this is not available, a black and white test pattern signal can be used. See figure 7 for adjustment locations.

Turn the Color Control and Contrast Control to the minimum positions (maximum counter-clockwise). Set the Brightness Control to near its maximum position (clock-wise direction). Adjust the Red, Green, and Blue Screen Controls alternately for a light grey or low-brightness white picture.

Turn the Contrast Control clockwise to about the mid-position. Adjust the Green Video Gain and Blue Video Gain controls to produce a satisfactory white picture. Then, turn the Brightness Control down (counter-clockwise) to where a picture is just visible. Adjust the Green Background and Blue Background controls for a grey picture.

The procedure in the two preceding paragraphs should be repeated until satisfactory grey-to-white pictures are seen in all positions of the Brightness and Contrast Controls.

H.V. ADJUSTMENT

Turn both the ganged Contrast control 2R204/2R210 and the Brightness control 1R124A fully counter-clockwise.

Fasten a short length of HV anode lead to the HV probe of the "VoltOhmyst" and set the "VoltOhmyst" for a 20 KV reading.

Fasten the other end of the short HV anode lead to the corona cup on the base of V121 the HV rectifier. This point is accessible through the hole provided on top of the H.V. compartment for adjustment of 3L139, the Horizontal Dynamic Convergence Adjustment.

Set the H.V. adjustment 3R256, on the rear of the HV compartment, to produce a reading of 19.5 KV on the "VoltOhmyst".

Turn the contrast control 2R204/2R210 and the brightness control 1R124A clockwise until a picture is obtained on the kinescope.

Adjust the focus control 3R259 (lower control on left side of chassis) for best kinescope focus. Adjust the convergence control 3R254 (upper control on left side of chassis) for best convergence in the center area of the kinescope.

Adjust the width control 3L120, on the rear of the HV compartment, to horizontally overscan the viewing area by one-half inch.

Set the horizontal drive control 2R266 on top of the chassis as high as possible without white foldover appearing in the raster.

Re-check the operation of the horizontal hold control (1R283B) to assure that the operation is still proper as previously determined by horizontal oscillator adjustment.

> NOTE: To check the performance of the HV circuit, a reading may be taken of V120 the 6BD4 regulator current. Insert a meter in the cathode circuit of the 6BD4. A reading of at least 600 microamperes should be obtained with 19.5 KV of Ultor Anode voltage.

Replacement of the fuse 3F101 should be made only with a 450 MA Type AG fuse.

Adjust the height (1R282A) and the vertical linearity (1R282B) for vertical linearity of the picture making the final adjustments to provide vertical overscan of the viewing area by one-quarter inch at top and bottom.

Remove all test equipment used in the preceding adjustments.

COLOR AFC ALIGNMENT

A color bar signal should be fed to the receiver for AFC alignment. (A transmitted signal may be used if available.)

Connect the Color Bar Generator to the receiver antenna terminals.

Connect the "VoltOhmyst" in series with a calibrated RF Probe (or the Wide Band Oscilloscope) to terminal "B" of 2T128, the 3.58 mc oscillator transformer.

Adjust 2T128 (top) to read 5 volts peak-to-peak on the "VoltOhmyst" or the oscilloscope.

Ground the grid of the burst amplifier, pin 8 of V129 A, with a short jumper.

Connect the "VoltOhmyst" to pins 1-2 of the phase detector V130B.

Adjust the quadrature transformer 2T125 (bottom), for maximum DC reading on the "VoltOhmyst", then adjust 2T125 (top) for minimum DC reading on the "VoltOhmyst".

Remove the jumper shorting the grid (pin 8) of the burst amplifier V129A and set the HUE control to the center of its range.

Adjust 2L141 (top) and the burst amplifier transformer 2T122 (bottom) for maximum DC on the "VoltOhmyst". The burst amplifier transformer 2T122 will tune very broadly and seem to have a flat top. Adjust 2T122 for the maximum reading at the approximate center of the flat top.

NOTE: The Burst signal should be observed at this point. To do this, connect the wideband oscilloscope to pins 1-2 of the phase detector V130B. Check the burst signal, it should conform to figure 34. The burst signal should not change shape when rotating the horizontal hold control over its holding range. Remove the oscilloscope.

Ground the junction of 2L130, 2R340 and 2C275 (in the grid circuit of V131A reactance tube).

Connect the "VoltOhmyst" to pins 1-2 of V130B phase detector and carefully adjust 2T124 (top), Reactance Transformer, for zero beat on the output, which may be observed by a slow swing of the "VoltOhmyst". (Observation may also be made on an oscilloscope or on the kinescope face.)

Remove the short to ground at the junction of 2L130, 2R340 and 2C275 and connect the "VoltOhmyst" to this point.

Shunt the 3.58 mc crystal 2Y101 with a 15 mmf. capacitor.

Adjust the AFC Balance Control 2R306 on top of the receiver chassis for zero reading on the "VoltOhmyst".

Remove the 15 mmf. capacitor shunting the crystal 2Y101 and disconnect the "VoltOhmyst".

DYNAMIC CONVERGENCE CIRCUIT ALIGNMENT

HORIZONTAL—Clip the oscilloscope probe on the insulated lead to pin 13 of the kinescope socket.

Connect a clip lead to the same lead to pin 13 of the Kinescope socket to supply a triggering signal for the oscilloscope.

Turn the vertical convergence amplitude control 1R248A fully counter-clockwise. Set the vertical convergence shape control 1R248B to the center of its range. Turn the horizontal convergence amplitude control 1R238 fully clockwise.

Adjust the horizontal convergence phase control, 1L138 on the front panel of the chassis, for maximum sine wave output on the oscilloscope, as shown in figure 39.

Turn the horizontal convergence amplitude control 1R238 fully counter-clockwise. Adjust the horizontal dynamic convergence adjustment 3L139 on top of the HV compartment for correct phasing of minimum waveform.

The horizontal pulse will appear on top of the sine wave as shown in figure 39.

Turn the horizontal convergence amplitude control 1R238 to its maximum clockwise position and adjust the horizontal convergence phase control 1L138 for correct phasing as above. See figure 39.

Return the horizontal convergence amplitude control 1R238 to its full counter-clockwise position.

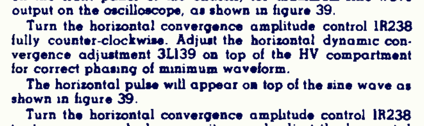

Figure 39—Horizontal Dynamic Convergence Waveforms

VERTICAL—Connect the oscilloscope to the output plate of the vertical convergence amplifier, pin 1 of V119. Adjust the vertical convergence amplitude control 1R248A and the vertical convergence shape control 1R248B for the wave shape shown in figure 40(b).

The amplitude control varies the amplitude of the parabola from 0 to 200 volts peak to peak. The shape control varies the amount of negative or positive sawtooth to the parabola. Make the final adjustment to conform to the waveform in figure 40(b).

Clip the oscilloscope probe in series with a high-voltage capacitor to pin 6 of the kinescope. The waveform obtained should conform to that shown in figure 41.

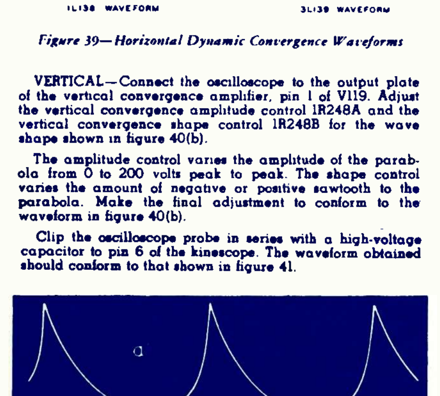

Figure 40—Vertical Dynamic Convergence Waveforms

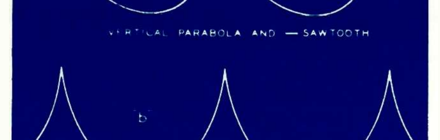

Figure 41—Dynamic Convergence Parabola

Return the vertical convergence amplitude control to minimum.

Disconnect the oscilloscope from the kinescope convergence lead.

MATRIX ALIGNMENT

Turn the color bar generator "on" (allow 5 minute warmup), and connect the "VoltOhmyst" to the metering terminals. Set the metering switch to the "SUB-CARRIER" position and set the "SUB-CARRIER MOD" control to maximum. A reading of −1.2 volts (±20%) should be obtained on the "VoltOhmyst". Set the metering switch to the "SYNC" position and adjust the "BRIGHTNESS MOD" control for a reading of −1.5 volts on the "VoltOhmyst" from the metering terminals.

Depress the "BRIGHTNESS MOD" button. The reading should increase to −1.85 volts. Turn the metering switch to "off".

Connect the "RF OUT" of the color bar generator to the receiver antenna terminals. Turn the channel selector to channel 3 or 4 (whichever crystal has been supplied with the generator) and adjust the "HOR HOLD" control of the generator until the bar pattern synchronizes on the kinescope.

Adjust the Fine Tuning control until the picture on the kinescope shows no sound interference. Advance the Color control 2R317, until color appears in the bar pattern. If the width and horizontal drive controls are properly adjusted (as explained in Installation Instructions) 10 color bars will be seen on the kinescope.

The normal sequence of the ten bars visible on the Kinescope, starting from the left side, should be as follows. At the extreme left a dull yellow-orange bar, orange, then a bright red, bluish-red, magenta, blue, greenish-blue, cyan, bright bluish-green and ending with a dark green bar at the extreme right.

Connect the oscilloscope to test point 2TP103, "I" Phase Splitter cathode, the signal on the oscilloscope will be the "I" signal. (See figure 42.)

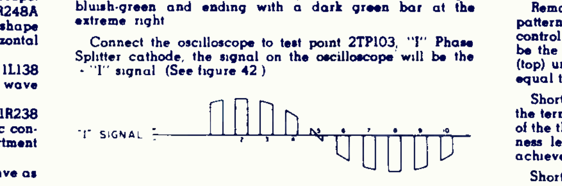

Figure 42—I and Q Waveforms

Set the Hue control, 2C186, to the center of its range, capacitor plates halfway meshed. Then adjust 2L141 until the 5th bar from "Burst" is at the zero axis.

Connect the oscilloscope to 2TP102, "Q" Phase Splitter cathode, and check the pattern. This will be the −"Q" signal on the oscilloscope. The 2nd and 8th bars from burst should be at the zero axis. If not, adjust 2T125 (top) Quadrature Transformer, to bring the 2nd and 8th bars to the zero axis. Recheck the "I" signal and readjust if necessary.

Connect the oscilloscope to the blue kinescope grid, pin 18 at the terminal at the rear of the chassis. . . . . . . Adjust the Color control to make the maximum amplitude bar the same amplitude as the sync pulse (in the opposite polarity).

Adjust the "I" Gain control until the 3rd and 10th bars are equal. (Refer to figure 43.)

Move the oscilloscope to the red kinescope grid, pin 3, at the terminal at the chassis rear. The pattern on the oscilloscope should show the 9th bar to be approximately one-half the height of the sync pulse, the 6th bar should be ½ the height of the 5th bar.

Move the oscilloscope to the green kinescope grid, pin 8, at the terminal at the chassis rear. The pattern should show the 4th bar to be approximately one-third the height of the sync pulse, and the 1st and 7th bars should be at the zero axis.

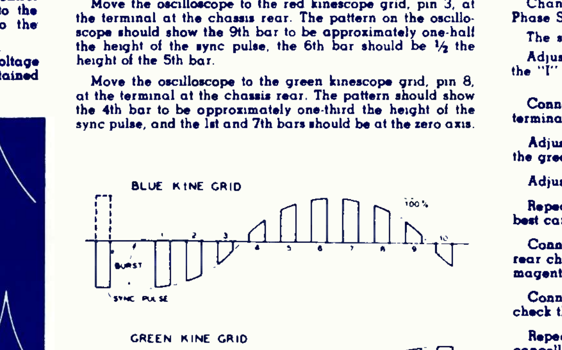

Figure 43—Matrix Waveforms

A reasonable check and adjustment of the matrix set-up of the receiver may be made in the field, by the following method, where an oscilloscope is not readily available.

Turn the color bar generator "on" (allow 5 minute warmup), and connect the "VoltOhmyst" to the metering terminals. Set the metering switch to the "SUB-CARRIER" position and set the "SUB-CARRIER MOD." control to maximum. A reading of −1.2 volts (±20%) should be obtained on the "VoltOhmyst". Set the metering switch to the "SYNC" position and adjust the "BRIGHTNESS MOD." control for a reading of −1.5 volts on the "VoltOhmyst" from the metering terminals.

Depress the "BRIGHTNESS MOD." button. The reading should increase to −1.85 volts. Turn the metering switch to "off".

Connect the "RF OUT" of the color bar generator to the receiver antenna terminals. Turn the channel selector to channel 3 or 4 (whichever crystal has been supplied with the generator) and adjust the "HOR. HOLD" control of the generator until the bar pattern synchronizes on the kinescope.

The normal sequence of the ten bars visible on the Kinescope, starting from the left side, should be as follows. At the extreme left a dull yellow-orange bar, orange, then a bright red, bluish-red, magenta, blue, greenish-blue, cyan, bright bluish-green and ending with a dark green bar at the extreme right.

Adjust the Fine Tuning control until the picture on the kinescope shows no sound interference. Advance the Color control 2R317, until color appears in the bar pattern. If the width and horizontal drive controls are properly adjusted (as explained in Installation Instructions) 10 color bars will be seen on the kinescope.

Set the contrast and brightness controls to normal setting as in reception of a black and white picture.

Set the Color control 2R317 to the center of its range.

Set the Hue control, 2C186, to the center of its range, capacitor plates halfway meshed.

Remove V115, the "Q" Phase Splitter, and observe the bar pattern on the kinescope. Adjust the receiver Brightness, Contrast and Hue controls if necessary. The fifth bar from the left should be the same as the background. If necessary, adjust 2L141 until the center of the fifth bar is equal to the background observed. Replace V115.

Remove V134, the "I" Phase Splitter, and observe the pattern on the Kinescope. Adjust only the receiver Brightness control if necessary. The second and eighth bars should be the same as the background. If necessary, adjust 2T125 (top) until the centers of the second and eighth bars appear equal to the background observed. Replace V134.

Short the red and green Kinescope grids to the chassis at the terminals on the rear apron. . . . . The centers of the third and tenth bars should be at the same blue brightness level. If necessary, readjust the "I" Gain Control to achieve this condition.

Short the red and blue Kinescope grids to ground. The centers of the first and seventh bars should appear the same green brightness level.

Short the blue and green Kinescope grids to ground. The sixth bar should appear slightly darker than the red brightness of the background.

Remove the short on the Kinescope grids and remove the color bar generator.

(Alternate Method for Matrix Alignment using 100% Saturated Color Bar Signal)

The matrixing adjustment should be made only after the completion of the receiver alignment and H.V. Adjustment are completed, with the receiver tuned for an NTSC color bar signal from the station (or provided from another source).

Adjust the contrast control 2R204/2R210 and the Color control 2R317 to mid-range.

Connect the oscilloscope to test point 2TP103, at the "I" Phase Splitter cathode.

Trigger the Oscilloscope at the horizontal sweep rate by clipping the lead from the oscilloscope to the insulated lead coming from pin 8 of the yoke plug 3P105B.

The signal on the oscilloscope will be the +"I" signal.

Adjust the Hue control 2C186, for correct waveform, which will be the point where the "Q" bar is on the "Zero" axis.

Change the oscilloscope to test point 2TP102, at the "Q" Phase Splitter cathode, trigger the oscilloscope as before.

The signal on the oscilloscope will be the −"Q" signal.

Adjust the Quadrature transformer (2T125 top) to place the "I" bar on the zero axis.

Connect the oscilloscope to the blue kinescope grid at the terminal on the rear edge of the chassis. (See figure 39.)

Adjust the Color Saturation control for best cancellation of the green and yellow bars. (Zero base line.)

Adjust the "I" Gain Control for best cancellation of Red.

Repeat the adjustment for green, yellow and red to achieve best cancellation.

Connect the oscilloscope to the green kinescope grid, at rear chassis terminal, and check the cancellation of the red, magenta and blue bars.

Connect the oscilloscope to the red kinescope grid and check the cancellation of the green, blue and cyan bars.

Repeat the matrixing adjustments until the best overall cancellation is obtained.

NOTE ON KRK12C TUNER ALIGNMENT.—The use of a crystal mixer in the KRK12C Tuner makes it necessary to observe the insert responses with the oscillator disabled. This is due to undesirable r-f/i-f interaction if the oscillator was allowed to operate during alignment. Therefore, the responses . . . . are not a strictly true representation of the insert band pass during actual operation. When an insert is aligned, using an oscilloscope to observe the response, the curve . . . . will be the correct response for reference. In actual operation, the band pass will be such that the sound and picture carriers will be at the tips of the curve. The adjacent channel picture and sound carriers will be in the valleys at each side. Care should be taken not to exceed the limits.

The valley, in the center of the response curve, may vary from 0 to 50% above the base line for VHF inserts. Adjust the output level of the sweep generator to prevent excessive signal input to the tuner. Excessive signal input will be indicated by the valley rising above the 50% level, particularly on the higher VHF channels.

Oscillator injection voltage is not adjusted on VHF inserts. A check may indicate variations from .08 to .3 volts at TP1 but such readings should not be interpreted as an indication of trouble. On UHF channels, however, the injection voltage should be adjusted to fall within the specified limits.

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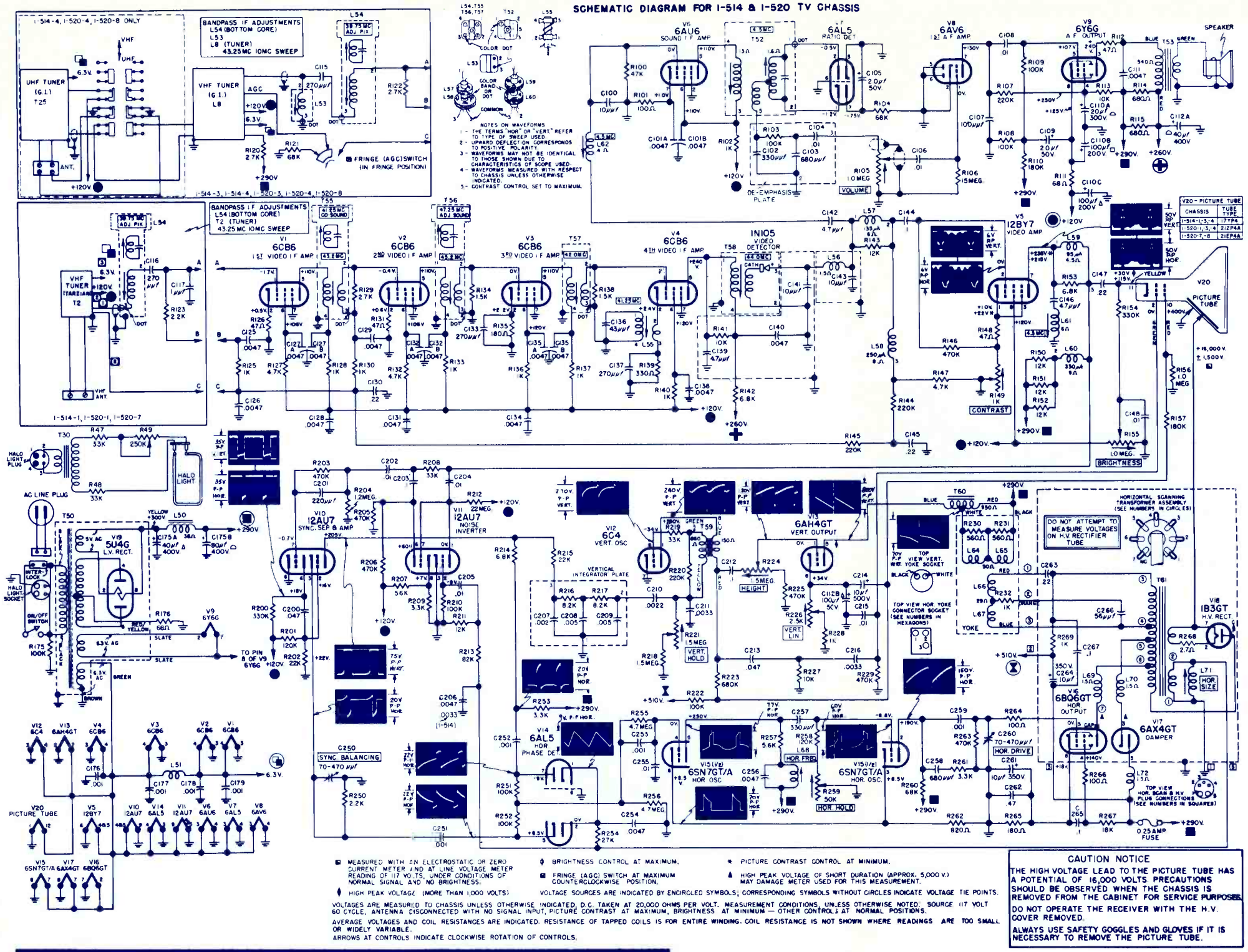
TECHNICIAN CIRCUIT DIGESTS

June • 1954

Sheet 1

SCHEMATIC DIAGRAM FOR I-514 & I-520 TV CHASSIS



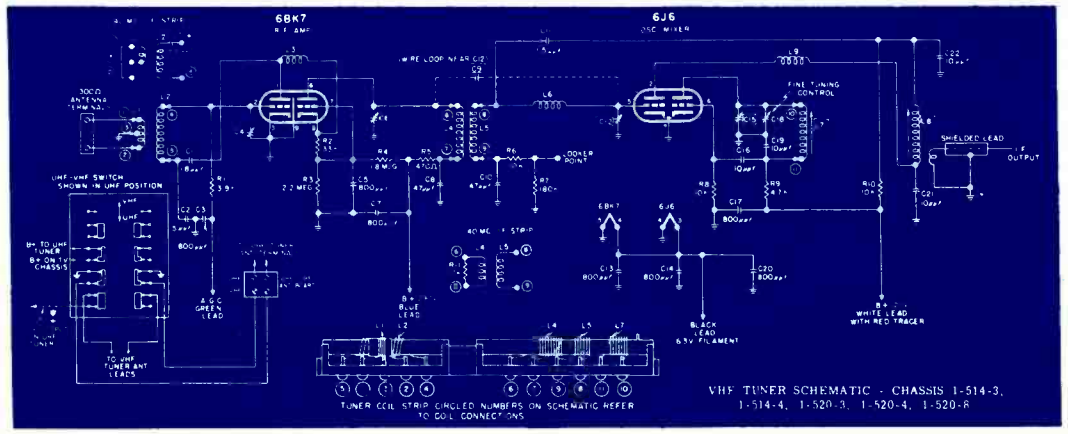
- ■ MEASURED WITH 2K ELECTROSTATIC OR ZERO CURRENT METER AND AT LINE VOLTAGE METER READING OF 117 VOLTS, UNDER CONDITIONS OF NORMAL SIGNAL AND NO BRIGHTNESS.
- ♦ HIGH PEAK VOLTAGE (MORE THAN 1,000 VOLTS)
- ◊ BRIGHTNESS CONTROL AT MAXIMUM.
- ■ FRINGE (AGC) SWITCH AT MAXIMUM COUNTERCLOCKWISE POSITION.
- * PICTURE CONTRAST CONTROL AT MINIMUM.
- ▲ HIGH PEAK VOLTAGE OF SHORT DURATION (APPROX. 5,000 V.) MAY DAMAGE METER USED FOR THIS MEASUREMENT.

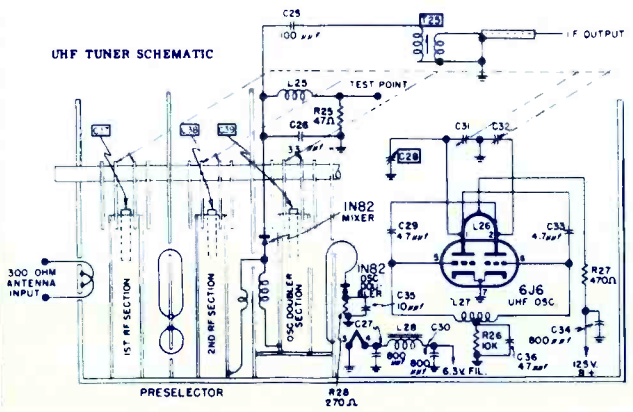
CAUTION NOTICE

THE HIGH VOLTAGE LEAD TO THE PICTURE TUBE HAS A POTENTIAL OF 16,000 VOLTS. PRECAUTIONS SHOULD BE OBSERVED WHEN THE CHASSIS IS REMOVED FROM THE CABINET FOR SERVICE PURPOSES.

DO NOT OPERATE THE RECEIVER WITH THE H.V. COVER REMOVED.

ALWAYS USE SAFETY GOGGLES AND GLOVES IF IT IS NECESSARY TO REMOVE THE PICTURE TUBE.





EARLY PRODUCTION PARTS REVISIONS

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
		DELETIONS
C261	181-1012	10 Mfd. - 350 V. - Electrolytic
		ADDITIONS
C267	160-0601	1 Mfd. - 600 V. - Molded Paper
R269	181-0102	1,000 Ohm - 1/2 W.
		CHANGES
C206	160-0624?	.0047 Mfd. - 600 V. - Molded Paper (I-514 Chassis Only)
R138	181-0122	1,200 - 1/2 W.
T50	141-0039	Transformer - Power - 117 V. 60 Cycle
	492-0059	Bracket and Socket Assembly (L. V. Rectifier) (Used with 141-0039 transformer)

CODE CHANGES

DESCRIPTION OF CHANGE \ CHASSIS →	I-514-1		I-514-3		I-514-4		I-520-1	I-520-3	I-520-4	I-520-7	I-520-8
Hor. Osc. socket and Audio Output transformer relocated.	C01	I. P.	C01	I. P.	I. P.	I. P.	I. P.	I. P.	I. P.	I. P.	I. P.
R269 - 1 K and C267 - .1 Mfd. added to H. V. assembly (Initial change).	C02	I. P.	C02	C01	I. P.	C01	I. P.	I. P.	I. P.	I. P.	I. P.
R269 - 1 K and C267 - .1 Mfd. added to H. V. assembly (Revised production).	C03	I. P.	C03	C02	I. P.	C02	C01	C01			
C206 - .0033 Mfd. changed to .0047 Mfd. (I-514 only)	C04	—	C04	—	—	—	—	—			
C261 - 10 Mfd. removed.	C04	I. P.	C04	C03	I. P.	C03	C02	C02			

CHASSIS VARIATIONS

CHASSIS	PICTURE TUBE	TUNERS VHF	TUNERS UHF	HALOLIGHT	MODELS
1-514-1	17YP4(Cyl.)	S. T.	—	No	105-14; 300
1-514-3	17YP4(Cyl.)	G. I.	—	No	Same as 1-514-1.
1-514-4	17YP4(Cyl.)	G. I.	G. I.	No	105-14; 300 ("U" Models)
1-520-1	21ZP4A(Spher.)	S. T.	—	No	120-20; 320; 325
1-520-3	21ZP4A(Spher.)	G. I.	—	No	Same as 1-520-1.
1-520-4	21ZP4A(Spher.)	G. I.	G. I.	No	120-20; 325 ("U" Models)
1-520-7	21EP4A(Cyl.)	S. T.	—	Yes	326
1-520-8	21EP4A(Cyl.)	G. I.		Yes	326 ("U" Models)

S. T. - Sarkes - Tarzian tuner.
G. I. - General Instrument tuner.
"U" Models - All-channel models designated BU, MU, etc.
Cyl. - Cylindrical faced; Spher. - Spherical faced.
I. P. - Change incorporated in initial production.

SUPPLEMENTARY SERVICE INFORMATION

July 17, 1953

Items 1, 2, 3 and 4 are incorporated in the chassis and identified by code change numbers as indicated in the following chart.

DESCRIPTION OF CHANGE	I-514-1	I-514-3	I-514-4	I-520-0	I-520-1	I-520-3	I-520-4	I-520-7	I-520-8
See Item 1.	C05	C01	C05	C01	C04	I. P.	C04	C03	C03
See Item 2.	C05	C01	C05	C01	C04	I. P.	C04	C03	C03
See Item 3.	C05	C01	C05	C01	C04	I. P.	C04	C03	C03
See Item 4.		C01	C05	C01		I. P.	C04		C03

I. P. - Change incorporated in initial production.

ITEM 1 SUBJECT: Code Changes as Noted in Above Chart.
REASON: Prevention of Possible Audio Interference in Horizontal Oscillator Circuit.
DESCRIPTION: C111 - .0047 Mfd., formerly across primary of T53, is reconnected from blue lead of T53 to +290V. (This change is incorporated on the initial 514/520 schematic on sheet 1.

ITEM 2 SUBJECT: Code Changes, as Noted in Above Chart.
REASON: Improved Video IF Response.
DESCRIPTION: R138 - 1,500 Ohm resistor is changed to 1,200 Ohms. (This component is included under "Early Production Parts Revisions" on sheet 1.)

ITEM 3 SUBJECT: Code Changes as Noted in Above Chart.
REASON: To Increase Wattage Tolerance.
DESCRIPTION: R269 - 1,000 Ohm 1/2 W. resistor is changed to 1,000 Ohm 1 W. resistor.

ITEM 4 SUBJECT: Code Changes as Noted in Above Chart.
REASON: Additional RF Filtering for Tuner B+ Lead.
DESCRIPTION: C114 - .0047 Mfd. capacitor is added and connected from junction of tuner B+ lead and R120-2.7K, to ground.

ITEM 5 SUBJECT: Addition of New Chassis.
DESCRIPTION: The following chassis should be added to the "Chassis Variations" chart on sheet 1.

CHASSIS	PICTURE TUBE	TUNERS VHF	TUNERS UHF	HALOLIGHT	MODELS
1-520-0	21EP4A(Cyl.)	G.I.	—	Yes	Same as 1-520-7. (326 Models)

All parts peculiar to 1-520-7 chassis are used in the 1-520-0 with the exception of the VHF tuner. This component is the same as that used in the 1-520-8 chassis.

ITEM 6 SUBJECT: Omission of Specific UHF RF Generator Setting on Sheet 2.
DESCRIPTION: In Oscillator Alignment section of "UHF Tuner Alignment", change step 4 to read, "Set UHF RF signal generator to 896 MC and adjust C28 on UHF tuner for maximum reading on VTVM."

Chassis 1-514-1,-3,-4
Models: All 105-14,300 series
Chassis 1-520-1,-3,-4,-7,-8
Models: All 120-20, 320, 325, 326 series

SYLVANIA
Chassis 1-514-1,-3,-4
Chassis 1-520-1,-3,-4, 1-520-7,-8

Technician
CIRCUIT DIGEST
132

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SYLVANIA
Chassis 1-514-1, -3, -4
Chassis 1-520-1, -3, 4, 1-520-7, -8

Technician
CIRCUIT DIGEST
132

ITEM 7 SUBJECT: Light Shield on 326 HaloLight Models.
DESCRIPTION: Order light shield, service part number 483-0019 when replacement of this item on 326 models becomes necessary.

ITEM 8 SUBJECT: Outer Knob and Dial Assemblies.
DESCRIPTION: The outer knob and dial assemblies for the various 514/520 models are outlined below by service part number.

743-0022: 1-514-3, -4 (105-14; 300 models)
1-520-0, -3, -4, -8 (120-20; 320; 325; 326 models)
743-0023: 1-514-1 (105-14 models only)
1-520-1, -7 (120-20; 320; 325; 326 models)
743-0024: 1-514-1 (300 models only)

(Note that the same models may contain different chassis. This condition necessitates a close check on chassis type when ordering this particular knob.

ITEM 9 SUBJECT: The parts list on sheet 1 should be revised as shown below.
REASON: To include parts changes noted in items 3, 4, 5 and 7 of this supplement.

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
	ADDITIONS	
C114	160-4700D 483-0019	0047 Mfd. - 500V. - Ceramic Shield - Light (326 Models)
	CHANGES	
*R269	182-0102	1,000 Ohm - 1W

SUPPLEMENTARY SERVICE INFORMATION

August 21, 1953

DESCRIPTION OF CHANGE	1-514-1	1-514-3	1-514-4	1-520-0	1-520-1	1-520-3	1-520-4	1-520-7	1-520-8
See Item 1.	—	C02	C06	—	C05	—	C05	—	C04
See Item 2.	—	C02	C06	—	C05	—	C05	—	C04
See Item 3.	—	C02	C06	—	C05	—	C05	—	C04
See Item 4.	—	C03	C06	—	C06	—	C06	—	C04

(—) Designates no change from previous issue.

ITEM 1 SUBJECT: Code Changes as Noted in Above Chart.
REASON: To Reduce Excessive Horizontal Drive.
DESCRIPTION: C259-.001 Mfd. mica capacitor is changed to 820 Mmfd. mica capacitor.

ITEM 2 SUBJECT: Code Changes as Noted in Above Chart.
REASON: To Improve Video Response.
DESCRIPTION: R150, R151 and R152-12,000 Ohm 2 Watt resistors are changed to new type units smaller physically than original type. This substitution effectively reduces the combined inductance of this resistor group; however, resistance and wattage ratings remain the same.

ITEM 3 SUBJECT: Code Changes as Noted in Above Chart.
REASON To Standardize Vertical Hold Control Types.
DESCRIPTION: R221-1.5 Megohm Vertical Hold control is changed to 2.0 Megohm control.

ITEM 4 SUBJECT: Code Changes as Noted in Above Chart.
REASON: To Improve Audio Performance.
DESCRIPTION: C111-.0047 Mfd. capacitor is changed to .015 Mfd. capacitor.

ITEM 5 SUBJECT: Change in Power Transformer Type.
REASON To Provide a More Satisfactory L.V. Rectifier Tube Mounting.
DESCRIPTION: Early production of 1-514 and 1-520 chassis substitute a new type power transformer, service part 141-0039 for the original transformer. This new transformer is electrically similar to the original but features an external bracket and socket assembly for the L.V. Rectifier Tube. (These components are included under "Early Production Parts Revisions" on Sheet 1.

ITEM 6 SUBJECT: Addition of 306 Model Series.
REASON: Revise the "Chassis Variations" chart on Sheet 1 as follows:

CHASSIS	PICTURE TUBE	TUNERS VHF	TUNERS UHF	HALOLIGHT	MODELS
1-514-3	17YP4 (Cyl.)	G.I.	—	No	105-14; 300; 306
1 514-	1 YP4 (Cyl.)	G I	G.I.	No	105-14; 300; 306 ("U" Models)

All parts peculiar to 306 models are listed in item 7 of this supplement.

ITEM 7 SUBJECT: Parts List Revisions on Sheet 1.
REASON: To include parts changes noted in items 1, 2, 3, 4 and 6 of this supplement

EFF CHASSIS SERIAL NO.	SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
		ADDITIONS (306 Models)	
		714-0025	Bezel Assembly
		715-0010	Bezel Lens
		760-0037	Cover-Interlock Assembly (Includes Line Cord)
		743-0022	Knob-Outlet and Dial Assembly
		415-0010	Plug-2 Prong-External Antenna Connector
		539-0802	Speaker-8" P M
		CHANGES	
514303-, 514406-, 520106-, 520406-, 520804-	C111	160-06115	.015 Mfd. -600V. -Molded Paper
514302-, 514406-, 520105-, 520405-, 520804-	C259	163-0820	820 Mmfd. -500V. -Mica
514302-, 514406-, 520105-, 520405-, 520804-	R150, R151, R152	189-0038	12,000 Ohm-2W.
514302-, 514406-, 520105-, 520405-, 520804-	R221	153-0018	Control-Vertical Hold (2 Megohm)

SUPPLEMENTARY SERVICE INFORMATION

November 6, 1953

Items 2 and 3 are incorporated in the chassis and identified by code change numbers as indicated in the following chart.

DESCRIPTION OF CHANGE	1-514-1	1-514-3	1-514-4	1-514-5	1-514-6	1-520-0	1-520-1	1-520-3	1-520-4	1-520-7	1-520-8
See Item 2.	C06	—	—	C00	C00	C02	—	C00	—	C04	—
See Item 3.	—	—	—	C01	C01	C02	—	C01	—	C04	—

(—) Designates no change from previous issue.

ITEM 1 SUBJECT: Change in Parts Coding Numbers of Revised Electrical Components.
DESCRIPTION: EFFECTIVE IMMEDIATELY, PARTS CODING NUMBERS OF ELECTRICAL COMPONENTS REVISED AFTER INITIAL PRODUCTION RUNS WILL CHANGE TO "DASH" VERSIONS OF THE INITIAL SERVICE SCHEMATIC PARTS CODING NUMBERS. For example, the parts coding for "R100" on the initial schematic diagram would change to "R100-1" on the first revision in value, "R100-2" on the second and so forth. This new system will follow through in all references to the subject component such as partial schematics, repair parts lists, and so on.

ITEM 2 SUBJECT: Chassis 1-514-1, C06; 1-520-0, C02; 1-520-7, C04.
REASON: As noted under Items 1, 2, 3 and 4 of Supplement 2 dated August 21, 1953.
DESCRIPTION: Items 1, 2, 3 and 4 of Supplement 2 have been incorporated in 1-514-1 TV chassis as code change C06.

In addition to revisions listed in Item 3 of this supplement, the aforementioned items have also been incorporated in 1-520-0 chassis as code change C02 and in 1-520-7 chassis as code change C04.

ITEM 3 SUBJECT: Code Changes as Noted in Above Chart
REASON: To Improve Horizontal Stability.
DESCRIPTION: The following component changes have been incorporated in the chassis noted in chart:

1. C202, .01 mfd capacitor changed to C202-1, .0047 mfd.
2. R204, 1.2 megohm resistor changed to R204-1, 2.7 megohms
3. R206, 470,000 ohm resistor changed to R206-1, 180,000 ohms.
4. R207, 56,000 ohm resistor deleted.
5. R209, 3,300 ohm resistor deleted.
6. R265, 180 ohm resistor changed to R265-1, 56 ohms.
7. R270, 120 ohm resistor added.

The partial schematic in Figure A illustrates wiring changes involved in these component revisions.

ITEM 4 SUBJECT: Addition of 301 Model Series and 1-514-5 and 1-514-6 Chassis.
DESCRIPTION: Revise the "Chassis Variations" chart on Sheet 1 as follows:

CHASSIS	PICTURE TUBE	TUNERS VHF	TUNERS UHF	HALOLIGHT	MODELS
1-514-5	17JP4 (Spher.)	G.I.	—	Yes	301
1-514-6	17JP4 (Spher.)	G.I.	G.I	Yes	301 ("U" Models)

The 1-514-5 and 1-514-6 TV chassis are electrically similar to other 514 chassis versions except for the HaloLight circuit and picture tube type. All parts peculiar to the 301 model series using these new chassis are listed in Item 5 of this supplement. The partial schematic in Figure B illustrates the HaloLight circuit used on 301 models.

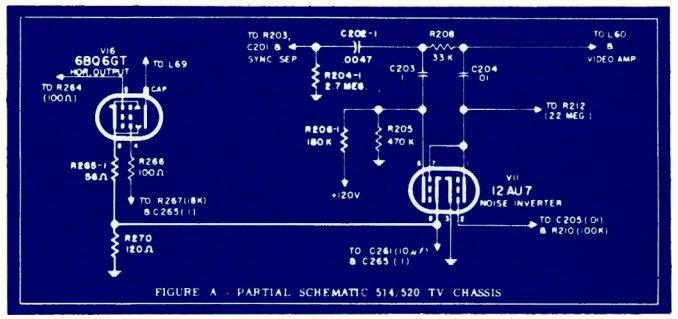

FIGURE A - PARTIAL SCHEMATIC 514/520 TV CHASSIS

ITEM 5 SUBJECT: Parts List Revisions on Sheet 1
REASON: To include parts changes noted in items 2, 3, 4 of this supplement.

EFF. CHASSIS SERIAL NO	SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
		ADDITIONS (301 MODELS/1-514-5, -6 CHASSIS)	
		714-0025	Bezel Assembly
		157-0028	Control - Dual & On/Off Switch
	R105		Volume
	R155		Brightness
	R149	153-3018	Control - Contrast
		760-0056	Cover - Interlock Assembly (Includes Line Cord)
		743-0023	Knob - Outer and Dial Assembly
		716-0009	Mask - 17" Spherical
		494-0015	Pulley and Sleeve Assembly (1-514-6 Chassis)
	R45	183-0224	Resistor - 220,000 Ohm - 2 W.
	R46	182-0124	Resistor - 120,000 Ohm - 1 W.
		483-0028	Shield - Light
		539-0802	Speaker - 8" PM
		571-0009	Switch - SPST Slide Type - HaloLight Control
	T29	141-0030	Transformer - HaloLight Power
		611-1701	Tube - Cold Cathode - HaloLight
	V20		Tube - 17JP4 - Picture Tube
		333-0048	Tuner Unit - VHF
		CHANGES	
514304-, 514501-, 514601-, 520002-, 520301-, 520704-	C202-1	160-04247	.0047 Mfd. - 400 V. - Molded Paper
514304-, 514501-, 514601-, 520002-, 520301-, 520704-	R204-1	181-0275	2.7 Megohm - 1/2 W.
514304-, 514501-, 514601-, 520002-, 520301-, 520704-	R206-1	181-0184	180,000 Ohm - 1/2 W
514304-, 514501-, 514601-, 520002-, 520301-, 520704-	R265-1	182-0560	56 Ohm - 1 W
		ADDITION	
514304-, 514501-, 514601-, 520002-, 520301-, 520704-	R270	183-0121	120 Ohm - 2 W
		DELETIONS	
514304-, 514501-, 514601-, 520002-, 520301-, 520704-	R207	181-0563	56,000 Ohm - 1/2 W
514304-, 514501-, 514601-, 520002-, 520301-, 520704-	R209	181-0332	3,300 Ohm - 1/2 W.

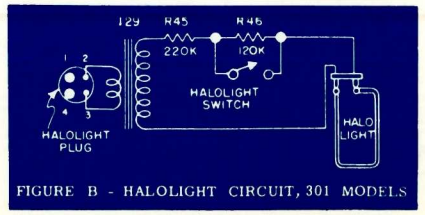

FIGURE B - HALOLIGHT CIRCUIT, 301 MODELS

SUPPLEMENTARY SERVICE INFORMATION

December 15, 1953

ITEM 1 SUBJECT: Addition of 321 Model Series and 1-520-5 and 1-520-6 Chassis
DESCRIPTION: The 1-520-5 and 1-520-6 TV chassis are electrically similar to other 520 chassis versions except for picture tube, VHF tuner, and HaloLight circuit. Parts peculiar to the 321 model series using these new chassis are listed in Item 8 of this supplement. The partial schematic in Figure A illustrates the HaloLight circuit used on 321 models. See chart in Item 2

ITEM 2 SUBJECT: Addition of 321-1 Model Series
DESCRIPTION: The 321-1 model series uses cabinets similar to the 321 series discussed in Item 1, however, 321-1 models utilize 1-520-0 and 1-520-7 chassis. Therefore, it is necessary to check chassis serial numbers when ordering parts for these particular models. See chart below

The following "Chassis Variations" chart is an up-to-date listing of all chassis and models added to the 514/520 series since initial production

CHASSIS	PICTURE TUBE	TUNERS VHF	TUNERS UHF	HALOLIGHT	MODEL SERIES
1-514-1	17YP4 (Cyl.)	S.T.		No	105-14, 300
1-514-3	17YP4 (Cyl.)	G I.		No	105-14, 300, 306
1-514-4	17YP4 (Cyl.)	G I	G I.	Yes	105-14, 300, 306, ("U" Models)
1-514-5	17JP4 (Spher.)	G.I.		Yes	301
1-514-6	17JP4 (Spher.)	G.I.	G.I	Yes	301 ("U" Models)
1-520-0	21EP4A (Cyl.)	G.I.		Yes	321-1, 326
1-520-1	21ZP4A (Spher.)	S.T.		No	120-20; 320; 325
1-520-3	21ZP4A (Spher.)	G.I.		No	120-20; 320; 325
1-520-4	21ZP4A (Spher.)	G.I	G.I.	No	120-20, 320, 325, ("U" Models)
1-520-5	21ZP4A (Spher.)	G I.		Yes	321
1-520-6	21ZP4A (Spher.)	G I.	G.I.	Yes	321 ("U" Models)
1-520-7	21EP4A (Cyl.)	S T		Yes	321-1; 326
1-520-8	21EP4A (Cyl.)	G I.	G.I.	Yes	326 ("U" Models)

Cyl. - Cylindrical Faced Picture Tube
Spher. - Spherical Faced Picture Tube
G.I. - General Instrument Tuner
S.T. - Sarkes Tarzian Tuner
"U" Models - All-channel (VHF/UHF) models designated BU, MU, etc.

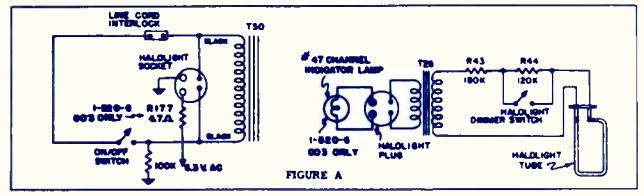

FIGURE A

DESCRIPTION OF CHANGE	1-514-1	1-514-3	1-514-4	1-514-5	1-514-6	1-520-0	1-520-1	1-520-3	1-520-4	1-520-5	1-520-6	1-520-7	1-520-8
See Item 3.	—	C05	C07	C02	C02	—	C07	—	C07	C01	C01	—	—
See Item 4.	—	C05	C07	C02	C02	—	C07	—	C07	C01	C01	—	—
See Item 5.	—	C06	C07	C03	C03	—	C07	—	C07	C02	C02	—	—
See Item 6.	—	—	C07	—	—	—	C07	—	C07	—	—	—	—
See Item 7. (1-520-6 only)	—	—	—	—	—	—	—	—	—	—	C03	—	—

(—) Designates no change from previous issue.

ITEM 3 SUBJECT: Code Changes as Noted in Above Chart.
REASON: To Increase Video IF Amplifier Sensitivity.
DESCRIPTION: R126 and R131, 47 ohm 20% resistors are changed to R126-1, 47 ohms 5% and R131-1 47 ohms 5%, respectivly

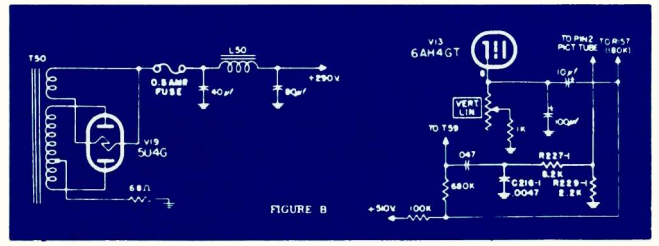

FIGURE B

ITEM 4 SUBJECT: Code Changes as Noted in Above Chart.
REASON: To Provide Additional Overload Protection.
DESCRIPTION: A 5 amp slow-blow fuse is added as illustrated in Figure B. This fuse is physically located near the existing .25 amp fuse and 5U4G rectifier tube and is readily accessible from the top of chassis

ITEM 5 SUBJECT: Code Changes as Noted in Above Chart.
REASON: Factory Change.
DESCRIPTION: The following component changes are incorporated in the chassis noted in chart and illustrated in the partial schematic in Figure B.

1. C215, .01 mfd capacitor deleted
2. C216, .0033 mfd. capacitor changed to C216-1, .0047 mfd
3. R227, 10,000 ohm 5% resistor changed to R227-1, 8,200 ohms 5%
4. R229, 470,000 ohm resistor chahged to R229-1, 2,200 ohms.

ITEM 6 SUBJECT. Chassis 1-514-4, C07, 1-520-1, C07; 1-520-4, C07
REASON. As noted in Items 3, 4 and 5 of this supplement and in Item 3 of Supplement 3 dated November 6, 1953
DESCRIPTION. Items 3, 4 and 5 of this supplement and Item 3 of Supplement 3 are code changes incorporated in 1-514-1 chassis as C07, in 1-520-1 chassis as C07 and in 1-520-4 chassis as C07

ITEM 7 SUBJECT: Chassis 1-520-6, C03,
REASON To Provide for Channel Indicator Light on 1-520-6 Models.
DESCRIPTION: R177, 4 7 ohm resistor is added and connected as shown in the partial schematic in Figure A. This change is effective only on 1-520-6 chassis coded C03

ITEM 8 SUBJECT: Parts List Revisions on Sheet 1.
REASON: To include parts changes noted in Items 1 to 7 of this supplement.

EFF. CHASSIS SERIAL NO.	SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
		ADDITIONS (321 MODELS/1-520-5, -6 CHASSIS)	
		714-0032	Bezel Assembly
		487-0026	Clip - HaloLight Tube Mounting
		760-0063	Cover - Interlock Assembly (Includes Line Cord)
		743-0023	Knob - Outer and Dial Assembly
		110-0006	Mask - 21" Spherical
	R43	183-0184	Resistor - 180, 000 Ohm - 2 W.
	R44	183-0124	Resistor - 120, 000 Ohm - 2 W.
		483-0029	Shield - HaloLight
		539-0802	Speaker - 8" PM
		571-0009	Switch - SPST - HaloLight Control
	T28	141-0030	Transformer - HaloLight Power
		611-2101	Tube - Cold Cathode - HaloLight
			Tube - 21ZP4A - Picture Tube
		333-0038	Tuner Unit - VHF
		CHANGES	
514305-, 514607-, 514502-, 514602-, 520107-, 520407-, 520501-, 520601-	R126-1	181-04705	47 Ohm - 1/2 W. - 5%
514306-, 514407-, 514503-, 514603-, 520107-, 520407-, 520502-, 520602-	R127-1	181-08225	8,200 Ohm - 1/2 W. - 5%
514306-, 514407-, 514503-, 514603-, 520107-, 520407-, 520502-, 520602-	R229-1	181-0232	2,200 Ohm - 1/2 W.
		ADDITIONS	
520603-	R177	189-0029	4.7 Ohm - 1 W. (Chassis 1-520-6 C03 only)
514305-, 514607-, 514502-, 514602-, 520107-, 520407-, 520501-, 520601-		191-0016	Fuse - .5 Amp. - Slow Blow
520603-		611-0047	Lamp - #47 (Chassis 1-520-6 C03 only)
		DELETION	
514306-, 514607-, 514503-, 514603-, 520107-, 520407-, 520502-, 520602-	C215	160-0411	.01 Mfd. - 400 V. - Molded Paper

ITEM 9 SUBJECT: Revision of Item 8 in Supplement 1 Dated July 17, 1953
DESCRIPTION: Service part numbers 743-0022 and 743-0023 are reversed in Item 8 of Supplement 1. A corrected and up-to-date portion of Item 8 follows. Note that the same model series may utilize different chassis. This condition necessitates a close check on chassis type when ordering an outer knob and dial assembly (channel selector knob).

743-0022: 1-514-1 (105-14 series only)
1-520-1, -7 (120-20; 320; 325; 326 models)

743-0023: 1-514-3, -4, -5, -6 (105-14; 300; 301; 306 models)
1-520-0, -3, -4, -5, -6, -8 (120-20; 320; 321; 321-1; 325; 326 models)

743-0024: 1-514-1 (300 series only)

ITEM 10 SUBJECT: Schematic Error in Figure A in Supplement 3 dated November 6, 1953.
DESCRIPTION: At V11 12AU7 Noise Inverter stage, the additional connections to pin 6 reading, "To C261 (10 mfd.) & C265 (.1)" should read, "To C262 (.47) & C265 (.1)". Capacitor C261, 10 mfd. was removed by code changes to the 514/520 chassis series early in production.

SUPPLEMENTARY SERVICE INFORMATION

March 1 1954

ITEM 1 SUBJECT: Addition of 401 Model Series.
DESCRIPTION: The 401 models are similar cabinet-wise and electrically to the 301 series. Utilizing the 1-514-5 and 1-514-6 TV chassis, the 401 series feature 17JP4 spherical picture tubes, G.I. tuners and HaloLight. When ordering parts for 401 models, refer to the model 301 parts listing in Item 8 of Supplement 3. This list is equally applicable to models in the 401 series.

ITEM 2 SUBJECT: Addition of 430 Model Series.
DESCRIPTION: The 430 models are similar cabinet-wise and electrically to the 320 series. Utilizing 1-520-1, 1-520-3 and 1-520-4 TV chassis, the 430 series feature 21ZP4A spherical picture tubes. Models using 1-520-1 chassis feature Sarkes-Tarzian tuners; models using 1-520-3 and 1-520-4 chassis feature G.I. tuners. The 430 models do not include HaloLight. All replacement parts listings for the 320 series apply also to the 430 series.

ITEM 3 SUBJECT: Addition of 421 Model Series.
DESCRIPTION: The 421 models are similar cabinet-wise and electrically to the 321 series. Utilizing the 1-520-5 and 1-520-6 TV chassis, the 421 series feature 21ZP4A spherical tubes, G.I. tuners and HaloLight. When ordering parts for 421 models, refer to the model 321 parts listing in Item 8 of Supplement 4. This list is equally applicable to models in the 421 series.

ITEM 4 SUBJECT: Addition of 425 Model Series.
DESCRIPTION: The 425 models are similar cabinet-wise to the 325 series. However, electrically the 425 series closely resembles the 321 and 421 series in that it utilizes 1-520-5 and 1-520-6 TV chassis, features a 21ZP4A spherical picture tube and HaloLight and uses G.I. tuners. When ordering parts for 425 models, refer to the model 321 parts listing in Item 8 of Supplement 4. This list is applicable except for speaker and interlock cover. These items peculiar to 425 models are listed in Item 9 of this supplement.

ITEM 5 SUBJECT: Addition of "Tinnerman" Compression Rings.
REASON: To Prevent Slippage of Knobs and Recessing of Dial.
DESCRIPTION: Later production chassis in the 514/520 series include compression rings placed over the UHF dial sleeve and over two control shafts - Brightness and Fine Tuning. These "Tinnerman" rings are designed to eliminate both knob slippage and recessing of the UHF dial. Item 9 of this supplement lists these rings by service part number.

ITEM 6 SUBJECT: Chassis 1-520-3, C03.
REASON: As noted in Items 3 and 4 of Supplement 4 dated December 15, 1953.
DESCRIPTION: Items 3 and 4 of Supplement 4 are code changes incorporated in 1-520-3 chassis as C03.

ITEM 7 SUBJECT: Chassis 1-514-5, C04; 1-514-6, C04; 1-520-3, C03; 1-520-5, C04; 1-520-6, C04
REASON: To Improve Horizontal Scan.
DESCRIPTION: V16 (6BQ6GT) Horizontal Output tube is changed to type 6CU6. No revision in wiring is involved in this change. (Note: a limited number of 1-520-6 chassis were coded C03 to designate addition of a channel indicator light as described in Supplement 4. Chassis 1-520-5 by-passes the C03 designation, proceeding from C02 to C04).

ITEM 8 SUBJECT: Repair Parts List Error on Sheet 1.
DESCRIPTION: Under "Miscellaneous Electrical Parts", change part number of de-emphasis plate to 190-0013.

ITEM 9 SUBJECT: Parts List Revisions on Sheet 1.
REASON: To include parts changes noted in items 4, 5, 6 and 7 of this supplement.

EFF. CHASSIS SERIAL NO	SCHEMATIC LOCATION	SERVICE PART NO.	DESCRIPTION
		ADDITIONS (425 MODELS)	
		760-0063	Cover - Interlock Assembly (Includes Line Cord)
		539-0802	Speaker - 6 1/2" P.M.
		MISCELLANEOUS CABINET PART ADDITION	
		486-0010	Insulator - Volume Control Knob
		MISCELLANEOUS CHASSIS PART ADDITIONS	
		554-0029	Ring - Compression (Brightness Control)
		554-0030	Ring - Compression (Fine Tuning Control)
		554-0031	Ring - Compression (UHF Dial Sleeve)
		CHANGES	
520302-	R126-1	181-04705	47 Ohm - 1/2 W. - 5%
520302-	R131-1	181-04705	47 Ohm - 1/2 W. - 5%
520302-	R227-1	181-08225	8200 Ohm - 1/2 W. - 5%
520302-	R229-1	181-0222	2200 Ohm - 1/2 W.
520302-	C216-1	162-04247	.0047 Mfd. - 400 V. - Paper
514504-, 514604-, 520303-, 520504-, 520604-	V16		Tube - 6CU6 - Horizontal Output
		DELETION	
520302-	C215	160-0411	.01 Mfd. - 400 V. - Molded Paper

TECHNICIAN
CIRCUIT DIGESTS

Fig. 41. Schematic Diagram Chassis 20M20 & 20M20U.

The 19M20, 19M21, 19M22, 20M20 and 20M21 chassis . . . . . are basically alike. Alignment and adjustment procedures are identical. The 20M series is similar to the basic 19M series except for the horizontal output tube, an additional 5U4G rectifier and a 18KV high voltage for the picture tube. The main differences between chassis are in the type of tuner and picture tube size.

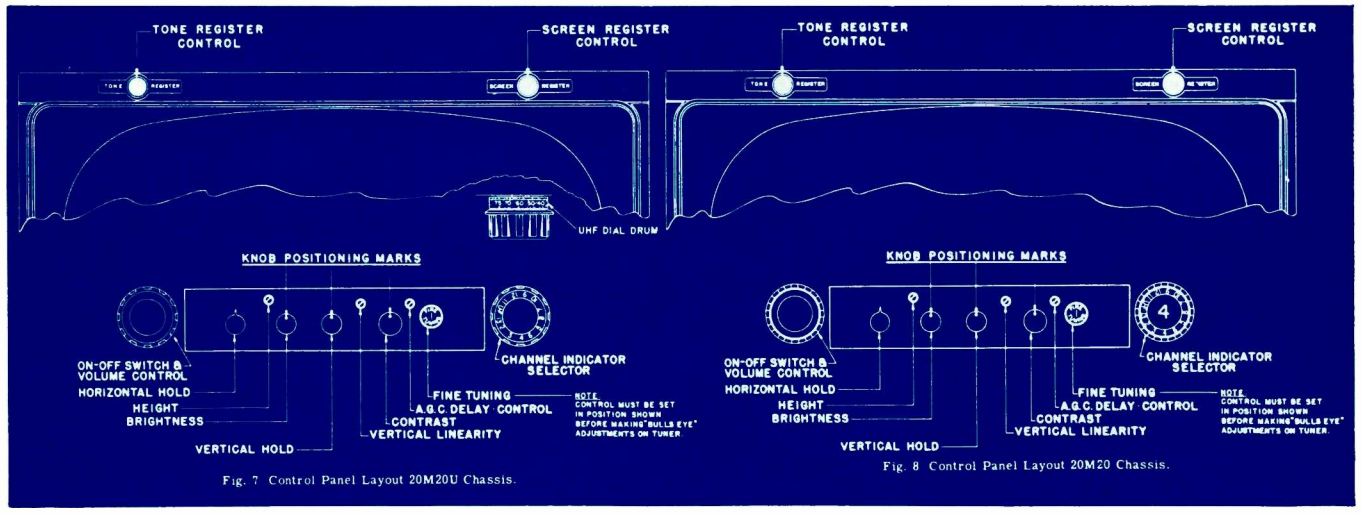

Fig. 7 Control Panel Layout 20M20U Chassis.

Fig. 8 Control Panel Layout 20M20 Chassis.

SCREEN REGISTER, 20M SERIES. This control is used to vary the response of the video amplifier much the same as a tone control varies the audio response. Clockwise rotation accentuates the high frequencies thus adding crispness to the picture, particularly old films, etc. Counter-clockwise rotation of this control is instrumental in reducing the ringing effect (halos, etc.) of certain transmissions and is particularly useful in fringe areas where some smearing of the snow and noise results in a much improved picture. Under normal conditions the setting of the control is usually near the maximum clockwise position. MISADJUSTMENT OF THIS CONTROL ON A NORMAL PICTURE MAY RESULT IN A SMEARED OR OTHERWISE INFERIOR PICTURE.

TONE REGISTER, 20M SERIES. This control, which consists of a 1 Megohm potentiometer and a .004 Mfd capacitor across the audio detector output, is to be adjusted to the user's preference. Clockwise rotation accentuates the high audio frequencies while counter-clockwise rotation accentuates the lows. In fringe or noisy areas, the tone control may be effectively used in the reduction of background noise which may accompany the sound.

VERTICAL LINEARITY CONTROL: The Vertical Linearity Control is in the cathode circuit of the vertical output tube and is used to shift the operating point of the tube so that the sweep is amplified along that portion of the plate current curve which results in a linear output.

HORIZONTAL LINEARITY CONTROL: The Horizontal Linearity Control should be adjusted for best horizontal symmetry while observing a test pattern on the screen. The position of the horizontal drive and width controls also affect linearity and possible interaction of these controls must be taken into consideration when making linearity adjustments.

FRINGE LOCK ADJUSTMENT

1. Turn the fringe lock control fully clockwise and then back it off approximately 1/4 turn. Adjust the vertical and horizontal hold controls and check operation of the receiver to see that it syncs normally when the turret is switched from channel to channel.

2. If the picture jitters or shows evidence of delay, tearing, split phase, etc., back down the fringe lock control further, a few degrees at a time, each time re-adjusting the hold controls and switching from channel to channel until normal sync action is obtained. It will be found that under normal signal conditions, the correct adjustment will be near the counter-clockwise position of the control.

3. In fringe and noisy areas, the best adjustment will be found at or near the maximum clockwise position of the control, however, do not automatically turn the fringe lock fully clockwise in fringe areas as has been done on previous models. Always follow the procedure outlined.

AGC ADJUSTMENTS

IMPORTANT: THE AGC CONTROL CANNOT BE USED IN ANY WAY TO IMPROVE THE RECEIVER SENSITIVITY. The sole function of this control is to set the level applied to the video amplifier (12BY7) tube so that the output of this tube is approximately 100 volts peak (100% modulated video signal) for application to the picture tube cathode.

The adjustment can also be made by connecting a calibrated oscillo-scope through a 10K isolation resistor, to test point "D" . . . . . and, while receiving the strongest TV signal adjust the AGC delay control for 2.75 volts peak output.

Satisfactory adjustment can also be made by observing the picture and slowly turning the AGC delay control from its maximum clockwise position, counterclockwise until a point is reached where the picture distorts and buzz is heard in the sound. The control should then be turned slowly clockwise and set at a point comfortably below this level of intercarrier buzz, picture distortion and improper sync.

CAUTION: Misadjustment of the AGC delay control can result in a washed-out picture, distorted picture, buzz in sound OR COMPLETE LOSS OF PICTURE AND SOUND.

AFC ADJUSTMENT

The AFC adjustment can effectively be made by setting the horizontal hold control L21 to a position where it is virtually impossible to "throw" the receiver out of horizontal sync when switching from channel to channel.

METAL WRAPPED RESISTORS

In servicing the TV receiver, the serviceman will find several circuits in which metal wrapped resistors are used. The metal wrapping dissipates much of the resistor heat and doubles the wattage rating. In replacing a resistor care should be used to mount it as the original. If the metal mounting clamp is discarded, the resistor wattage must be doubled.

NOTES
ALL VOLTAGES MEASURED FROM CHASSIS TO POINTS INDICATED
ALL VOLTAGES ARE D.C. UNLESS OTHERWISE SPECIFIED
ALL D.C. VOLTAGES TO BE MEASURED WITH VACULUM TUBE VOLTMETER HAVING 11 MEGOHM INPUT RESISTANCE.
ALL VOLTAGE MEASUREMENTS TO BE MADE WITH NO SIGNAL PRESENT, NORMAL SETTING OF CONTROLS & CHANNEL SELECTOR SET TO 2 UNLESS OTHERWISE SPECIFIED.
ALL CONDENSER VALUES IN MICROFARADS UNLESS OTHERWISE SPECIFIED
ALL RESISTORS ± 20% TOLERANCE UNLESS OTHERWISE SPECIFIED
ALL CONDENSER CAPACITY TOLERANCE ±20% UNLESS OTHERWISE SPECIFIED
RESISTANCE MEASUREMENTS SHOWN WITH COILS DISCONNECTED FROM CIRCUIT
COIL RESISTANCES NOT GIVEN ARE UNDER ONE OHM
CATHODE RAY TUBE 2NU ANODE VOLTAGE TO BE MEASURED WITH ELECTROSTATIC OR 20K MIN OHM PER VOLT HIGH VOLTAGE METER
ARROWS ON POTENTIOMETERS INDICATE CLOCKWISE ROTATION
(A) ALIGNMENT POINTS → CIRCLED ALPHABETS INDICATE ALIGNMENT AND TEST POINTS

TUBE COMPLEMENT

20M20 CHASSIS

SYMBOL	TUBE	FUNCTION
V1	6BK7A	RF Amplifier
V2	6U8	V2A Mixer
		V2B RF Osc.
V3	6CB6	1st IF Amplifier
V4	6CB6	2nd IF Amplifier
V5	6CB6	3rd IF Amplifier
V6	12BY7	Video Amplifier
V7	6AU6	Sound Limiter
V8	6BN6	Audio Detector
V9	6BK5	Sound Output
V10	12AX7	V10A AGC Amp.
		V10B Vert. Osc.
V11	6CS6	Sync Clipper
V12	6AH4GT	Vertical Output
V13	6AQ7GT	V13A Horiz. Phase Det.
		V13B Horiz. Control
V14	6SN7GT	V14A Horiz. Osc.
		V14B Horiz. Disch.
V15	6CD6G	Horiz. Output
V16	1B3GT	High Voltage Rect.
V17	6AX4GT	Damper
V18	5U4G	Low Voltage Rect.
V19	5U4G	Low Voltage Rect.
V20	21EP4A or B	Picture Tube

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133

Chassis 20M20, 20M20U
Models: M2237R, M2260R, M2261E, M2267Y

June • 1954

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CIRCUIT DIGESTS

In This Issue (No. 22)

Circuit Digest No.

RCA (Color Receiver) 131
Chassis CTC2: Model CT-100

SYLVANIA 132
Chassis 1-514-1,-3,-4: Models—All 105-14, 300 series
Chassis 1-520-1,-3,-4,-7,-8: Models — All 120-20, 320, 325, 326 series

ZENITH 133
Chassis 20M20, 20M20U: Models M2237R, M2260R, M2261E, M2267Y

22

For complete Index to all earlier Circuit Digests, see main section of magazine

ALIGNMENT

A suitable VHF and UHF sweep generator in conjunction with an accurate marker must be used for alignment work. It is very important to have the sweep generator output cable properly terminated and to check whether or not its attenuator is reactive. If the attenuator is reactive or if the output cable is improperly terminated, correct alignment cannot be made since the degree of attenuation then may change the shape as well as the amplitude of the response curve. The position of the attenuator should only vary the amplitude and not the shape of the response curve.

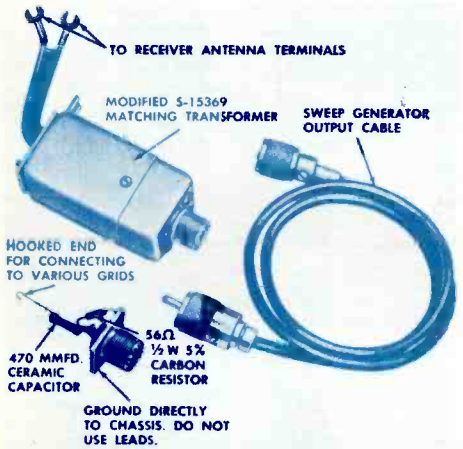

Fig. 22 IF-RF Alignment Fixtures

CALIBRATING THE OSCILLOSCOPE

When aligning the RF and IF stages of the receiver, it is necessary to measure detector peak output.

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133

This may be done with a voltage calibrator used in conjunction with an oscilloscope. If a calibrator is not available, the oscilloscope can be calibrated with a known DC voltage. To make the calibration, connect the ground lead of the vertical input cable to the negative side of a 3 volt battery supply. Turn the horizontal gain control fully counterclockwise. With the "hot" lead, make a momentary contact to the positive connection on the battery and observe the instantaneous spot deflection on the screen. Discharge the scope input capacitor by shorting out the leads and repeat the procedure, each time readjusting the scope vertical gain until the spot deflects 3 large divisions on the screen. Each division then represents 1 volt peak. The position of the vertical gain control should be marked for future reference.

SOUND ALIGNMENT

Proper alignment of the 4.5 Mc intercarrier sound channel can only be obtained if the signal to the receiver antenna terminals is reduced to a level below the limiting point of the 6BN6 Gated Beam Detector. This level can be easily identified by the "hiss" which then accompanies the sound.

Various methods may be used to reduce the signal level, however, it is recommended that a step attenuator similar to the S-17203 unit be used for most satisfactory results.

1. Connect the step attenuator between the antenna and the receiver antenna terminals.

2. Tune in a tone modulated TV signal and adjust the step attenuator until the signal is reduced to a level where "hiss" is heard with the sound.

3. Adjust the sound take-off coil L17 (top and bottom slugs), intercarrier coil L19, quadrature coil L20 and buzz control R32 for the cleanest sound and minimum buzz. It must be remembered that any of these adjustments may cause the "hiss" to disappear and further reduction of the signal will be necessary so that the "hiss" does not disappear during alignment.

If intercarrier buzz is in evidence, after all normal sound adjustments have been made, the cause may be attributed to one or more of the following:

1. Improper adjustment of the AGC delay control.
2. Defective 6AU6 sound limiter.
3. Extremely high signal levels which require attenuation in the antenna circuit.
4. Transmitter over modulation.

VIDEO IF ALIGNMENT

1. Connect the negative lead of a 2 volt battery supply to terminal "E" . . . . . and the positive lead to chassis. The bias supply should be made variable so that it can be varied from negative 3 volts to positive 3 volts. Keep the supply leads short.

2. Connect the calibrated oscilloscope through a 10,000 ohm isolation resistor between terminal "D" and chassis. The sweep generator input to the receiver should be adjusted for 3 volts peak to peak detector output. Do not exceed this output level during any of the adjustments.

3. Feed the output from the sweep generator through the special termination unit shown in Fig. 22 to point "C" (Pin 1 of 6CB6, 3rd IF). Adjust the generator until a pattern similar to Fig. 23 is obtained.

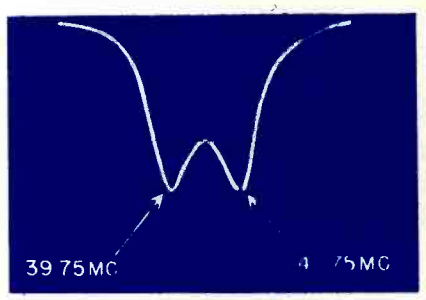

Fig. 23 4th IF Response.

4. Set the Marker Generator to 45.75 Mc and alternately adjust the top and bottom slugs of the 4th IF transformer for maximum gain and symmetry with the 45.75 Mc markers positioned as shown in Fig. 23 The 39.75 Mc marker can be within ±0.5 Mc of the specified frequency. If the correct response curve cannot be obtained in this step, check the position of the two slugs to see that they are entering their respective coils from the opposite ends of the coil form. The position of the slugs near the center of the coils may change the coefficient of coupling, making correct alignment difficult if not impossible.

5. Connect the sweep generator cable to terminal "A" (Mixer Grid). In this step it may be necessary to temporarily reduce the bias to zero or even to go to a slightly positive voltage in order to see the highly attenuated trap slots with the oscilloscope vertical gain near maximum.

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133

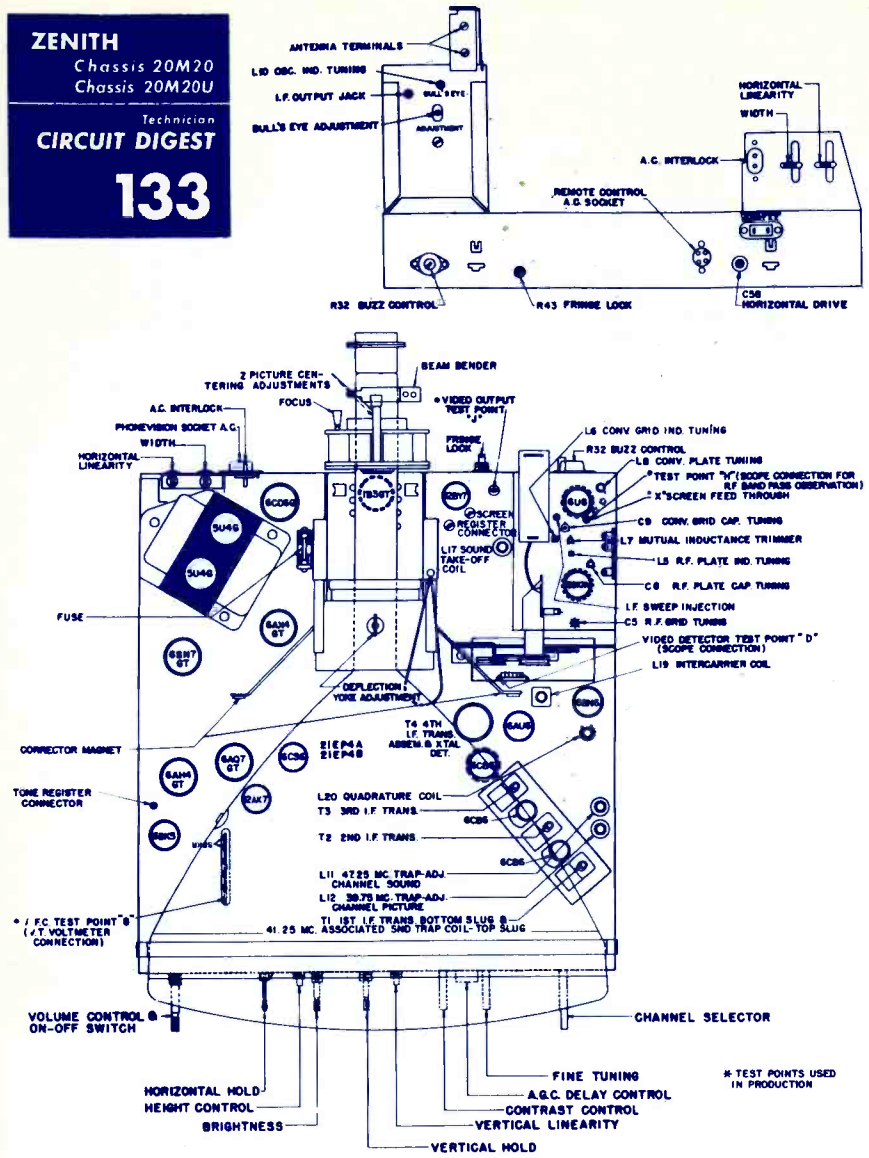

Fig. 13 Tube And Trimmer Layout 20M20, 20M20Z, 20M20U & 20M20UZ Chassis.

6. Adjust the 47.25 Mc, 41.25 Mc and 39.75 Mc traps for minimum marker amplitude, See Fig. 24. It can be seen that maximum oscilloscope gain has been used and as a result the top of the response curve has been "run off" the oscilloscope screen in order to see a "blow-up" of the trap slots.

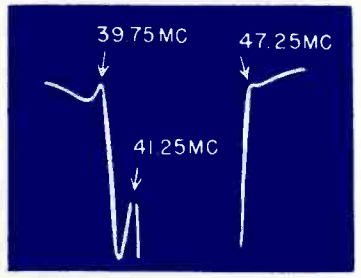

Fig. 24 Exploded View of Trap.

7. Readjust the bias to -2 volts and set the oscilloscope vertical gain to the calibrated position. Adjust the sweep generator for a 3 volt peak to peak output from the video detector.

8. With the test equipment set up as in Step 7, alternately adjust the 2nd IF, 3rd IF, 1st IF and the converter plate coil until an overall response curve similar to Fig. 25 is obtained. Do not adjust the 4th IF in this step. It will be found that the 2nd IF affects the low side (42.75 Mc) and the 3rd IF the high side of the response curve.

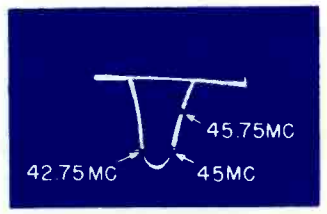

Fig. 25 Overall IF Response. (It is possible to erroneously obtain an RF response in this step. If the proper response is obtained switching the turret from channel to channel or between channels will have no noticeable effect on the response shape).

TURRET TUNER ALIGNMENT

The RF chassis adjustments have been made at the factory and normally do not require readjustment in the field unless tampered with. If adjustment becomes necessary check the overall IF response and proceed as follows:

1. Temporarily ground the turret AGC by connecting a jumper between the AGC bus (yellow lead) and chassis.

2. Connect the calibrated oscilloscope to the feed through terminal "H" . . . . through a 10K isolation resistor. This terminal is the screen of the 6U8 mixer.

3. Use the S-15369 matching transformer (Fig. 22) and feed the output from the sweep generator to the antenna terminals of the receiver.

4. Turn the channel selector to Channel 4 and adjust the sweep generator until a response curve somewhat similar to Fig. 26 is obtained.

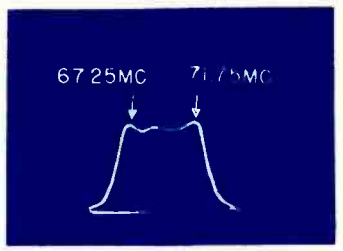

Fig. 26 Channel 4 RF Response.

5. . . . . adjust the converter grid capacitor (C9), the RF plate capacitor (C8) and the RF grid capacitor (C5) until a response curve similar to Fig. 26 is obtained.

6. Turn the channel selector to Channel 11 and adjust the sweep generator until a response somewhat similar to Fig. 29 is obtained. Adjust L5 and L6 to obtain symmetry. If the band pass is too great or too narrow also adjust L7.

7. Repeat steps 5 and 6 until the best overall symmetry is obtained. REMOVE AGC JUMPER.

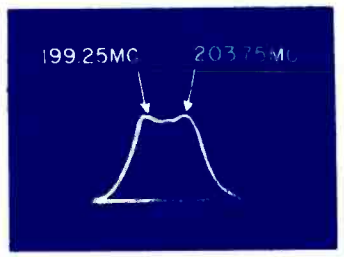

Fig. 29 Channel 11 RF Response.

MASTER OSCILLATOR ALIGNMENT

The master oscillator adjustment is to be made only if resonance cannot be obtained with the strip oscillator adjustment wrench with the fine tuning control in its center position, and after it has been determined that the channel strip itself is not at fault.

If channels 2 through 6 can be made to resonate with the bull's-eye adjustment at the rear of the turret and the high channels do not resonate, a slight readjustment of the oscillator inductance L10 . . . . . may be necessary to affect resonance on the high channels.

If the fine tuning capacitor is replaced, proper alignment of the fine tuning mechanism can be made as follows:

1. Remove the turret from the chassis.

2. Insert an allen wrench through the opening on top of the tuner and loosen the set screw. Leave the allen wrench in, partially slide out the shaft and tape it to prevent the stop mechanism from falling out or being turned out of position.

3. Unsolder the tuning capacitor lead replace capacitor and re-assemble bracket on the RF chassis. DO NOT TIGHTEN ALLEN HEAD SCREW.

4. Use a sweep generator on Channel 3 or tune in a station on the lowest available channel and turn the turret shaft until resonance is obtained. This should be approximately 2-1/4 turns from either end of the fine tuning capacitor range. Turn the collar until the allen head screw is straight up as viewed through the opening and tighten screw.

5. Check the fine tuning knob to see that it is in the center of its mechanical range.

6. Insert the dial cord pulley over the turret shaft and tighten set screw. If the set screw is in a position where it is difficult to tighten, the fine tuning shaft can be held in place and the pulley can be made to slip the dial cord until the pulley is in a position where the set screw is readily accessible.

7. It may be necessary to readjust the oscillator inductance L10 . . . . . for proper bull's-eye operation on the high channels (7-13).

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ADVERTISERS INDEX
JUNE, 1954

American Phenolic Corp. 53
Astatic Corp. 47
Astron Corp. 35

Bullet Electronics Corp. 4

CBS-Hytron Div., Columbia Broadcasting System, Inc. 37
Caldwell-Clements, Inc. 58
Century Electronics Co. 51
Channel Master Corp. 12
Clear Beam Antenna Corp. 45
Cornell Dubilier Electric Corp. 51
Crosley Div., Avco Manufacturing Corp. 6

Erie Resistor Corp. 56

General Electric Co. 9
General Industries Co. 53

International Rectifier Corp. 54
International Resistance Co. ... Cover 2

Jensen Manufacturing Co. 2

Karyall Body, Inc. 56
Kester Solder Co. 60

Madisco, Inc. 63
Magnavox Co. 63
Mallory & Co., Inc., P. R. 10
Miller Sales, Ken 56
Moss Electronic Distributing Co., Inc. 60

Philco Corp. 43
Precision Apparatus Co., Inc. 33

Radiart Corp. 8
Radio Corp. of America 5, 55, 57, 59, Cover 4
Raytheon Manufacturing Co. 3

South River Metal Products Co., Inc. 41
Sprague Products Co. ..... Cover 3
Sylvania Electric Products Inc. 11, Section Two, pp. 2 & 8

Technical Appliance Corp. 39
Telrex, Inc. 64
Tung-Sol Electric Inc. 48, 49

Walsco Electronics Corp. 7

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2C103	200 @ 250	78957	TVL-1542
2C104	200 @ 250	78957	TVL-1542
2C105	80 @ 450	18950	TVL-1735
2C106	80 @ 450	18950	TVL-1735
2C107	1000 @ 3 (Non-Polarized)	72611	TVL-1040
2C191	20+20+20 @ 450/100 @ 50	78946	TVL-4740
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C31	10 @ 475/4 @ 350/40 @ 50	22-2546	TVL-3807
C38	80+40+10 @ 400/20 @ 25	22-2547	TVL-3792 TVA-1205
C65	10 @ 475/40 @ 400/4 @ 350/100 @ 50	22-2479	TVL-4805
C67	4 @ 350/40 @ 25	22-2560	*TVL-3603
C68	80+40+30 @ 400	22-2437	**TVL-4670

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SYLVANIA CHASSIS 1-514, 1-520

Symbol No.	Rating MF @ Volts	Sylvania Part No.	Sprague Replacement
C105	2 @ 50	161-1001	TVA-1301
C109	2 @ 50	161-1001	TVA-1301
C110	20 @ 300/100+100 @ 200	161-3017	TVL-3561
C112	40 @ 400/100 @ 50	161-2005	TVL-2653
C175	80+40 @ 400	161-2004	TVL-2675
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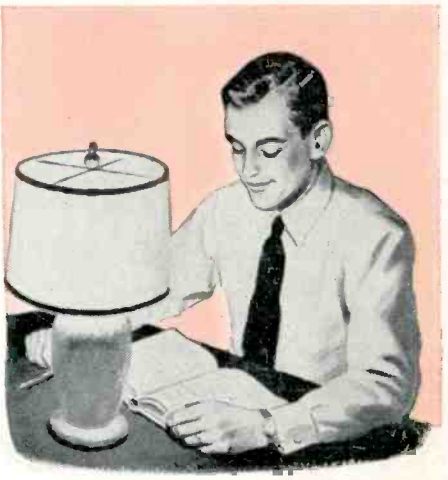

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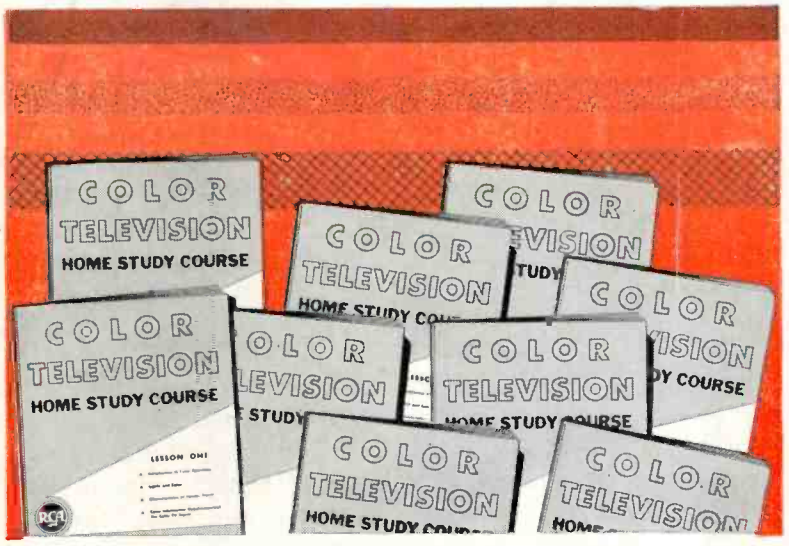

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