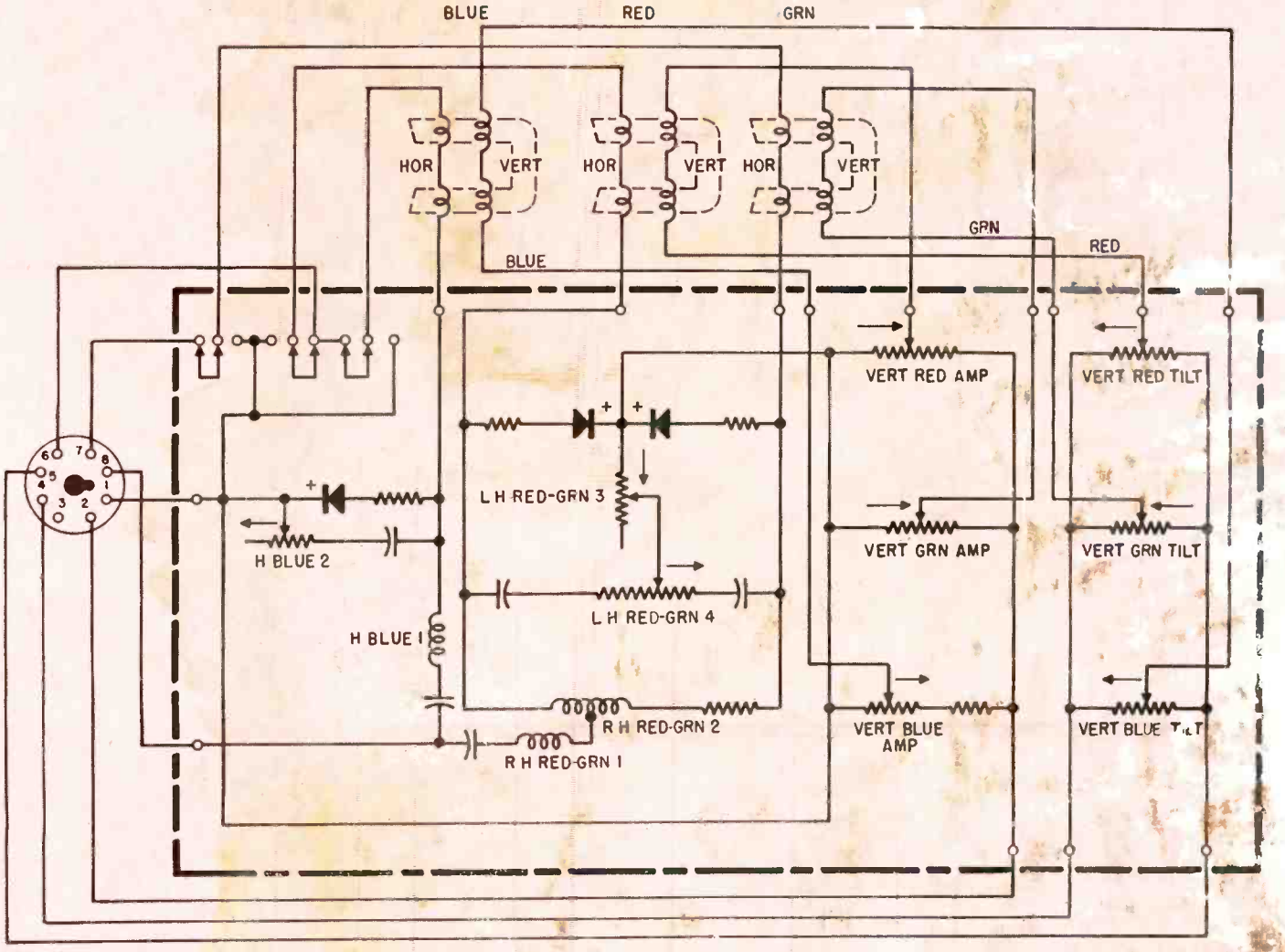
OCTOBER, 1957

COLOR TELE VISION

SERVICE

THE TECHNICAL JOURNAL OF THE TELEVISION-RADIO TRADE



Semiconductor dynamic convergence circuit developed for glass 21-inch tube color-TV receivers.

See circuit analysis, this issue

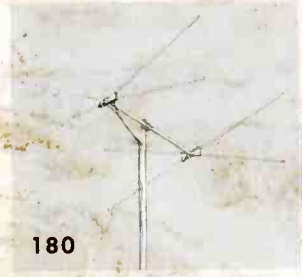
MODEL 280SW *(shown right)*

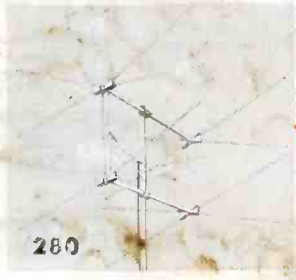
- Double stacked array PLUS high frequency elements.
- All Aluminum Construction.
- Mounts on any mast up to 1¾".
- QUICK-RIG design for speedy one man installation.
- Complete with stacking bars.

MODEL 180SW .... same as 280SW only not double stacked.

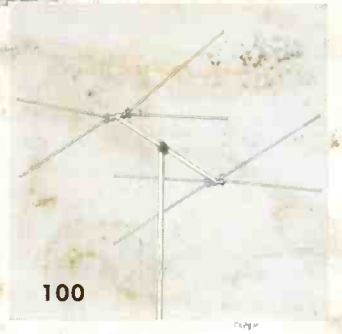
MODEL 180 .... QUICK-RIG 8 element "Lazy-X" Conical.

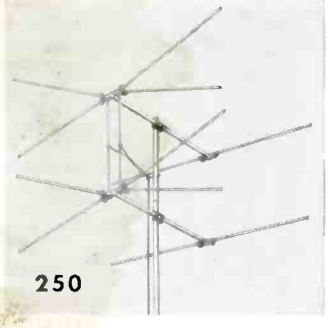
MODEL 280 .... QUICK-RIG double stacked "Lazy-X" Conical.





12 NEW RADIART TV ANTENNAS



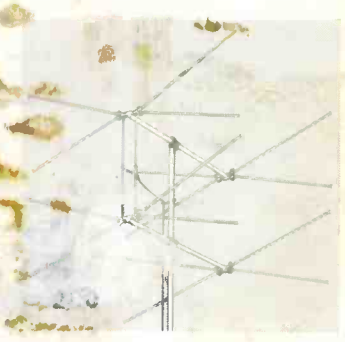


Proven Unquestionably . . .

the best performing at

the lowest possible price!

RADIART . . . the name you can depend upon for QUALITY and VALUE . . . offers a COMPLETE and NEWLY ENGINEERED line of superbly performing TV antennas at an economy price. Carefully tested under all conditions . . . each of these new models is guaranteed to be the best performing at the lowest possible price.



LZX 100 single array

LZX 101 single array, unassembled

LZX 200 8 element conical completely assembled, stacked array

LZX 201 8 element conical unassembled, stacked array

LZX 150 single array

LZX 151 single array, unassembled

LZX 250 6 element conical assembled, stacked array

LZX 251 6 element conical unassembled, stacked array

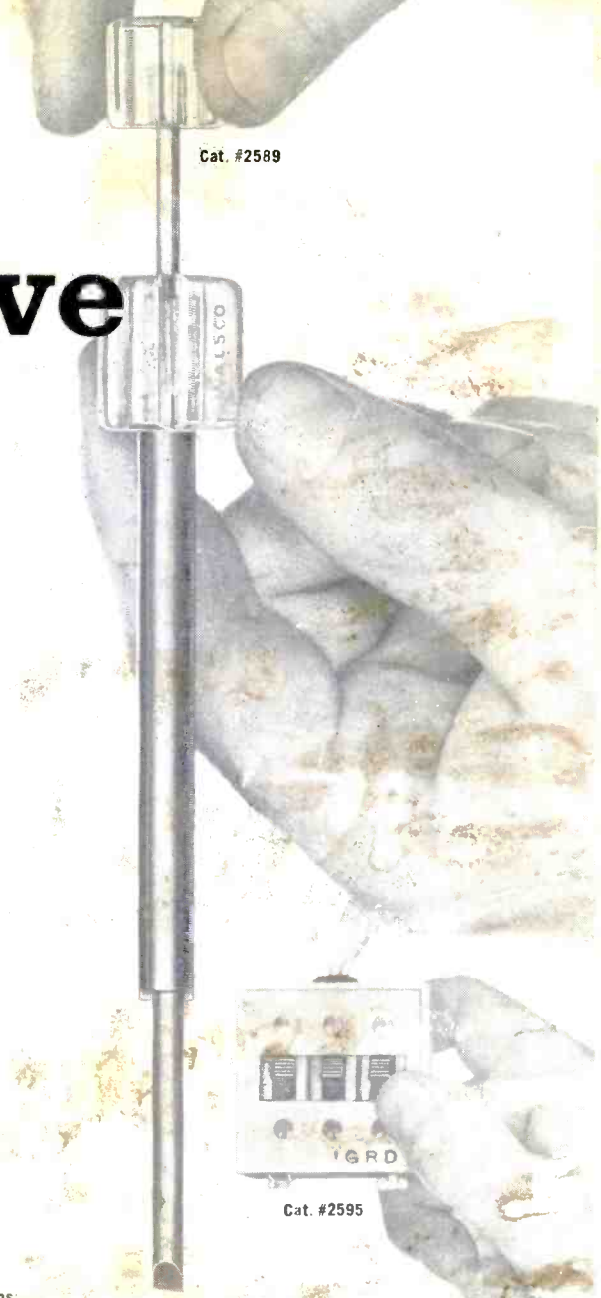
SUBSIDIARY OF AVCO MANUFACTURING CORPORATION

THE RADIART CORPORATION / CLEVELAND 13, OHIO

To install or service COLOR-TV...

you must have these 5 new Walsco tools

Cat. #2548



Cat. #2589

Specially designed . . . absolutely essential to make Color-TV servicing easy and profitable!

Cat. #2548 NEW WALSCO COLOR-TV INTERLOCK CHEATER.
Lets you service color sets with rear panel removed. Blocks grounding of high voltage supply. Special design permits safe insertion of high voltage probe. **Net 59¢**

Cat. #2590 NEW WALSCO COLOR-TV DEGAUSSING COIL.
Required to eliminate stray magnetic fields prior to purity adjustments. Made to standard industry specifications, enclosed in molded plastic cover. Monentary switch safely de-energizes coil without pulling plug.
Cat. #2590 with monentary switch. . **Net $16.90** Cat. #2591 without switch . . **Net $14.90**

Cat. #2589 NEW WALSCO COLOR-TV ALIGNMENT TOOL.
Adjusts and aligns all concentric controls on color, as well as black-and-white sets. Makes two separate adjustments at the same time: outer shaft aligns outer control shaft, inner shaft aligns inner control shaft. **Net $1.19**

Cat. #2595 NEW COLOR-TV GRID GROUNDING BOX.
Essential for grounding controlled grids of color tube to permit convergence and matrix adjustments. Special "insulation piercing" terminals make application easy. **Net $5.10**

Cat. #2596 NEW WALSCO TV COLOR VIEWER.
Balanced optical filters speed accurate color phase and matrix adjustments on all color TV sets without using an oscilloscope. **Net $1.50**

Cat. #2595

Cat. #2590

Cat. #2596

FREE!
Special folder explaining how to use these Walsco Color-TV tools. Ask your jobber or write direct.

Walsco
ELECTRONICS MANUFACTURING COMPANY
a Division of Textron, Inc.
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Vol. 26 No. 10 OCTOBER, 1957

26th YEAR OF CONTINUOUS PUBLICATION

SERVICE

THE TECHNICAL JOURNAL OF THE TELEVISION-RADIO TRADE
Including RADIO MERCHANDISING and TELEVISION MERCHANDISING
Registered U. S. Patent Office

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CIRCUIT DIAGRAMS

DEPARTMENTS

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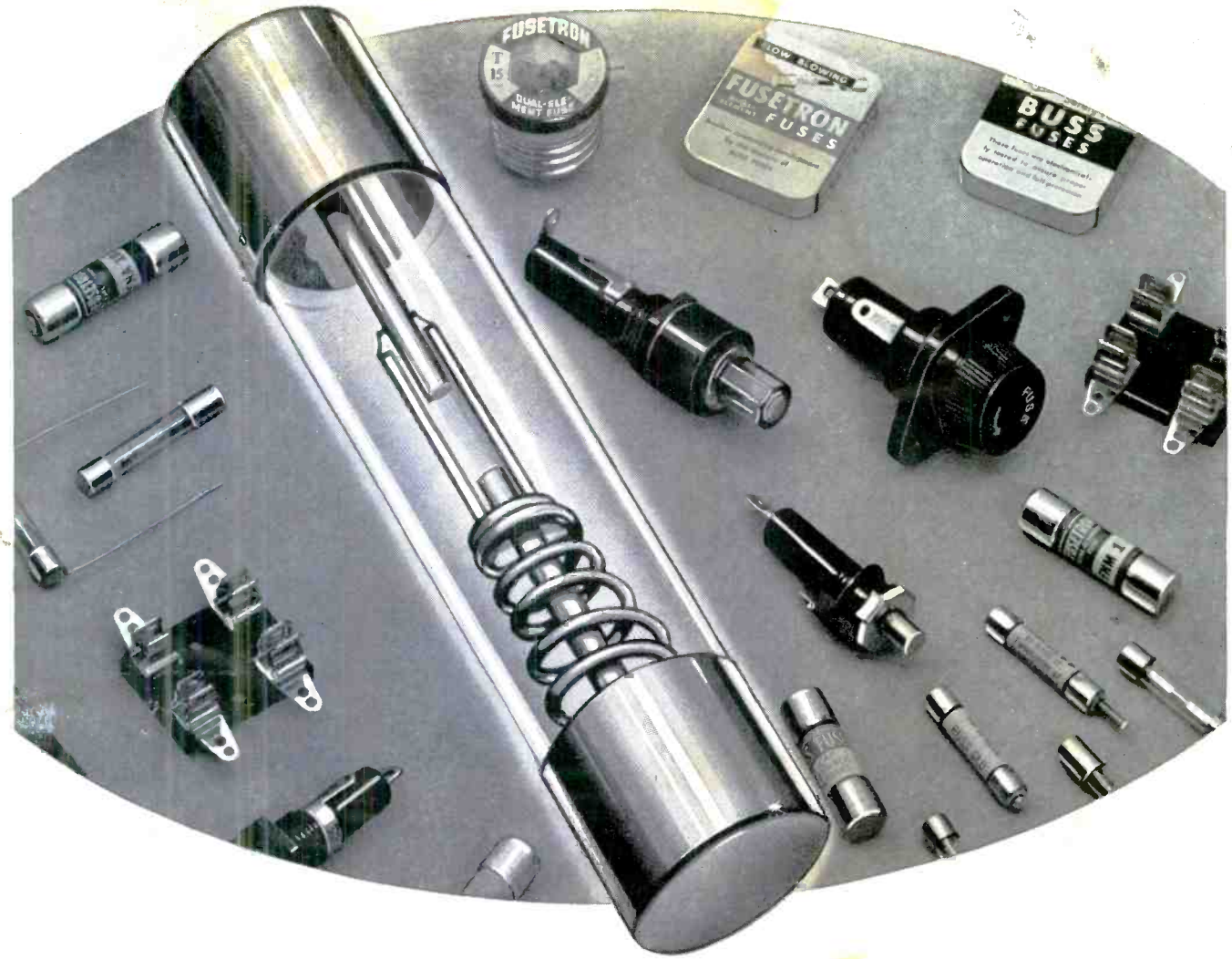


Save Time and Trouble by Standardizing on BUSS Fuses

YOU'LL FIND THE RIGHT FUSE EVERYTIME . . . IN THE COMPLETE BUSS LINE

By using BUSS as your source for fuses, you can quickly and easily find the type and size fuse you need. The complete BUSS line of fuses includes: dual-element (slow blowing), renewable and one-time types . . . in sizes from 1/500 amp. up — plus a companion line of fuse clips, blocks and holders.

BUSS TRADEMARK IS YOUR ASSURANCE OF FUSES OF UNQUESTIONED HIGH QUALITY

Over the past 43 years, millions upon millions of BUSS fuses have operated properly under all service conditions. Thus, BUSS fuses have earned a reputation for accurate and dependable electrical protection.

To make sure this high standard of dependability is maintained . . . BUSS fuses are tested in a sensitive electronic device. Any fuse not correctly calibrated, properly constructed and right in all physical dimensions is automatically rejected.

LET BUSS FUSES HELP PROTECT YOUR PROFITS . . . The dependability of BUSS fuses helps you avoid 'kicks' and complaints that the fuses you sold or installed failed to protect or blew needlessly. This safeguards you against costly adjustments and 'call-backs'. It pays to refuse to take a chance with anything less than BUSS quality in fuses.

For more information on BUSS and FUSETRON Small Dimension fuses and fuseholders . . . Write for bulletin SFB. Bussmann Mfg. Division McGraw-Edison Co., University at Jefferson, St. Louis 7, Mo.

BUSS fuses are made to protect – not to blow, needlessly

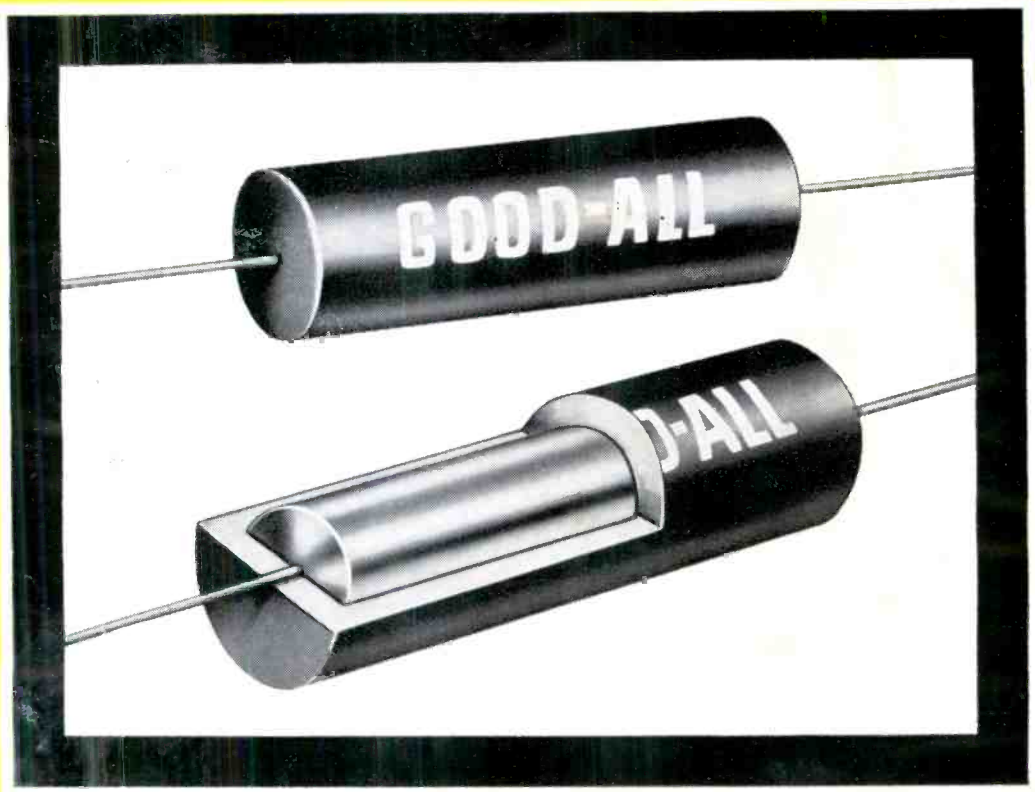
FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

MAKERS OF A COMPLETE LINE OF FUSES FOR HOME, FARM, COMMERCIAL, ELECTRONIC, AUTOMOTIVE AND INDUSTRIAL USE.

S-1057

EPON® RESIN does it!

Improved GOOD-ALL capacitors have low leakage, high stability—even in extremely humid climates



Here's how:

EPON RESIN is helping to set new standards of excellence in a line of 600 UE capacitors made by Good-All Electric Manufacturing Company, Ogallala, Nebraska.

Good-All reports that Epon resin offers superior moisture resistance . . . far better humidity protection than obtained with conventional molding materials. These capacitors offer rugged, trouble-free performance because Epon resin assures high dielectric strength, low leakage, great resistance to chemical and corrosive attack, and handsome appearance.

For molding . . . for potting . . . for laminating, sealing and encapsulating . . . Epon resins are preferred because they offer an almost ideal combination of electrical and physical properties.

• • •

Write for complete information on the use of Epon resins in protective enamels, tool and die materials, etched circuit laminates, transformer and motor sealing compounds.

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SHELL

A wonderful offer from the RAYTHEON RECEIVING TUBE DISTRIBUTORS who sponsor the Raytheon Bonded Dealer Program . . .

at no added cost . . .

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for Raytheon

who by preference

Now, Registered Bonded Dealers can gain personal security for themselves and their families — automatically increase their life insurance coverage, through their regular purchases of Raytheon Receiving Tubes. The amount of coverage is determined by the quantity of Receiving Tubes the dealer buys.

The New England Mutual Life Insurance Company has created a Group Life Insurance Plan for Raytheon Bonded Electronic Technicians — a plan offered exclusively by Raytheon Distributors who sponsor the Bonded Dealer Program. Any such Distributor who meets the necessary requirements for setting up a Group Life Insurance Plan for Bonded Dealers may give them this valuable protection without the necessity of a physical examination. Check with your Raytheon Sponsoring Distributor and see if he has it available to you.

If you're not at present a Raytheon Bonded Dealer, better see your Sponsoring Distributor as to whether you can qualify. You'll find being a Raytheon Bonded Dealer a real asset to you. You'll find using Raytheon quality receiving tubes is a big help, too.

**Administered and underwritten by New England Mutual Life Insurance 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.

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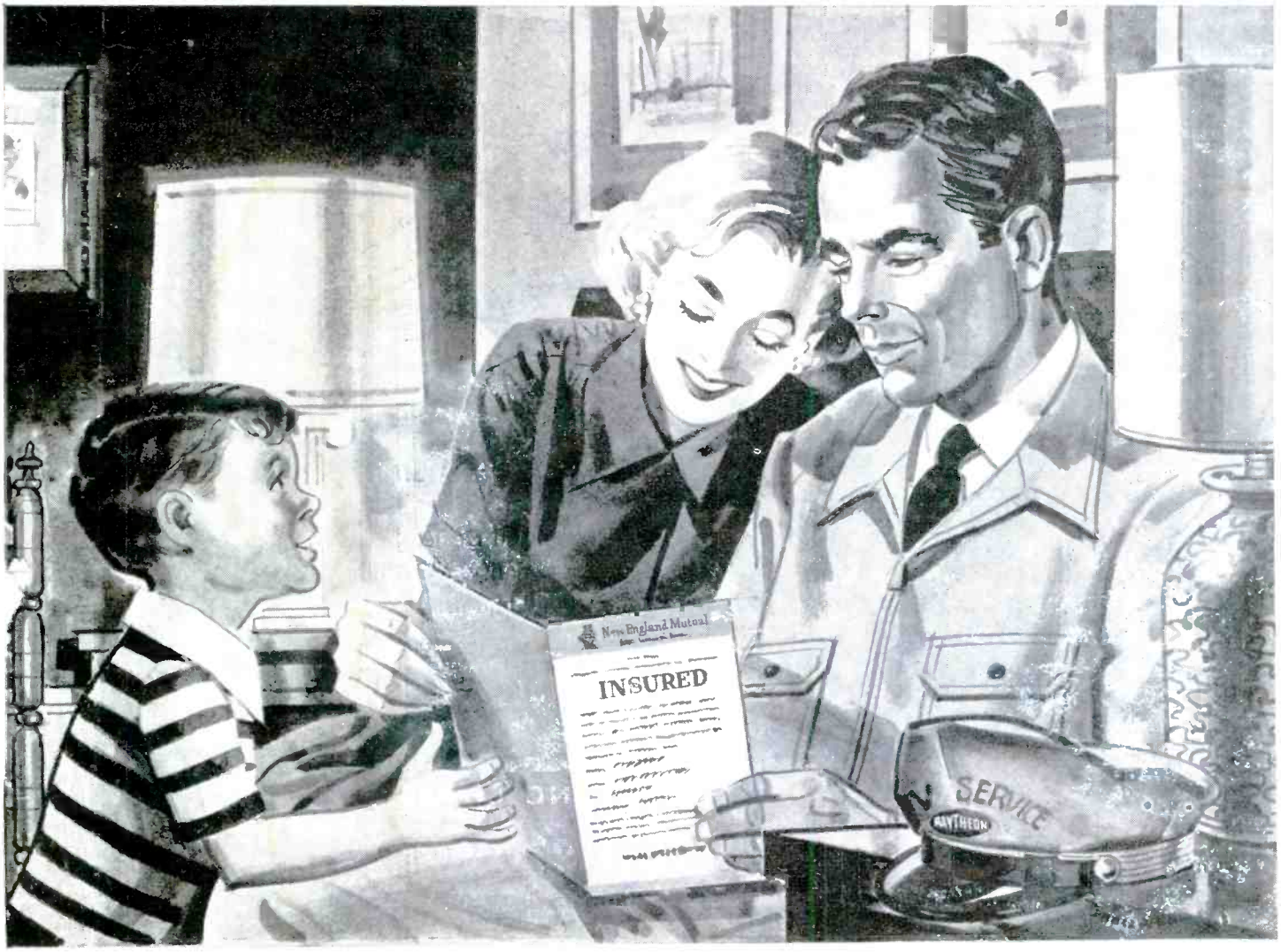
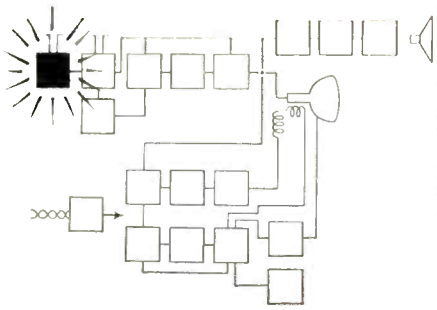
Excellence in Electronics

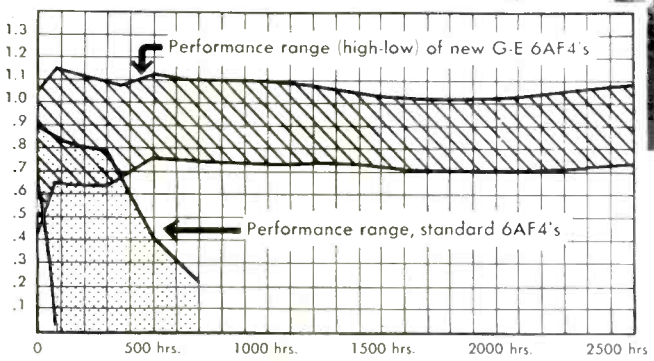
LIFE INSURANCE*

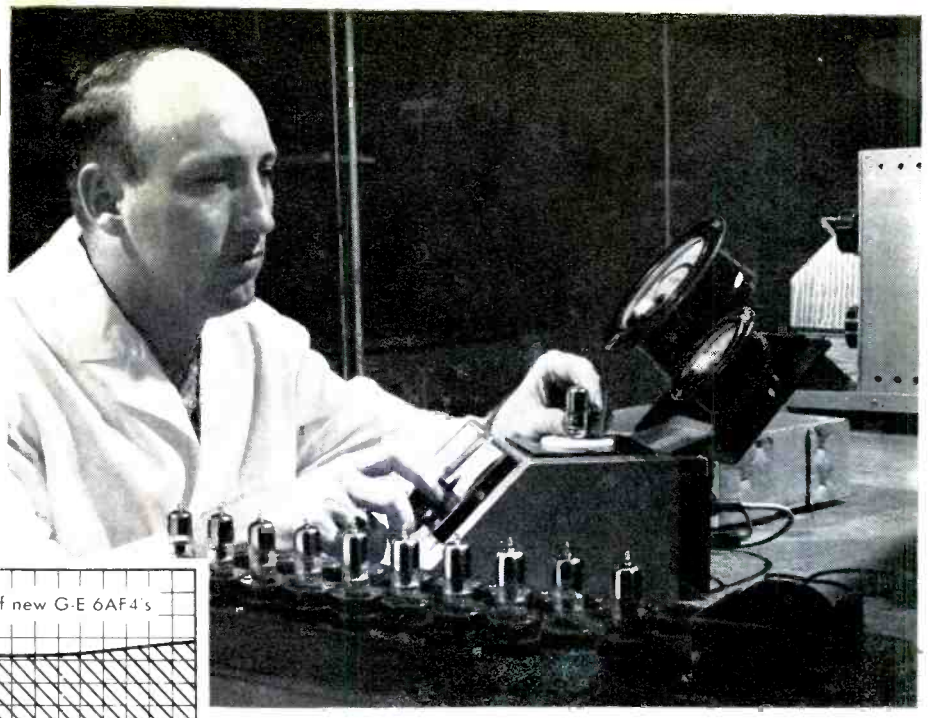
Bonded Electronic Technicians use RAYTHEON RECEIVING TUBES





Life-test comparison chart below shows oscillator activity versus hours of life of new G-E 6AF4's and standard 6AF4's.





ABOVE: General Electric Design Engineer J. G. Tucker checks, for oscillator activity, new G-E 6AF4 tubes that are undergoing life test.

LEFT: Effect of tube operation over long periods on new vs. standard 6AF4's is shown by the chart. Tests of many thousand tubes are represented. Note that the oscillator activity of new G-E 6AF4's averages a straight horizontal line, whereas standard 6AF4's show a sharp, sudden drop . . . meaning rapid loss of picture quality.

Now....from General Electric....a long-life 6AF4 for sustained high-quality u-h-f TV reception!

Only General Electric can give you . . . in the long-life 6AF4 u-h-f oscillator tube . . . the tube industry's newest, most effective means for making friends of service customers. Installing a new General Electric 6AF4 cuts snow, brings a clear picture that will retain its high quality. Tests prove that after 2500 hours and more of service, this u-h-f oscillator tube performs just as well as one freshly taken from a carton!

Virtually no receiving tube is called on to undergo the same electrical "stresses" as a 6AF4. With small electrodes and close spacing to meet low-inductance, low-capacitance demands of up-to-900-mc operation, current density is 5 to 6 times that of other triodes.

Consequently, extremely high cathode emission is called for. The plate and grid, subjected to high temperatures, must resist gas-forming tendencies that would destroy tube efficiency. Stiff requirements like these have meant short life for 6AF4's. Now General Electric, through creative design, combines new materials with new manufacturing and test methods to give TV-technicians and set-owners a 6AF4 that *for the first time* is fully as efficient and dependable as other tubes.

The same long-life performance is being built into General Electric's 2AF4, 2AF4-A, 3AF4-A, and 6AF4-A.

Outstanding examples like this of ever-higher quality, of design steadily improved, make General Electric tubes the best you can install. Phone your G-E tube distributor at your earliest opportunity! *Distributor Sales, Electronic Components Division, General Electric Company, Owensboro, Kentucky.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

161-1A10

how to pick up the chips in the

Non Color-Blind **HELIX**

SELL JFD Electronics COLOR

NOW WITH BRILLIANT ALCOA SPEC.

Yes Mr. Service Dealer

Your thousands of Colortenna orders and reorders prove it . . .

You like the idea of an integrated antenna line that assures you the right antenna answer for every reception problem . . .

You like the idea of the red helix which identifies the Colortenna to prospects as an outstanding performer in black and white and color . . .

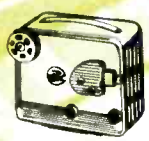
You like the big prizes and trips you win in the fabulous Colortenna Sell-A-Bration . . .

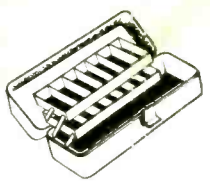
You like the hard-hitting local advertising and promotion that pays off in Colortenna sales in your store . . .

You like the ready-made customer acceptance and confidence that Colortenna performance builds for you . . .

Cash in 1958

You'll *love* the spectacular new JFD Colortenna line that will send your antenna profits rocketing to new highs. Put its dynamic selling power to work for you by seeing your JFD distributor now.





CASH IN ON THE SELL-A-BRATION SWEEPSTAKES!
Over $100,000.00 worth of prizes given so far to TV dealers and servicemen!

3 GRAND PRIZES TO SERVICE-DEALERS
with highest totals for season, September 1, 1957—March 31, 1958.
Winners to be announced May 19, 1958

First Prize ALL-Expenses Paid Trip for Two to Paris

Second Prize ALL-Expenses Paid Trip for Two to Bermuda

Third Prize ALL-Expenses Paid Week-End for Two at the Waldorf-Astoria in New York

EVERY COLORTENNA COUNTS FOR FREE PRIZES!

Wallace 16 Pc. Tableware Set
Only 14 Power Helix—PX911S

12 Spalding GOLF Ball Set
Only 25 Star Helix—SX711

Chatham Orlon Blanket
Only 11 Wonder Helix—WX811S

Samsonite Ladies Case
Only 38 Wonder-Helix—WX811

Samsonite Men's "Quick-Tripper"
Only 40 Wonder-Helix—WX811

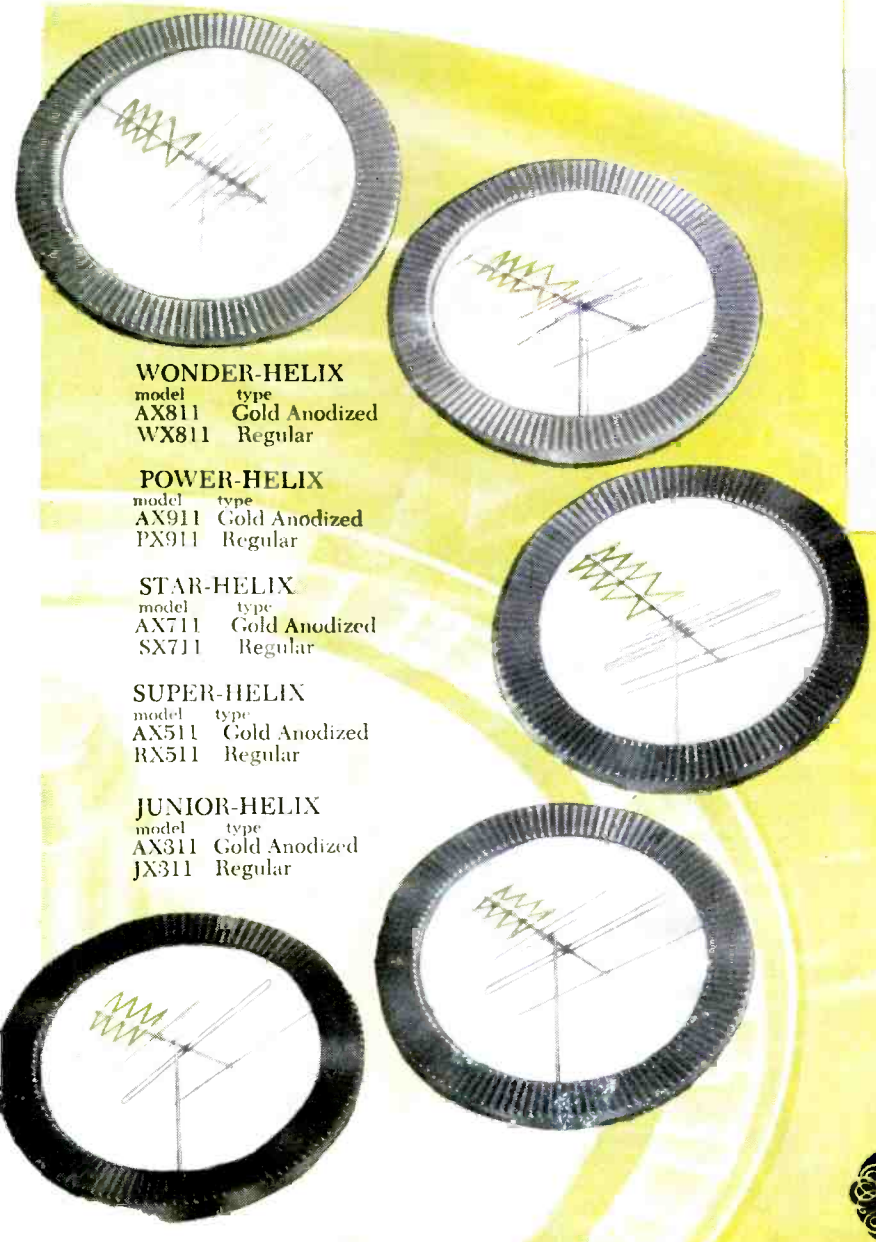
Aluminum Fishing Tackle Box
Only 11 Star Helix—SX711S

PLUS HUNDREDS OF OTHER BRAND-NAME PRODUCTS

TV Antenna Market

TENNAS®

SUN-FAST GOLD ANODIZING!



WONDER-HELIX

model	type
AX811	Gold Anodized
WX811	Regular

POWER-HELIX

model	type
AX911	Gold Anodized
PX911	Regular

STAR-HELIX

model	type
AX711	Gold Anodized
SX711	Regular

SUPER-HELIX

model	type
AX511	Gold Anodized
RX511	Regular

JUNIOR-HELIX

model	type
AX311	Gold Anodized
JX311	Regular

GLEAMING GOLD ANODIZING GIVES YOU MORE TO SHOW!... MORE TO SELL!

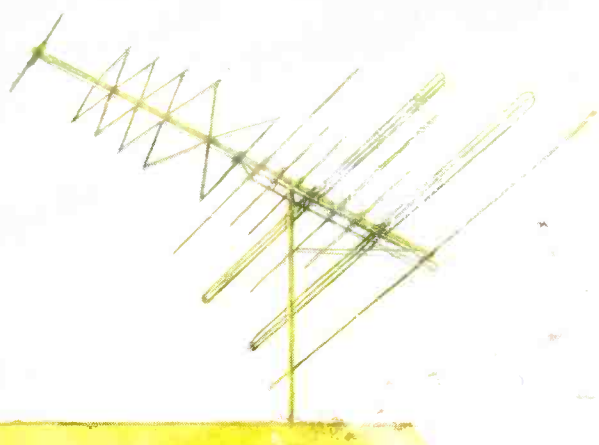
New . . . new . . . new! *Gold* Colortennas with ALCOA Spec. fade-proof gold anodized finish that catches the eye and makes them buy.

NEW UNBREAKABLE "KRALASTIC" INSULATORS

You get the toughest, hardest, strongest insulators money can buy. Matchless electrical, physical and weathering properties for better performance all year, every year.

NEW RIGIDIZED REFLECTORS

Twice the strength—twice the rigidity. Every element over 30 inches long is now reinforced with 16 inch aluminum dowels in center. Never before so many dynamic selling features packed in one antenna.



THE FUSE IS LIT! Get Set FOR THE COLORTENNA BOOM in 1958

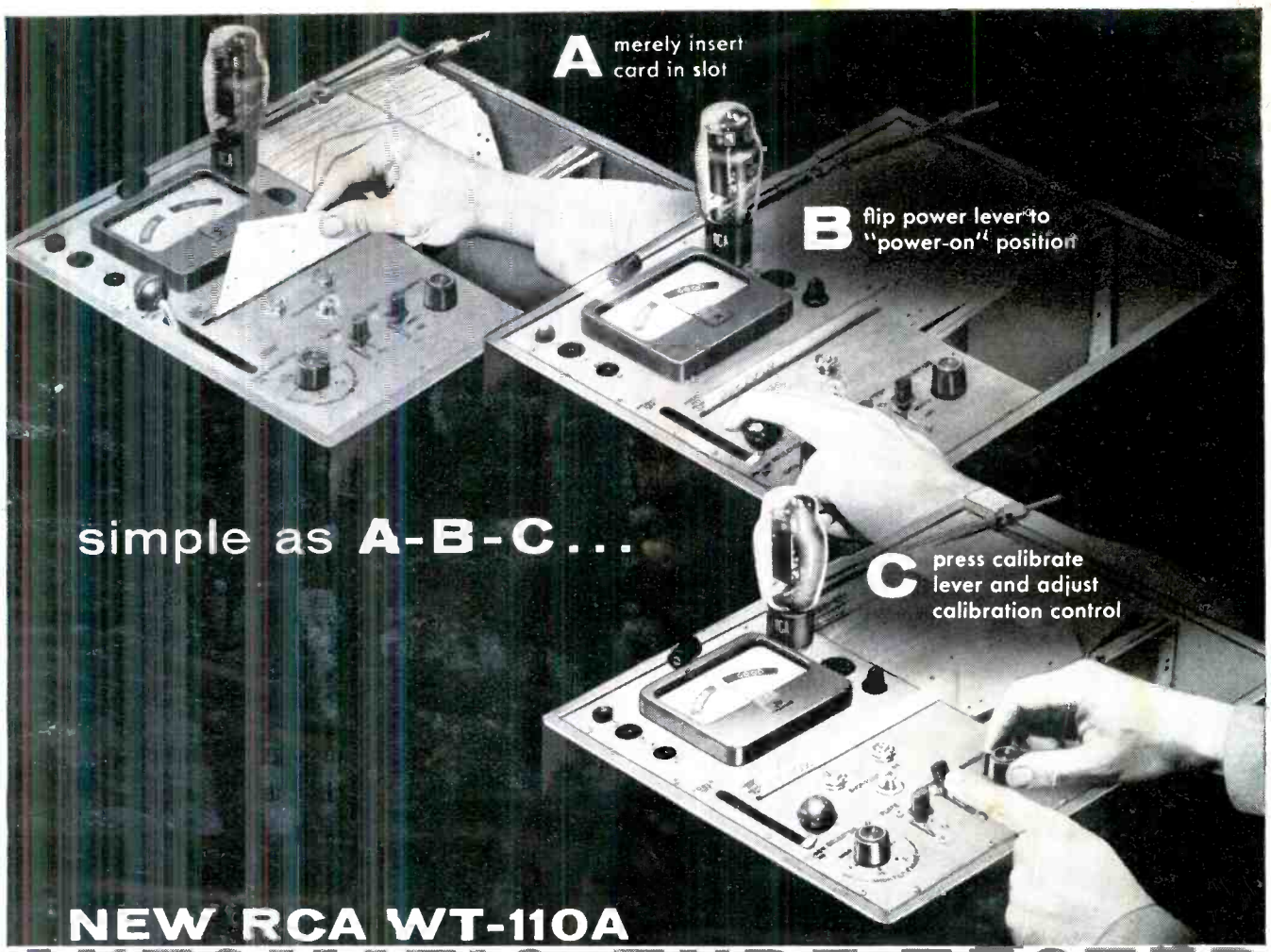
IN PROFITS!
PERFORMANCE!
PREMIUMS!
PROMOTION!

See your JFD distributor.

JFD ELECTRONICS CORP.

Brooklyn 4, N. Y.

Pioneers in electronics since 1929



NEW RCA WT-110A AUTOMATIC TUBE-TESTER

means more service profits!

Dollar for dollar, feature for feature, you'll find RCA's WT-110A the fastest, most accurate automatic punched-card tester you can buy today. It's a virtually *obsolescence-proof design* ... from the exclusive RCA 700-card capacity magazine file that always keeps the pre-punched cards in type number sequence, to the fully automatic circuit setup (including *all* operating voltages) and the easy, do-it-yourself punch card accessories available to keep the tube-card file up-to-date!

See and test the WT-110A at your local RCA Distributor. Prove to yourself what a boost in business, prestige, profits the RCA-WT-110A can mean!

All this for

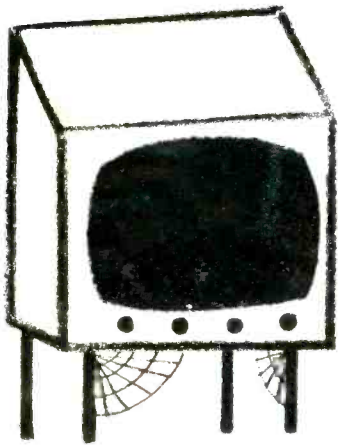
$199.50

USER PRICE (Optional)
Prices higher in Hawaii and Alaska

- automatically sets up socket connections, and all operating voltages such as heater, signal, plate and screen voltages, and bias (both fixed and cathode).
- checks tubes for transconductance, gas, shorts, and leakage between elements.
- automatically selects correct conditions from 220 possible combinations of heater voltage (from 0.1 volt to 120 volts) at currents up to 4 amps., 10 bias voltages and 11 values of cathode resistors.
- tubes, such as rectifiers, tested under heavy load currents up to 140 ma per plate.
- high-and-low sensitivity ranges for leakage tests.
- 12-volt plate and screen supply for testing new auto-radio tubes.
- meter protected against burnout.
- test card provided for checking instrument.
- 239 pre-punched cards supplied with instrument cover 95% of currently active TV tubes. Pre-punched accessory cards available.
- active card magazine capacity—350; storage capacity—350...a total capacity of 700 cards.

RCA TEST EQUIPMENT
RADIO CORPORATION OF AMERICA
Electron Tube Division, Harrison, N. J.

Reputation Builder #2: it pays to be prompt



- Only 51% of set-owners who wait 3 to 4 days for service are satisfied with the bill

- BUT . . . 69% of customers getting same-day service are satisfied with the bill

it pays to replace with Sprague Twist-Lok* Electrolytics

- Another way to build and hold a reputation is to insist on top quality replacement parts. Callbacks due to replacement failures not only cost you *money* . . . they also cost you customers! Replace with less than the best and you place your reputation at stake. In capacitors, the best is *Sprague.*

- Take the Twist-Lok 'lytic, for example. Sprague TVL's have everything! More exact ratings . . . higher quality to meet original equipment specifications. *Every* TVL for *every* voltage rating is made with expensive high-purity etched-foil anode construction—ultra stable film formation techniques. And etched cathodes meet the toughest ripple requirements. No wonder they're your first line of defense against callbacks!

- Get your copy of Sprague's latest radio and TV service catalog, C-455. Write Sprague Products Co., Distributors' Division of Sprague Electric Company, 61 Marshall Street, North Adams, Mass.

don't be vague...insist on

SPRAGUE®

world's largest capacitor manufacturer

*Trademark

SPRAGUE RESEARCH IS CONSTANTLY PRODUCING NEW AND BETTER CAPACITORS FOR YOU

FULL COLOR TV demands reliable

MODEL U-98—first and finest fully automatic rotator. Eye-appealing decorator colors—Ivory, Forest Green and Standard Mahogany Grain. Retail **$44.25**

MODEL T-12—with exclusive Tenna-Teller Pointer—highly accurate. Striking modern design. Forest Green and Ivory or Std. Mahogany. Retail . . . **$34.25**
Decorator Colors priced $2.00 extra.

alliance TENNA-ROTOR®
TELEVISION ANTENNA ROTATOR

DON'T ASK VIEWERS TO PUT UP WITH A 'STAY-PUT' ANTENNA!

- TV authorities admit the higher sensitivity of color.*
- Viewers won't tolerate weak, washed out color!
- Maximum directivity with ALLIANCE TENNA-ROTOR is the best insurance for top antenna performance—for FULL COLOR!

Wherever you find Color TV, it will pay you to recommend Alliance!

Every color TV buyer is a potential Tenna-Rotor sale . . . even in metropolitan areas. Because the ***"fringe"*** area for color is closer to the transmitter! Viewers who might tolerate black and white TV that's "so-so", will ***not*** put up with irritating, "ghosty" color. And independent interviews ***at point of sale*** show that color TV customers find it ***easy*** to say Yes to Alliance Tenna-Rotor!

*Practically all TV authorities agree "color is critical"—more sensitive than black and white. "Chromatic gradation" with color that's ghosty, is harder on the eyes than black and white. Many recommend properly installed outdoor antennas with rotators, to improve directivity of the antenna, to help overcome interference and reduce annoying effects caused by the higher sensitivity of color, and the normal characteristic of **color** to "drop out" quicker.

Ride the Trend to Color . . .
and soak up those extra profits with Alliance! Tie in with the largest and strongest TV campaign in TV accessory history! Remember . . . Poor color is worse than no color . . . and Alliance Tenna-Rotor is the *sensible answer!*

THE ALLIANCE MANUFACTURING COMPANY, INC.
(Division of Consolidated Electronics Industries Corp.)
ALLIANCE, OHIO
In Canada—ALLIANCE MOTORS, Schell Avenue, Toronto 10.

26th YEAR OF CONTINUOUS PUBLICATION

SERVICE

THE TECHNICAL JOURNAL OF THE TELEVISION-RADIO TRADE

The Growing Stature of COLOR-TV

COLOR TELEVISION has reached a point of technical excellence and stabilization.

In the three years since its debut, color-TV has made truly remarkable progress, both technically and commercially, and is now firmly established as a mature business promising tremendous potentials for the alert Service Man.

Color-TV has forged ahead so rapidly because of the extensive experience gained in black-and-white developments, and engineering ingenuity. Measured by the rate of increase in retail sales, color has exceeded even the phenomenal rate of increase enjoyed by black-and-white during the comparable period of development.

The slow evolution of black-and-white chassis was dictated by tube-size problems. Many, many years elapsed before 21-inch tube chassis were available in quantities. But in color, the change from small to large tubes was swift; 21-inch models appeared very soon after a limited production of 15-inch sets. Today's receivers feature 21-inch glass-envelope picture tubes with brilliance great enough to permit satisfactory viewing in brightly-lighted rooms.

CIRCUIT-WISE, the advancements have been marked, too. The tube complements have been reduced substantially, semiconductors have been introduced in simplified networks and adjustments have been minimized. Controls regulating color—and there are only two now—have been removed from the hidden panel and moved up next to the channel selector. One is a color control designed to bring color into the picture in varying intensity; the second is a tint control (formerly called hue) which shades the color to the viewer's personal taste.

The mystery in color has been removed. The supplementary color circuits present no problems to those who have a sound knowledge of black-and-white design.

COLOR RECEIVERS now being made generally arrive from the factory in ready-to-operate condition. But one must always be prepared—armed with sufficient knowledge of the chassis, and adequate test equipment and tools to make adjustments, perhaps for color purity or convergence, to insure performance which will instill customer confidence.

THE GIANT STRIDES made by color-TV offer enormous opportunities to the Service Man in installation, repair and sales, too.

An exclusive progress report on the growing stature of color-TV appears in this issue on pages 18 to 27. Described for the first time are the circuits used in the latest glass-picture-tube chassis, new features of the viewing tube, test equipment required, and an analysis of the outstanding prospects in color-TV for every Service Man.

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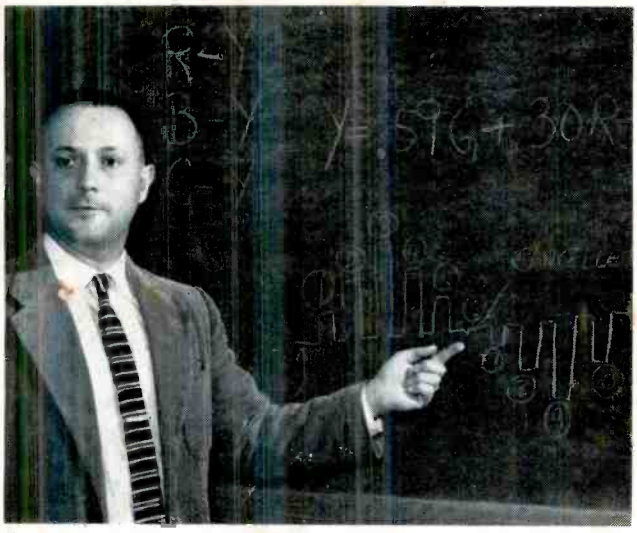
Thus the ABC symbol is a constant reminder that (*1*) your interests come first with us and that (2) our advertisers get what they pay for—your interest.

SERVICE, the only technical journal in the radio-TV trade which has maintained *unbroken* membership in the ABC for over twenty years, with a continuing record of the largest audited circulation in the field, is proud once again to salute the Bureau, during this, ABC month.



Why The Television

by C. E. WALTER, RCA Service Company, Inc.

C. E. WALTER, delivering a talk, one of a nation-wide series, on color-TV, at a recent association meeting.

THERE SURELY CAN BE no doubt in the mind of the average television Service Man that color-TV, as an entertainment medium, is second to none in its potential as a factor in his future business success. Why, then, should not the Service Man be a *booster* of color television? Most of the TV industry, manufacturers and distributors alike, have been taking every possible means to build a foundation for color-TV which could only provide one answer to that question; the Service Man *should* boost color at every opportunity. It will be his future, and the efforts to provide a firm basis for this future will be rewarded.

TV has meant a great deal to those of us associated with this miraculously growing industry. We see in it a future which will demand the best from the television Service Man, and it is obvious that those who can learn color now, who can gain invaluable experience, and who can invest in this future, will be the ones to benefit most. We have already seen color-TV receivers begin to move into customer's homes at a rapidly increasing rate. Thousands of Service Men have already had the opportunity to gain considerable experience and *know how*. This experience has proved several things: (1) The quality, dependability and performance of color-TV sets is definitely established as excellent; (2) the servicing industry is ready in many areas to handle the color installation and service demands, and (3) customers are ready to buy.

Service Charges

We might examine the pattern of charges for color-TV service. Generally speaking, Service Men are charging, and getting, more for the more specialized knowledge required for color installation and service. This is justified, though it is not a universal pattern. Some self-servicing dealers, who also sell television, are charging the same rates for color service as for black-and-white. At first, this was admittedly a *sales tool*, permitting the dealer to give a favorable answer to the customer who asked, "Don't you charge more for color television service?" After some months of operation under this policy, it was then evident that a few well-trained, well-equipped service organizations *could* handle color installation and service at black-and-white rates. It should be made clear that the Service Man who has invested a lot of his time, money, and effort into training and equipping himself for color television should be entitled to adequate compensation and a fair return. The proper installation, setup, and servicing of color television is somewhat more critical, and more time-consuming than for black-and-white.

The Service Man—Key to Color

Actually, it is the Service Man who is the key to successful color television sales efforts. The sale of a product does not automatically imply consumer satisfaction. With any product as complex as a television receiver, color or black-and-white, performance over a period of time is demanded. The quality of the installation is of particular importance — first impressions are created—and to the installing Service Man falls the honor of making or breaking the sale. Following a successful installation, the burden of keeping the instrument sold falls upon the Service Man. It can truly be said that the role of the Service Man in color television is the most important single feature in achieving the ultimate goal — consumer satisfaction. Such a statement is probably subject to some debate, but story after story of successful dealer sales efforts in color television is being recorded, and each and every one of them stresses the importance and dependence placed upon the installing and servicing personnel.

Another of the important reasons why the Service Man should boost color, is that his name is then associated with color by his customers. Even though the customer may not be interested in color at this time, just a few favorable words by the Service Man may start Mrs. Jones thinking, and when Mrs. Jones is ready for color, she knows you are ready to help her. There have been instances when customers, believing that color service is more complex and more demanding than black-and-white, feel that the Service Man who advertises and boosts color must be better qualified on black-and-white than his competitor who sticks to black-and-white service, or who has a negative approach to color. This is entirely logical, and in many cases the competent Service Man who effectively services and installs color, also enjoys an increase in his black-and-white business.

In many communities there is a dealer or independent Service Man who has set himself up as *Mr. Color Television* in his area. This has been very effective. By advertising and

Service Man Should Be A COLOR-TV Booster

promoting the association between color and the Service Man, the consumers in the area will naturally turn to *Mr. Color Television* with their color questions and problems, and, as previously mentioned, will often bring black-and-white problems as well.

The color-television servicing specialist often finds himself in contact with the type of consumer who is financially more able to promptly pay for the service, or who may be interested in the purchase of additional equipment or appliances. Regardless of the type of customer, however, the Service Man is an excellent source of prospects for many types of home equipment. Many sales and service dealers will pay a commission to their Service Men who submit prospects resulting in sales. Many independent Service Men have similar arrangements with local retail dealers.

The Product

Color-TV receivers have come a long way—from the 15-inch picture tube, and complex circuitry of early 1954, to the 21″ picture tube and simplified circuitry of today. The receiver quality is most satisfactory. This is a matter of statistical record. They are much easier to operate, to install and to service.

The specialized test equipment for proper installation and servicing of color is available. Service Men often bring up the question of test equipment obsolescence. While it is always difficult to *star gaze*, it is felt that there is no reason why the excellent test equipment available today should become obsolete in the foreseeable future. Some of it is expensive, to be sure, but it is of high quality and durability, and favorable terms are available from most distributors.

Training

Adequate training facilities are available to the majority of the industry. Manufacturers have been conducting training programs at dealer-Service Man level, and have produced thousands of well-trained Service Men. We have been conducting field training lectures and workshops (practical do - it - yourself training) since early 1954, and have had a total Service Man attendance of more than 105,000. Many trade and vocational schools are now offering color-TV courses, and excellent correspondence course training is available at low cost.

At one time it was felt that there would be TV-antenna problems in color. We have now learned from experience that this is not so. In many installations indoor type antennas are being used, though the superiority of a high-quality outdoor antenna, properly installed, cannot be denied. This is another avenue of possible profit for the Service Man—a new antenna. Unfortunately, there is considerable mis-information in the field about antennas in general. The antenna requirements for color are slightly more critical than for black-and-white, as a result of the added transmitted signal components. However, any efforts by the Service Man to improve the quality of the color signal delivered to the receiver antenna terminals, will also result in improved black-and-white performance.

Most of the factors which were advanced several years ago as reasons why color-TV could not be pushed are now things of the past. The quality of the product is high. Color receivers are easier to install and service. Retail prices are more favorable. Many banks or other lending institutions, recognizing the future of color television, have favorable financing terms for the purchase of receivers. The frequency and quality of color programming have advanced tremendously. Some television stations transmit practically all of their local programs in color. Many more stations are being equipped; there are now almost 300 stations equipped to rebroadcast network color and more than 100 of these are equipped to originate color.

The manufacturers of today's color receivers have solved practically all of the problems related to production and distribution. This directly benefits the Service Man and the consumer. Fortunately, the Service Man has had a say in the design of today's receivers, and the installation and servicing adjustments are easier to make and more effective than ever before. The quality and performance are better than ever before; those who are

(*Continued on page* 48)

SIMPLIFIED COLOR-TV TUNING controls in new glass picture-tube color receivers; color and tint controls mounted on the upper right side of the cabinet. Color brings color into the picture; tint shades it to the viewer's personal taste.

Circuitry Report On 21-Inch COLOR-TV

Complete Analysis of

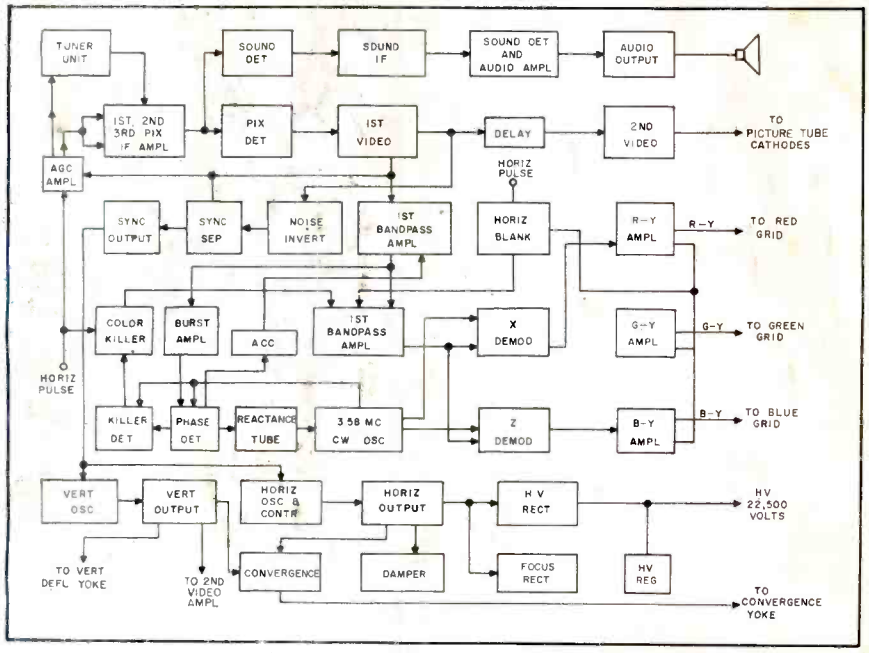


FIG. 1: BLOCK DIAGRAM of the complete RCA CTC7 color-TV chassis.

THE 800 SERIES[3] COLOR-TV receivers[4] recently introduced by RCA include a number of features designed as conveniences not only for the consumer, but the Service Man.

A glass-envelope picture tube (21CYP22) with a viewing area of approximately 260 square inches is used in this new chassis.

Some of the customer features include improved picture brightness and contrast both for color and black-and-white pictures, and convenient color-coded *tint* and *color* controls. These controls show, on an escutcheon, the direction of rotation for proper tuning to achieve the desired color effects on the viewing screen of the picture tube.

Other features of the CTC7 chassis include: Intercarrier FM sound system, quadrature-grid FM detector, separate picture and sound detectors, 4.5-mc sound trap and sound rejection control in the input circuits of the video amplifier stages, *agc* control of the *rf* amplifier and the first and second picture *if* amplifier stages, an automatic noise-cancellation circuit, automatic-frequency phase control in the chrominance circuits, crystal-controlled 3.58-mc color subcarrier reference oscillator, stabilized *synchroguide* horizontal oscillator and control, an automatic chroma-control circuit, an automatic noise-immune color killer circuit, and continuously-regulated high-voltage to the ultor of the picture tube.

A feature of particular interest to the Service Man is the mechanical arrangement of the convergence circuits. The controls necessary to perform convergence adjustments are on a printed circuit in a mounting which is detachable from the cabinet. When removed from its normal mounting position it may be inverted and secured to two mounting screws provided on the rear of the cabinet, permitting adjustment from the front of the receiver.

The chassis contains six printed circuit boards. New type tube sockets are utilized on these boards and should prove a boon to the Service Man. From the top side of the printed boards each of the pin connections on the tube sockets are accessible through a guide opening. Thus, voltage measurements can be made quickly and easily whenever required.

Two types of tuner units are used in these receivers. The *vhf*-only tuners[5] use a new tube, 6BC8, in a driven grounded-grid circuit with *if* and FM traps in the input circuit. A

FIG. 2: PICTURE-TUBE accessories required for the glass-tube color-TV models.

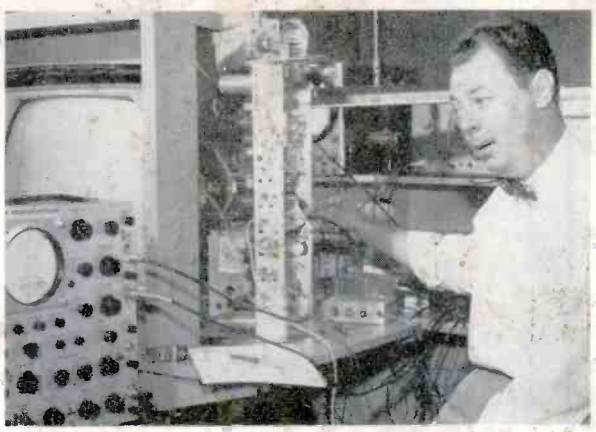
All of the deluxe models in this series use a new CTC7 chassis. Models are available with a vhf-only tuner, or optionally, a combination uhf-vhf head end; the uhf-vhf models have a U designation following the model number. VHF tuning in the U models is accomplished with a 13-position switch-type tuner; the 13th position automatically switches to a continuously variable tuning system which covers all 70-uhf channels.

[See Front Cover and Pages 22, 23, 39 and 40 for Circuit D agrams]

Chassis Using Glass Picture Tube

Circuits Used in RCA 800 Color-TV Line

by J. A. MAY, RCA Service Company, Inc.



(Right)
J. A. MAY in lab checking latest glass picture-tube color model.

6CQ8 triode-pentode is used as the local oscillator and mixer providing output in the 41-mc range. The *uhf-vhf* tuner uses a *vhf*[3] and a *uhf* section[4]. The *uhf* section is similar to the type used in previous color receivers and consists of a 6AF4A local oscillator operating at fundamental frequency throughout the *uhf* range, and a 1N82 crystal mixer.

In *vhf* operation, the tuner, in the *vhf-uhf* combination, uses the same tubes and operates in the same manner as the *vhf*-only tuners. However, this tuner has an extra switch position. When switched into this position, the output of *uhf* unit is fed to the 6CQ8 which becomes a 41-mc *if* amplifier for the *uhf* channels.

Three stages of picture-*if* amplification are used in bifilar-coupled stagger-tuned stages. The first and second picture *if* stages are *agc* controlled. The printed-circuit board[5] for the picture *if* stages also includes separate detectors for picture and sound, a 4.5-mc trap, and a sound-rejection control. These features assist in minimizing the possibility of a 920-kc beat from appearing in the video during a color program; 920-kc is the difference-frequency resulting from the color subcarrier, 3.58-mc above the picture carrier, beating with the sound carrier, 4.5-mc above the picture carrier.

The sound system in this new color-receiver series differs from previous color models in using a single stage of sound *if* amplification and a quadrature-grid FM detector—first audio stage similar to those used in current black-and-white receivers. A single 6AQ5A provides audio output and, in the cathode circuit, a secondary B+ source for other circuits in the receiver.

Two video amplifiers are incorporated, as in previous color receivers, with the first stage, the pentode section of a 6AW8A, serving as the signal distribution center for sync, *agc* and chroma information. A delay line, as is the normal practice, is in the grid circuit of the second video amplifier. A 12BY7A second video amplifier feeds the brightness component of the color signal, or in the case of a black-and-white picture, the picture information to the cathodes of the picture tube through a dividing network. The dividing network is required because the phosphors in the picture tube, characteristically, have unequal light output efficiencies; thus, the dividing network supplies each cathode with the proper proportion of video signal during either black-and-white or color picture reception. The

(*Continued on page* 38)

[3]*KRK48A* [4]*KRK49A* [4]*KRK56D* [5]*PW300*

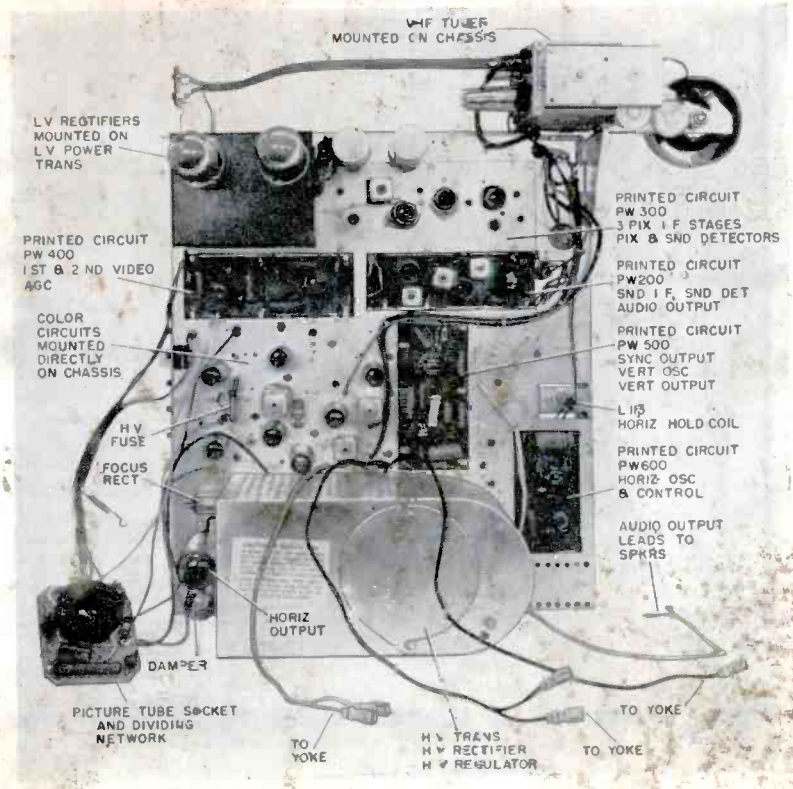


FIG. 3: TOP VIEW of color chassis showing key assemblies and components.

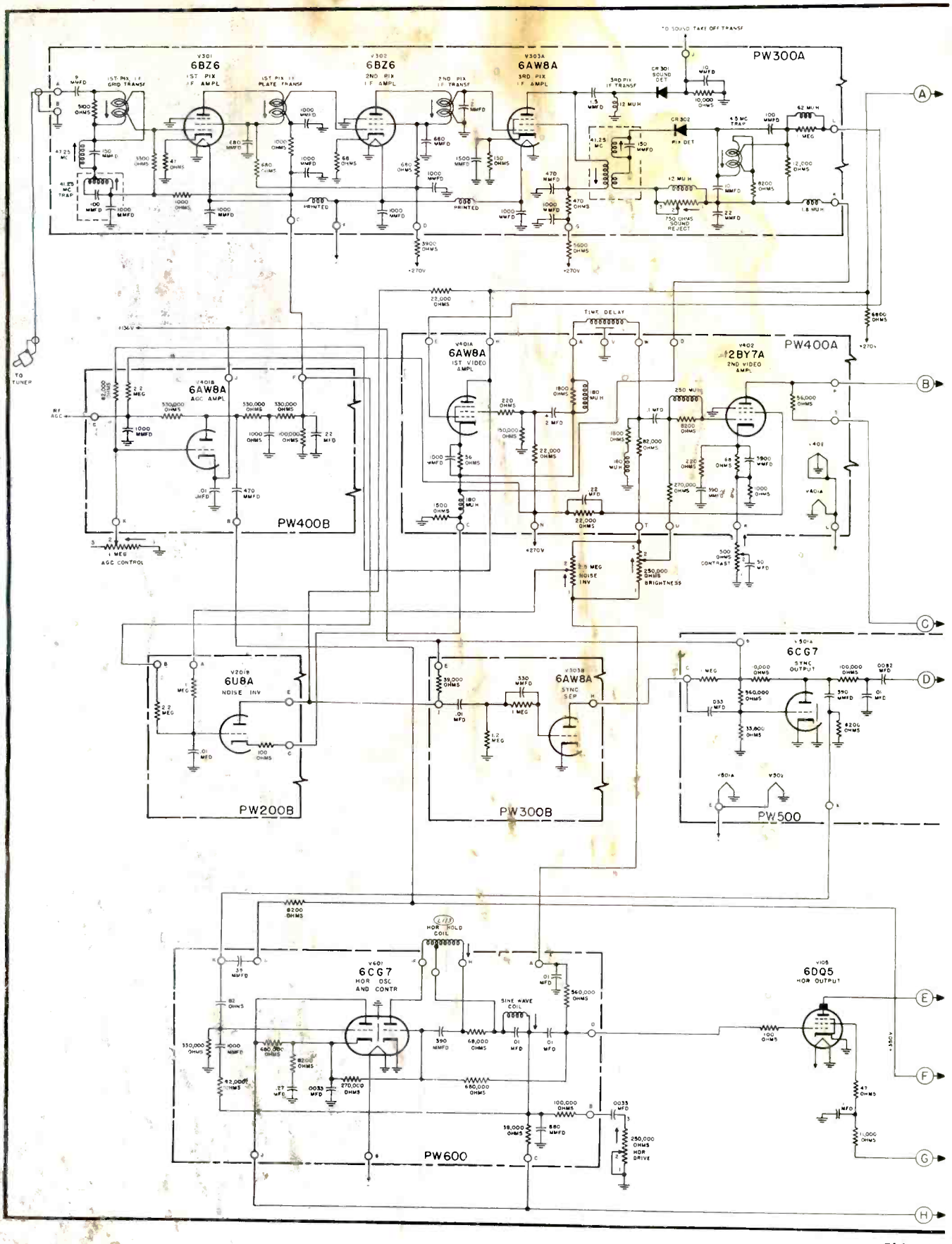


FIG. 4A

Circuit Diagram of 21-Inch Color-TV Chassis Which Features All-Glass Picture Tube. See Systems Used

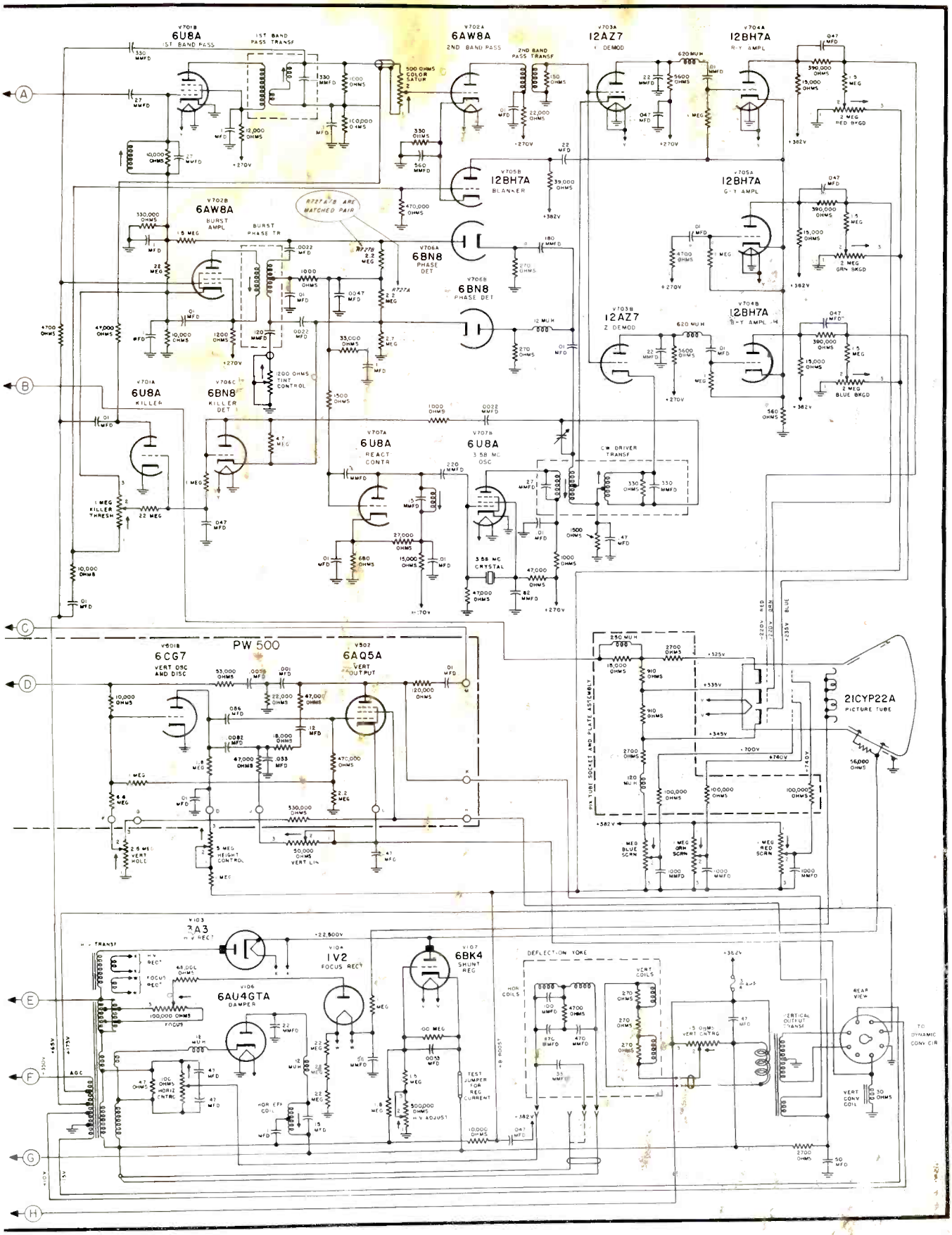
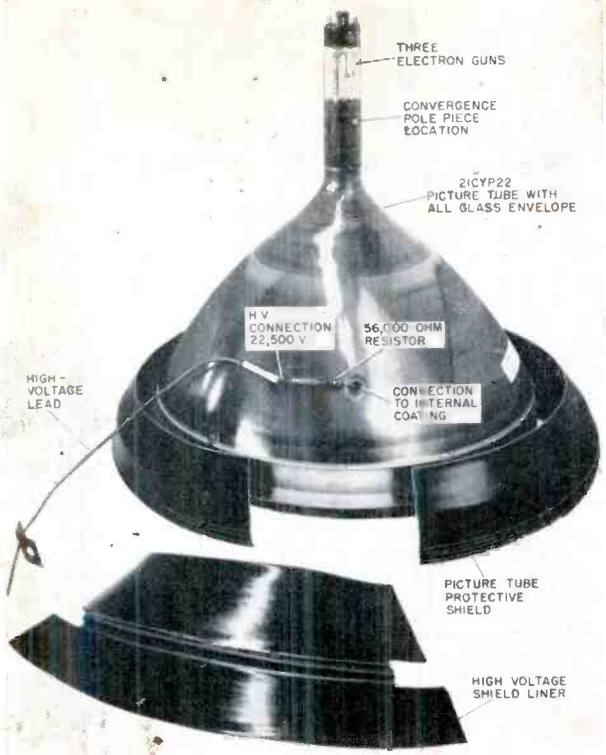


FIG. 4B

Pages 39 and 40 for Schematics of Audio, Dynamic Convergence and Power Supply in Chassis *(RCA CTC7; 800 Series)*



Glass Envelope 21-Inch Picture Tube For COLOR-TV

by L. B. HEADRICK, Electron Tube Division, RCA

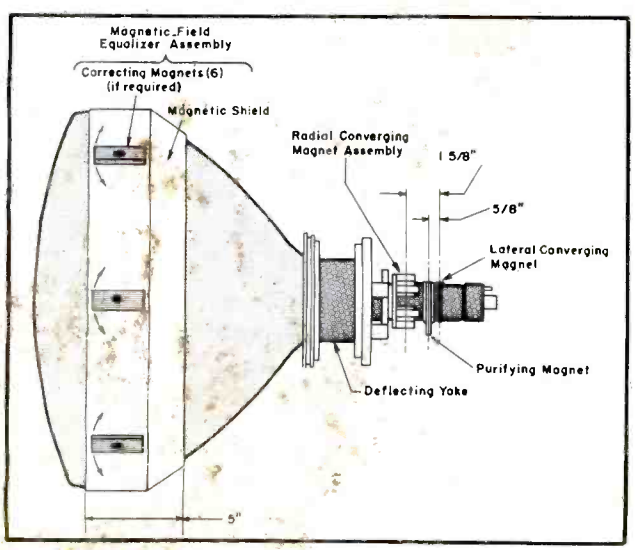
New Three-Gun Tube Provides Increased Brightness and Contrast . . . Requires Less HV Insulation and Electric Shock Protection in Chassis

AN ALL-GLASS ENVELOPE[1] picture tube has been designed for use in color-TV receivers. It is a round, directly-viewed type having a graded-hole shadow-mask and an improved three-gun assembly. Because it has an all-glass envelope, the need for high-voltage insulation and electric-shock protection in the color receiver has been reduced. It is provided with an external conductive envelope coating, which with a portion of the internal conductive coating, forms a high-voltage filter capacitor.

The graded-hole shadow mask utilized in the new tube permits increased light output from the screen. In addition, the light-filtering action of the face glass of the tube has been increased so that the picture has both improved contrast in a well-lighted room and higher brightness resulting in more vivid colors.

An average correction for the vertical component of the earth's magnetic field has been built into the tube so that a minimum of additional magnetic correction is required in the color receiver. Correcting magnets to provide both or either radial and tangential beam motion in localized areas are shown in Fig. 1. Most of the tubes will not require any or only one or two of these magnets for good color purity; a few tubes may require up to six magnets. The magnetic shield placed around the faceplate end of the tube, as shown in Fig. 1, minimizes the effects of extraneous magnetic fields and contributes to the simplicity of magnetic correction adjustments required during the installation of a color-TV receiver in the home.

[1] 21CYP22



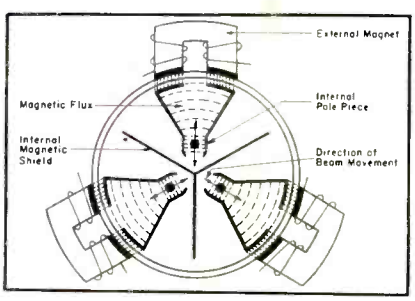
(Left)

FIG. 1: A CROSS-SECTIONAL view of glass-envelope color-TV picture-tube, illustrating correcting magnets in magnetic-field equalizer assembly, and the radial-converging magnets.

Additional Magnetic Shielding

Additional magnetic shielding, shown in Fig. 2, has been built into the electron gun to reduce the amount of dynamic convergence correction required by the deflecting yoke and picture-tube combination, as well as to reduce the interaction between the

(*Continued on page* 48)



(Right)

FIG. 2: ADDITIONAL MAGNETIC shielding built into the electron gun to reduce the amount of dynamic convergence correction required by the deflecting yoke and picture-tube combination.

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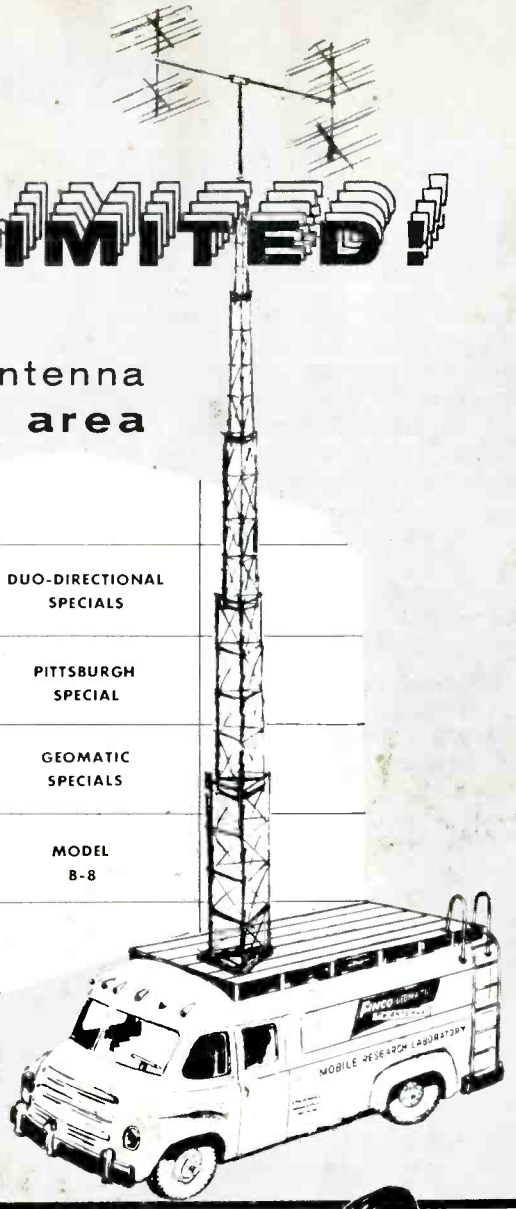
	PATENTED FIDELITY PHASING	DETROIT-TOLEDO SPECIAL	MODEL B-8
UHF-VHF SPECIALS	MODEL B-66		
MODEL B-7	FRONT-TO-BACK SPECIALS		



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Form No. 20-199

Installation Checks For Latest

How To Test and Adjust New Receivers

SERVICE MEN who have had experience in installing the 600 and 700 series color receivers will find that the chassis in the new line are equally easy to install. In most cases it is necessary only to degauss the receiver. In a few cases it may be necessary to touch up the center-convergence or purity adjustments, as outlined in this report.

Installation and servicing of the new series receivers requires the same test equipment as earlier models:

- A *degaussing coil* for purity correction.
- A *dot-bar-crosshatch generator* for adjusting convergence.
- A *color-bar generator* for checking demodulator phasing, for checking the relative gains of the *R-Y*, *B-Y*, and *G-Y* channels, and for other adjustments and trouble-shooting applications.
- A *wideband 'scope*, flat to 4 mc, for signal tracing and trouble-shooting in the color circuits.
- A *vtvm and a high-voltage probe* for checking the adjustment and operation of the high-voltage regulator circuit.

Preliminary Steps

In preparing the receiver for checking, the chassis must be placed in the position and direction which it will finally occupy. The receiver *must* then be demagnitized with a degaussing coil to aid in obtaining good purity.

The following checks should be made on each installation job. These checks are in addition to the conventional checks for height, width, linearity, drive, centering, focusing, etc.

Any necessary adjustments should be made in accordance with the adjustment procedure in the manufacturer's service data for the particular receiver.

Purity Checks

One should first obtain a *clean* raster by removing the *if*-link plug from the *rf* tuner, or by removing a tube from the *if* amplifier. The raster should be examined for impure (tinted or colored) areas. Impurities usually show up most prominently in the red field. The red field may be viewed by biasing off the blue and green guns with a switching device[1] diagrammed in Fig. 1.

If there are impure areas in the central portion of the red field, it will be necessary to adjust the purifying magnet, which is mounted on the neck of the picture tube. If there are impure areas at the edges, one must adjust the corresponding edge-purity magnets to eliminate the impure areas.

Edge-Purity Magnets

The edge-purity magnets in the new receivers are mounted around the picture tube, several inches in front of the deflecting yoke. Each magnet assembly consists of two magnetized *hairpins* which may be turned with respect to each other to alter the strength of the magnetic field, and both hairpins may be turned together to alter the direction of the field.

A *Z-axis* coil is used in the new chassis to aid in counteracting the *Z-axis* effect of the earth's magnetic field. This coil is energized momentarily by pressing a push button which connects a 50-mfd capacitor (charged to 270 *v*) to the coil. A center-tapped potentiometer, identified as the Z-purity adjustment, is used to establish the direction and intensity of current through the coil.

[1] *RCA 226X1.*
[2] *Such as the RCA WR-46A.*

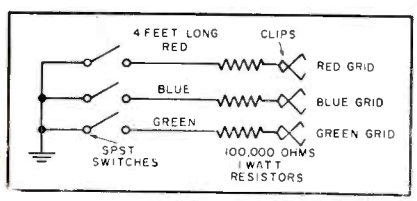


FIG. 1: SWITCHING CIRCUIT designed to permit biasing off of one or two guns in the color tube, when adjusting purity or convergence.

Convergence Checks

In the first step in the convergence adjustment, one should tune in a black-and-white program. The picture should be inspected to see if there are any noticeable color fringes around the edges of objects and lettering.

If there are color fringes at the center of the picture, the center convergence should be adjusted. Four permanent-magnet adjustments are provided for this purpose. Three of these adjustments (one for the red gun, one for the blue gun, and one for the green gun) are in the converging-coil assembly which is mounted on the neck of the picture tube. The fourth magnet, identified as the *lateral* magnet, is also mounted on the neck of the picture tube.

Adjustment of center convergence is all that is required in the majority of installations to obtain good convergence over the entire picture, but if there is an objectionable amount of misconvergence in other areas of the picture after center convergence has been adjusted, it is necessary to adjust vertical or horizontal dynamic convergence.

For all convergence adjustments a suitable dot-bar-crosshatch pattern generator[2] should be used.

To check gray-scale tracking, it is also necessary to tune in a black-and-white program and examine the highlights and lowlights in the picture. The highlights should be untinted white; the lowlights should be untinted gray. If the highlights or lowlights are tinted, gray-scale tracking (red, blue, and green screen and background adjustments) should be adjusted in accordance with the procedure specified in the service data.

Color Operating Control Checks

Color receivers have only two new *customer* operating controls. These

COLOR-TV Chassis

by J. R. MEAGHER, Electron Tube Division, RCA

controls are labeled *tint* and *color* in the new series; the tint control is equivalent to the hue control in earlier models.

Fine Tuning Control: The fine-tuning control should be turned in the direction which will put sound slightly into the picture, thus producing a .9-mc beat in the picture, and then the control should be turned in the opposite direction until the beat just disappears. If the control is turned too far in this direction, the colors will become weaker, and continued rotation in the same direction will cause complete loss of color.

Color Control: The color control should be adjusted to obtain a natural and pleasing intensity of color, neither too pale nor too vivid. It should be possible to overload and distort the colors by turning the color control fully clockwise.

Tint Control: The tint control should be adjusted to obtain natural flesh tones on faces of persons in the picture. If the tint control is turned slightly in one direction from its correct position, the flesh tones become bluish. If the tint control is turned slightly in the opposite direction, the flesh tones become greenish. Correct flesh tones should be obtained with the tint control set at approximately mid-position.

Killer-Threshold Adjustment Checks

In making these adjustments the receiver should be switched to an unoccupied channel. The contrast control and the color control should be turned fully clockwise. The killer-threshold adjustment should be turned to produce colored snow in the raster, and then this adjustment should be turned in the opposite direction until the colored snow just disappears.

To check reception on each color channel, if color is missing or weak on one channel, but is satisfactory on other color channels, one should try orienting the antenna, or try a new antenna. Also any traps, stubs, branch lines, or inductive-type multiple-set couplers, which may be connected to the transmission line, should be disconnected.

If the existing antenna is falling apart from age, or if the transmission line is rotted, a new antenna and a new line should be installed, using a type of antenna recommended for color reception on the desired channels. An antenna rotor should be used in those areas where the stations are in different directions, and in areas of multi-path reception where reflections or ghosts are present.

If the receiver is operated from an indoor antenna of a type which has a tuning or switch control, or an adjustable stub, the adjustment usually has a marked effect on color reception.

HV Regulation Checks

To test the *hv* regulation, a black-and-white or color program should be tuned in, and the brightness and contrast controls turned over the ranges in which they are normally operated; the picture should not *bloom* or go out of focus. The high-voltage regulator circuit should maintain the ultor anode voltage substantially constant (at approximately 22,500 volts in the 800 series receivers) when the picture changes from all-dark to all-light scenes, or vice versa.

Phasing and Relative Gain Checks

In the unlikely event that the tints or hues in color pictures are not normal, it will be necessary to use a suitable color-bar generator[3] to check the phasing of the demodulators and to check the approximate relative gains of the *R-Y*, *B-Y*, and *G-Y* channels. These checks can be made in the home, without using a 'scope, by means of the generator, as follows:

To check phase, the generator should be connected to the receiver, adjusting both the generator and the receiver to obtain a color-bar pattern on the picture tube.

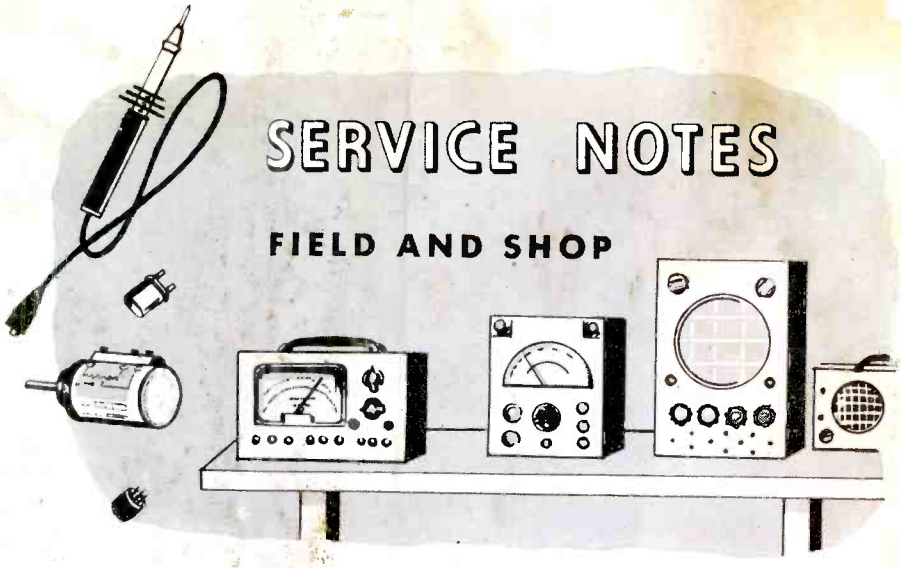
Using the switching circuit shown in Fig. 1, the blue and green guns should be biased off, leaving only the red gun operating. The tint control should be adjusted so the center of bar number 6 has the same brightness as the adjacent spaces between the bars. The tint control should be left in this position.

Now the red and green guns should be biased off, leaving only the blue

(Continued on page 49)

[3]*Such as the RCA WR-61B.*

[4]*The reader is referred to the recently published RCA Color Television Pict-O-Guide for illustrated information on adjustment and troubleshooting procedures.*



SERVICE NOTES

FIELD AND SHOP

RF Chassis-Power Supply Modifications to Reduce Motor Noise . . . Cures for Improper Damping . . . Multirange Ohmmeter Accuracy Checks . . . Remedies for Weak-Strong Station Distortion in Transistor Radios . . . TV Tuner Repair

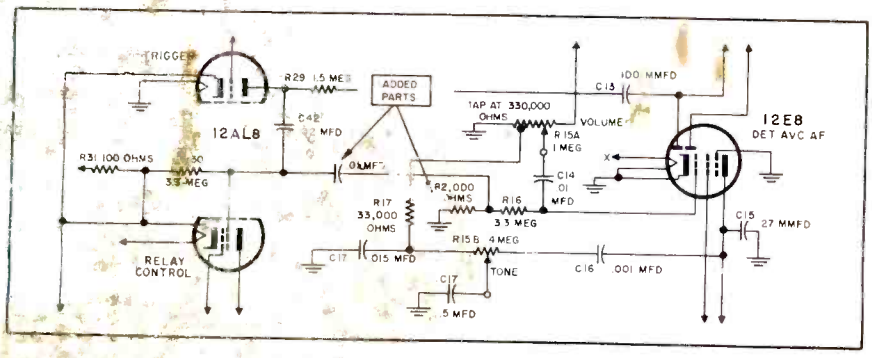
PRODUCTION CHANGES to reduce phono motor noise in Motorola chassis have been made in the *rf* chassis and power unit. The *rf* chassis and power units made prior to these changes *are not interchangeable* with those made after the alteration. The new chassis and corresponding power units have been color coded with a red dot and numbered as follows:

Model 918—serial number greater than 4600; models 919 and 919 HR—serial number greater than 11050.

An *rf* chassis which has a red dot on its power-cable connecting plug requires the use of a power unit that has a red dot adjacent to its power-cable receptacle, and vice versa. (If in doubt about the identification of a power unit, check the power-cable receptacle; if the power-cable receptacle has a grounding clip, then it is to be used with a red dot chassis, and conversely). When servicing these receivers, one must be sure that two matching units are used (either color coded or non-color coded). If a non-color coded type is mistakenly used with a color-coded type, continuous fuse blowing will result.

In the modified receivers, the driver transformer (T_3) has been changed to a new type which has a tapped primary winding. The bottom section of this transformer is connected to the acceleration grid of the driver stage and injects an out-of-phase motor noise pulse into the primary of the driver transformer, thus eliminating the motor noise existing in the B+ line. Choke L_7 has been eliminated, and choke L_8 has been changed to a transformer-type and relocated into the power unit chassis; resistor R_{23} and capacitor C_{21} have been eliminated from the power unit chassis. A grounding clip has been added to the power receptacle on the power-unit chassis; the plug used on the power cable has been changed to a wafer type and an insulated shell has been added to the plug. The plug was changed to accommodate the shell, which acts as an electrical shield.

In addition, new components have been added to the chassis as indicated in Fig. 1.



(Left)
FIG. 1: REVISED CIRCUITRY of Motorola 918 and 919 HR chassis with added components to reduce phono motor noise.

Improper Damping

THE FUNCTION of the damper tube is to eliminate the shock-excited oscillation that occurs in the horizontal output system during horizontal retrace. Since this function is performed immediately after each horizontal retrace, the linearity of the left side of the raster depends upon the damper operation.

In Westinghouse TV chassis, the horizontal linearity control (L_{401}) with capacitors C_{431} and C_{432} constitute a phasing network. When L_{401} is correctly adjusted, the phase of the *ac* component of the voltage from across C_{432} is such that the *ac* component, when applied to the plate of the output tube, compensates for any non-linearity in the output circuit. When C_{431} is open, this compensating voltage is removed, distortion results, causing non-linearity of the horizontal trace.

Resistor-Installation Notes

WHEN INSTALLING resistors on the terminal strip, one should allow sufficient length to the leads; this will prevent solder crystalization due to prolonged overheating. Spaghetti used on these leads should be of *fiberglass* or other heat-resisting material. One should never use the common soft plastic spaghetti, as it will not stand up under overheating.

Multirange-Ohmmeter Accuracy Checks

THE BEST WAY to estimate the accuracy of a multirange ohmmeter is to look at the pointer on the *dc* volt scale and see what 3% of the full scale reading corresponds to on the ohms scale. Broadly speaking, one can expect that the ohms reading to be accurate within ±1½ small divisions on the *dc*-voltage scale. This can readily be transferred from one scale to the other by eye, so as to estimate the accuracy.

For instance, if, on the direct scale the reading is 20 ohms, which is opposite to 150 on the *dc* volts scale, the accuracy will be between approximately 18 and 22 ohms, which is ±10%. Moving further up the

scale to, say 60 ohms, the accuracy will be from approximately 53 to 68 ohms, which is even wider deviation. At the lower end of the scale, say a reading of 5 ohms, the accuracy will be within 4.3 to 5.7 ohms. This again is more than 10% deviation, and the maximum accuracy of the ohmmeter is seen to be at the midscale point, which is true of all ohmmeters.

A reading within ±10% at the best position on the scale does not sound very accurate, and it is for this reason that the accuracy of the ohms scale is often omitted. Information normally provided covers microammeter accuracy which, it is said, is within ±2% and shunt and multiplier accuracy, said to be within ±1%. You are thus left to deduce the fact that the accuracy of all the ranges is somewhere within ±1% and ±3%. However, a more critical examination will show that these accuracies combine to limit the ohms range to a value of ±10%. This is true of all ohmmeter ranges, and the reading obtained should never be trusted to a greater accuracy than this. If resistors are to be checked to a finer percentage, such as 5% tolerance, the only solution is to use a proper resistance bridge for the measurement.

Tuner Repair

A RECENT ANALYSIS of in-warranty returns of Magnavox 700584-6 tuners has revealed that a number are returned as being *shorted*. Examination of these shorted tuners has disclosed that in a great many cases the short has been caused by one of the *rf* plate coils touching the low potential end of R_6, a 10,000-ohm resistor feeding +140 volts to the mixer stage. When this happens, the 2200-ohm (R_{501}) resistor (outside the tuner) burns. The repair necessary is to clear the short by bending the coil away and replacing R_{501}.

Hum and Buzz Remedies

A FEW EARLY Magnavox 21-01BB, 21-02, etc., chassis were produced with the high side of R_{307} connected to +270 v. This, under certain conditions, can result in sync buzz being fed back from sync splitter to the *af* amplifier. If this condition is encountered the high side of R_{307} should be disconnected from +270 and reconnected to the junction of R_{215} and R_{216}.

A few cases of 120-cycle hum also have been reported. This has been found to be due to a change in value of R_{502}; 680 ohms. If this resistor checks off value, it should be replaced.

Deflection-Yoke Failure

YOKES used in all current Magnavox chassis except the 19 series have been found to fail because of puncture of the insulation between leads and solder terminals.

These yokes can be repaired by splicing new leads in place of the burned sections and installing a 1" piece of insulated sleeving as shown in Fig. 4.

Cures for Weak or Strong-Station Distortion in Transistor Radios†

WHEN DISTORTION is present and varies with the strength of the station signals, an abnormal condition obtains in the circuit of those transistors whose bias is *agc* controlled.

Distortion only on weak stations is most often due to unsatisfactory operation of the detector. The diode should have a slight initial forward bias. A check should be made for presence of this bias voltage, and one should also check to see that polarity does not reverse with signal and that *agc* voltage with signal is of proper polarity; base to emitter voltage should decrease with increase of signal.

Distortion on strong stations indicates that the transistors are being driven to cutoff by a strong *agc* voltage. On some pocket-size models an overload diode is used to reduce the gain of an *if* circuit only on strong signals. One should therefore check terminal voltages and the overload diode, if such is used.

Transistor radios will not handle large variations of signal as well as vacuum-tube radios, and it may be that on excessively strong signals the best solution is to turn the radio so

(*Continued on page 55*)

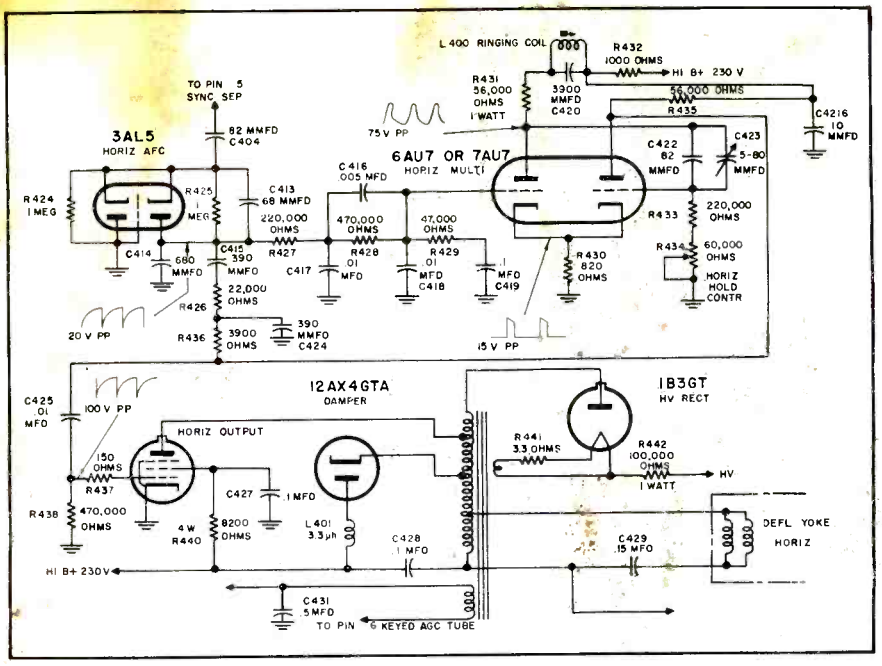
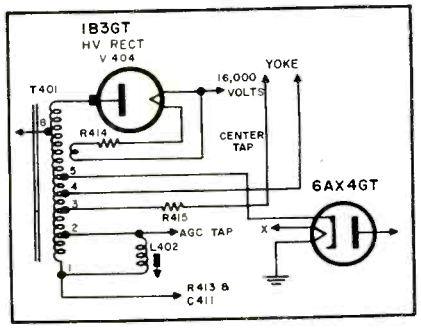
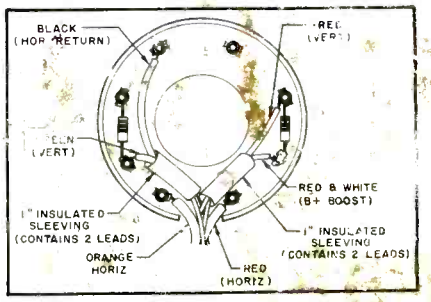


FIG. 2: WESTINGHOUSE horizontal sweep circuit.



(Left)

FIG. 3: MODIFIED HIGH-VOLTAGE TRANSFORMER connections in Magnavox chassis. The agc keying pulse is now obtained from the top of the horizontal width coil.



(Right)

FIG. 4: REPAIRS required in Magnavox yoke to prevent lead-insulation puncture.

CATALOGS—BOOKS

SYLVANIA ELECTRIC PRODUCTS, INC., 1740 Broadway, N. Y. 19, N. Y., has released two booklets: *Industrial Tubes* and *Guide to Replacement*. The *Industrial Tubes* booklet describes the general characteristics of vacuum and beam power tubes, rectifiers, thyratrons, magnetrons, mercury vapor rectifiers and ignitrons. It also lists the maximum ratings of these types. In addition, there are sections devoted to reliable and ruggedized tubes. The *Guide to Replacement* booklet lists the basic designation, tube class and various manufacturers' type numbers for over one-hundred tubes in Sylvania's industrial line.

° ° °

GENERAL ELECTRIC CO., Schenectady 5, N. Y., has published a 12-page booklet describing the why, where and how of industrial capacitor applications. Publication details units and equipments available; discusses problems and solutions in selection of industrial capacitors, and includes diagrams and pictures.

° ° °

CENTRALAB, a division of Globe-Union, Inc., 900 E. Keefe Ave., Milwaukee 1, Wis., has issued a 121-page pocket control guide (No. 6) with listings on the latest replacement controls. Feature of guide are data on carbon and wire-wound controls listed by ratings and part numbers, together with taper curves. Guides are priced at 20 cents each.

° ° °

ELECTRONIC INSTRUMENT CO., INC., 33-00 Northern Blvd., Long Island City 1, N. Y., has released a 6-page catalog (form A5) describing the EICO line of high fidelity equipment in both kit and factory-wired form. Contains specifications on master control preamp, 60-watt ultra-linear power amp, 50-watt ultra-linear power amp, 50-watt ultra-linear integrated amp, 20-watt ultra-linear Williamson-type integrated amp, 12-watt Williamson-type integrated amplifier and a two-way speaker system.

° ° °

THE NATIONAL APPLIANCE Trade-In Guide Co., 2105 Sherman Ave., Madison, Wis., has released the 1958 issue of the *TV Blue Book* which features articles on servicing, advertising and merchandising.

° ° °

HOWARD W. SAMS AND CO., INC., 2201 E. 46th St., Indianapolis, Ind., has issued volume nine in the Sams' *audio amplifier* series. Presents photo coverage, schematics, parts lists, voltage and resistance measurements and servicing information. Contains data on fifteen amplifiers, three preamplifiers, twelve tuners, and five custom radios produced during 1956. Contains 240 pages; priced at $3.95.

° ° °

GENERAL TRANSISTOR CORP., 91-27 138th Place, Jamaica 35, N. Y., has published bulletin G-120, which describes a line of *pnp* and *npn* transistors for radio, *rf*, and *if* applications.

° ° °

TUNG-SOL ELECTRIC, INC., 95 Eighth Ave., Newark 4, N. J., and Minnesota Television Service Engineers, Inc., have published a 20-page *Radio-TV Apprenticeship Standards Guide*. Copies are free to all Service Men and associations. They may be obtained through local Tung-Sol jobbers or by writing to TTLB, Special Services Department, P. O. Box 1321, Indianapolis, Ind.

° ° °

ALLIED RADIO CORP., 100 N. Western Ave., Chicago 8, Ill., has announced the release of a 404-page catalog listing over 27,000 items.

° ° °

CLEVELAND INSTITUTE OF RADIO ELECTRONICS, 4900 Euclid Ave., Cleveland 3, O., has published a 24-page brochure and course outline describing electronic industry employment requirements and opportunities.

° ° °

CBS-HYTRON, Danvers, Mass., has issued a 650-page handbook with data on over 1000 tubes along with 300 curves for current receiving and television picture tubes, regardless of make. Abbreviated data are included for seldom-used tubes of these types, as well as a variety of special-purpose tubes. Data and curves for CBS semiconductors are also given.

ASSOCIATIONS

TSA, Detroit, Mich.

THE SECOND ANNUAL MIDWEST Electronic Forum sponsored by Television Service Association, 8225 Woodward Ave., Detroit 2, Mich. will be held in February, 1958.

The forum will cover technical lectures on b-w and color television, radio, hi-fi, tape recorders and industrial electronics.

RTG, Long Island, N. Y.

THE FIRST FALL TECHNICAL meeting of the Radio and Television Guild was held recently.

Pete Langer of Sylvania was the featured speaker. He covered the *technical aspects of servicing Sylvania's 1958 TV receivers.*

At an earlier executive meeting, a group-insurance program was discussed. Tentative plans call for a study of accident, health, income protection and life forms of coverage for possible use by the guild and its membership.

ESFETA, New York

THE EMPIRE STATE FEDERATION of Electronic Technicians Associations, Inc., held a meeting recently in Ithaca, New York, with *Ben DeYoung,* representing Ithaca, acting as host member.

Among those at the session was NATESA eastern vice president *Bert Lewis,* representing Rochester.

George Carlson, ESFETA secretary, reported that Jamestown's self-certification program has been very effective where individual members advertised association membership, and general promotion of the plan obtained.

The next meeting of ESFETA has been scheduled for Nov. 10 in Rochester, N. Y. *Robert LeMay,* president of the Rochester group will be host.

TEN YEARS AGO IN SERVICE

THE RADIO TECHNICIANS GUILD of Rochester, N. Y., announced a two-day meeting featuring talks on FM, TV, tubes and business management. . . . The first organization meeting of the State of New York Federation of Radio Technicians has held. . . . A twice-a-month newspaper advertising campaign listing association members was set up by the Radio and Electronic Technicians Association of Indiana, Inc. . . . Officers of RETA were *John Lackman,* president; *John Davies,* vice president; and *Charles Palmer,* publicity director. *Robert Tate, Harold Gibson, Carlton Kindig, Charles Palmer* and *Claude High* were on the board of directors. . . . The Long Beach, Calif., Radio Technicians Association conducted a drive for old TV sets for use in apprentice training at schools and boys clubs. *Wes Farrell* was president of the association; *John J. Sawyer,* vice president; *Verne Preston,* secretary; and *Clare Reese,* treasurer. Directors included *P. N. Nibbelin, M. E. Mattox, H. M. McNeil* and *R. J. Hayden.* . . . The Radio Technicians Association of Huntington, W. Va., announced membership requirements: Two years' experience in active servicing and a written examination of ten questions where the passing grade was 80%. . . . First circuit report on *if* systems used in prewar and postwar TV receivers was published in SERVICE. . . . Over 100,000 TV receivers (mostly 10-inch type) were reported to be in operation. . . . *Les A. Thayer* of Belden Manufacturing Co. was elected chairman of the Association of Electronic Parts and Equipment Manufacturers in Chicago.

THIS MONTH IN SERVICE

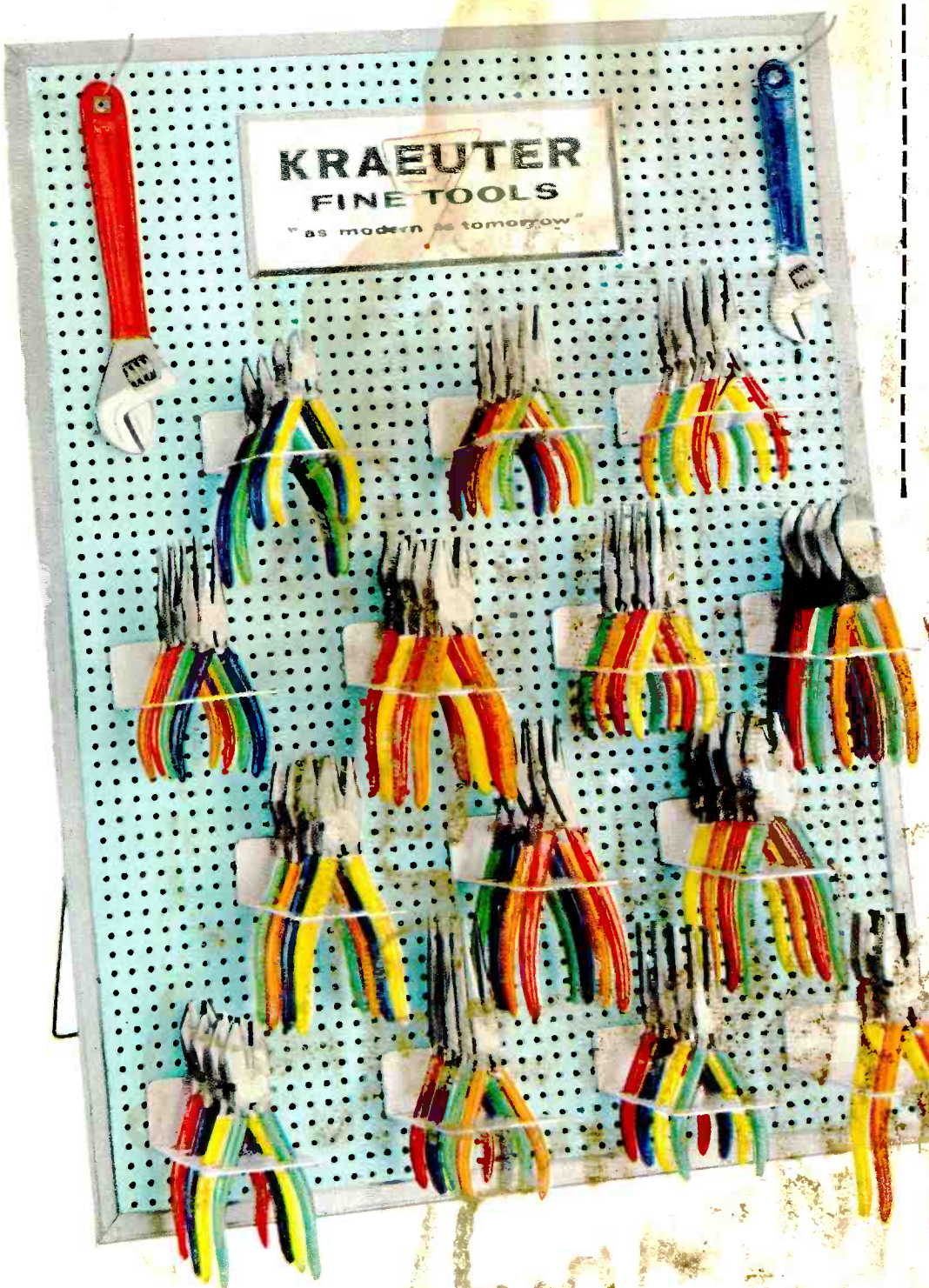
BOOM IN CLOSED-CIRCUIT TV OPERATION--The increasing use of closed-circuit TV, and its widening scope of application, is writing a new chapter on the television scene. . . . Today CC-TV, which basically concerns TV signals confined to cable circuits for reception by interconnected receivers, is serving many business, industrial, educational, entertainment, religious, professional, and municipal activities. Current interest in CC-TV ranges from apartment houses and banks, to theatres and toll-TV cable systems. . . . CC-TV is providing many schools and colleges with an economic means of giving graphic instruction to different classes, often in different buildings, at the same time. In several places, it is bringing educational programs from the schools to local community centers. . . . CC-TV business uses include facing and talking to representatives throughout the country without any of them leaving their home cities, linking stockholders' meetings in different cities, verifying signatures of bank customers, watching for poachers on parking lots, and even baby sitting. . . . Industrial CC-TV use covers inspecting manual and mechanical operations, watching heat and pressure gauges, detecting unnecessary chimney smoke, locating trouble in equipment, monitoring entrance gates and yard traffic. . . . In transportation, CC-TV applications are broad, too; railroads are using closed circuits to check car numbers and inspect freight-car running gear in switchyards, to speed issuance of reservations and tickets at passenger stations, and to police gradecrossings. Airports employ CC-TV to check aircraft, watch planes take off and land and to provide waiting passengers with information about plane arrivals and departures. . . . A number of hotels and apartment houses now offer guests free non-broadcast video entertainment and other programs via closed circuit.

WHERE CC-TV OPERATION is confined to a single building, interior cables can be installed to connect up several rooms. Or it can be strung outside to link a group of buildings. In more extended operations, because of the cost factor, the cable is not usually buried in the ground, as are most of the common carrier coax lines. In such cases, the private cable is, under a mutual rental or other arrangement, normally suspended on the same poles which carry local power and telephone lines, or on poles erected for the purpose.

ASSOCIATIONS COOPERATING IN UHF FIELD TESTS--Affiliated groups in NATESA are cooperating with TASO (Television Allocations Study Organization) in a series of home-observation field tests, which began a short while ago in the south and midwest. . . . In the south, a team of association members have been helping crews check reception from two Baton Rouge TV stations--WABF-TV, operating on channel 28, and WBRZ (TV) operating on channel 2. . . . In these studies measurements of field strength outside the home are taken at the same time that observations in the home are being made by Service Men and the viewer, in an attempt to find a correlation between the strength of TV signals as actually measured and the degree of satisfactory service received on typical home receivers. . . . The tests in the midwest were conducted in Madison, Wisconsin.

PICTURE-TUBE LIFE STUDY UNDER WAY BY STANDARD-BRAND MANUFACTURER--An investigation of the life and performance efficiency of standard-brand picture tubes as compared to other types is now being conducted by a leading tube maker. . . . Preliminary tests have indicated that the extreme precautions taken by standard-brand plant research, production and test result in not only a substantial increase in tube life, adding thousands of hours in many cases, but performance values, too.

TUBES-TESTED-BY-EXPERTS PROMOTION SET--A promotion campaign, aimed at helping independent Service Men inform the public about the importance of having tubes tested by experts has been introduced. . . . This campaign will stress that only a trained Service Man using reliable electronic test equipment can make an accurate analysis of the conditions of receiving tubes. . . . The promotion points out that unskilled attempts of radio and TV set owners to fix it themselves can result in damage to the receivers.



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RADIO & ELECTRONICS

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3 ea. of Short Jaw Nose Cutting Pliers 71	8 R*	3.95	11.85
" " " Long Needle or Snipe Nose Pliers 1621	6 Y	2.85	8.55
" " " Curved Needle or Snipe Nose Pliers 1631	5½ G	3.25	9.75
" " " Short Chain Needle Nose Pliers 1641	5 R	2.85	8.55
" " " Long Chain Needle Nose Pliers 1661	6 B	3.15	9.45
" " " Radio & Ignition Nose Cutting Pliers 1663	6 Y	3.25	9.75
" " " Tongue-N-Groove Joint Pliers 710	10 R	3.60	10.80
" " " Extra Long Chain Nose Pliers 1781	7 O	3.75	11.25
" " " Electricians' Side Cutting Pliers 1830	7 Y	3.25	9.75
" " " Diagonal "Oblique" Cutting Pliers 4501	4½ B	2.50	7.50
" " " Diagonal "Oblique" Cutting Pliers 4501	5 O	2.75	8.25
" " " Diagonal "Oblique" Cutting Pliers 4501	6 R	3.10	9.30
" " " Heavy Duty Diagonal Cutting Pliers 4610	7 G	3.10	9.30
" " " Diagonal Cutting Pliers-Needle Point 5601	5 R	3.50	10.50

List	134.55
Cost to retailer	89.70
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Peg Board Display & 14 Brackets	FREE

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3 ea. of Short Chain Needle Nose Pliers 1641	5 R*	2.85	8.55
" " " Long Chain Needle Nose Pliers 1661	6 B	3.15	9.45
" " " Long Chain Needle Nose Pliers 1671	6 G	2.60	7.80
" " " Extra Long Chain Nose Pliers 1781	7 O	3.75	11.25
" " " Linemen's Side Cutting Pliers 1801	8½ Y	4.50	13.50
" " " Electricians' Side Cutting Pliers 1830	6½ O	2.90	8.70
" " " Electricians' Side Cutting Pliers 1830	8 B	3.70	11.10
" " " End Cutting Nippers 1850	7 R	3.60	10.80
" " " Diagonal "Oblique" Cutting Pliers 4501	4½ B	2.50	7.50
" " " Diagonal "Oblique" Cutting Pliers 4501	5 O	2.75	8.25
" " " Diagonal "Oblique" Cutting Pliers 4501	6 R	3.10	9.30
" " " Heavy Duty Diagonal Cutting Pliers 4610	7 G	3.10	9.30
" " " Tongue-N-Groove Joint Pliers 710	10 R	3.00	9.00
" " " "Griptite" Combination 356	6 O	2.30	6.90

List	131.40
Cost to retailer	87.60
Profit to retailer	43.80
Peg Board Display & 14 Brackets	FREE

HARDWARE

		List each	Total List
3 ea. of Short Chain Needle Nose Pliers 1641	5R*	2.85	8.55
" " " Long Chain Needle Nose Pliers 1661	6 B	3.15	9.45
" " " "Griptite" Combination Pliers 356	6 O	2.30	6.90
" " " Extra Long Chain Nose Pliers 1781	7 O	3.75	11.25
" " " Linemen's Side Cutting Pliers 1801	8½ Y	4.50	13.50
" " " Electricians' Side Cutting Pliers 1830	6½ O	2.90	8.70
" " " End Cutting Nippers 1850	7 R	3.60	10.80
" " " Diagonal "Oblique" Cutting Pliers 4501	4½ B	2.50	7.50
" " " Diagonal "Oblique" Cutting Pliers 4501	5 O	2.75	8.25
" " " Diagonal "Oblique" Cutting Pliers 4501	6 R	3.10	9.30
" " " Heavy Duty Diagonal Cutting Pliers 4610	7 G	3.10	9.30
" " " Gripping & Cutting Pliers 2018	7½ R	3.50	10.50
" " " Button's Pattern Pliers 1841	8 O	2.90	8.70
" " " Tongue-N-Groove Joint Pliers 710	10 R	3.00	9.00

List	131.70
Cost to retailer	87.80
Profit to retailer	43.90
Peg Board Display & 14 Brackets	FREE

*Color code:
R-Red, Y-Yellow, G-Green,
B-Blue, O-Orange

Alternate Packages are available in 6 each of any 7 tools listed in the Hardware, Mill Supply and Radio-Electronics assortments.

RF Amplifier Stages For VHF TV Tuners

How Pentode-Tuner Amplifiers Operate . . . Circuit And Tube Conditions Which Affect Cascode And Pentode RF-Amplifier Performance

by WAYNE S. RIAL

Application Engineer, Electronic Tube Div.,

Westinghouse Electric Corp.

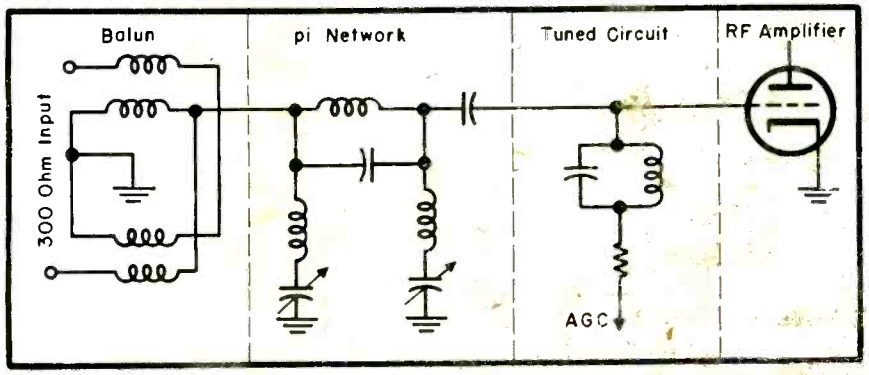

FIG. 1: ANTENNA matching network and its relation to tuner circuitry.

TUNED CIRCUITS in series-cascode amplifiers, which employ a *pi-network*, obtain this net by way of the output capacity-to-ground of the grounded-cathode stage, the coil, and the input capacity-to-ground of the grounded-grid stage. Most tuner manufacturers select a value of coil inductance such that the *pi* network will resonate slightly above the highest *vhf* channel.

Another peculiarity, typical to series cascode amplifiers, is the method of establishing grid bias on the grounded-grid stage. Several circuit configurations are used.

Another condition, peculiar to the series-cascode circuit, is that dual triodes containing very low heater-cathode leakage must be used, because the cathode of the grounded-grid stage is above 100-*v* positive with respect to the heater. With modern dual triodes designed for cascode use, this problem has not been serious.

Several types of sharp cutoff triodes are available for cascode operation; cascode transconductances vary between 8,000 and 10,000 umhos at -1-*v* bias on the input section. These tubes are the BQ7A, BZ7, BK7A and BS8 in the order of magnitude of increasing cascode *GM's*. Also a remote cutoff cascode tube (the BC8) is available with a -1-*v* bias cascode GM of near 10,300 umhos. The larger tuner manufacturers require a sharp-cutoff cascode tube, because most tuners are to be used with TV receivers employing simple *agc* bias systems. Also, tuner designers say that less variation of cascode stage input-conductance occurs with sharp cutoff tubes, although this statement has never been truly evaluated.

Recently two new dual-triodes have been announced for cascode-tuner use; these have been especially designed for low B+ operation (cascode B+ of 125 volts). These tubes (the 4BX8 and 6BX8) are of great value where high gain, low noise, tuner *rf* amplifiers are desired for low B+ operation.

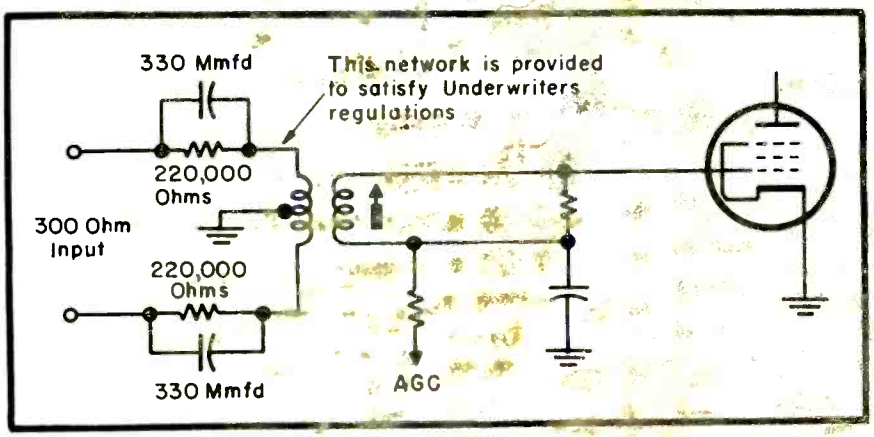

FIG. 2: TYPICAL TUNER input circuit using a matching transformer.

Pentode-Tuner Amplifiers

The main reasons for using pentode-tuner *rf* amplifiers are cost and available supply voltage. Pentodes are only used in low-cost B+ receivers. As stated earlier, the principal disadvantage of tuner pentodes is [illegible] output.

Some other inherent characteristics of the pentode are:

(*1*) They operate at high gain.

(*2*) Neutralization is not required.

(*3*) Stable operation with tuned grid circuits can be achieved.

(*4*) The input impedance varies greatly with *agc* voltage variation.

(*5*) They are noisier than triodes.

One noise source in a pentode (as in a triode) is due to shot effect. The pentode has an additional noise source called *partition* noise which is due to irregularities in the division of

(*Continued on page 54*)

VHF RF Tuner Amplifiers, SERVICE, August 1957.

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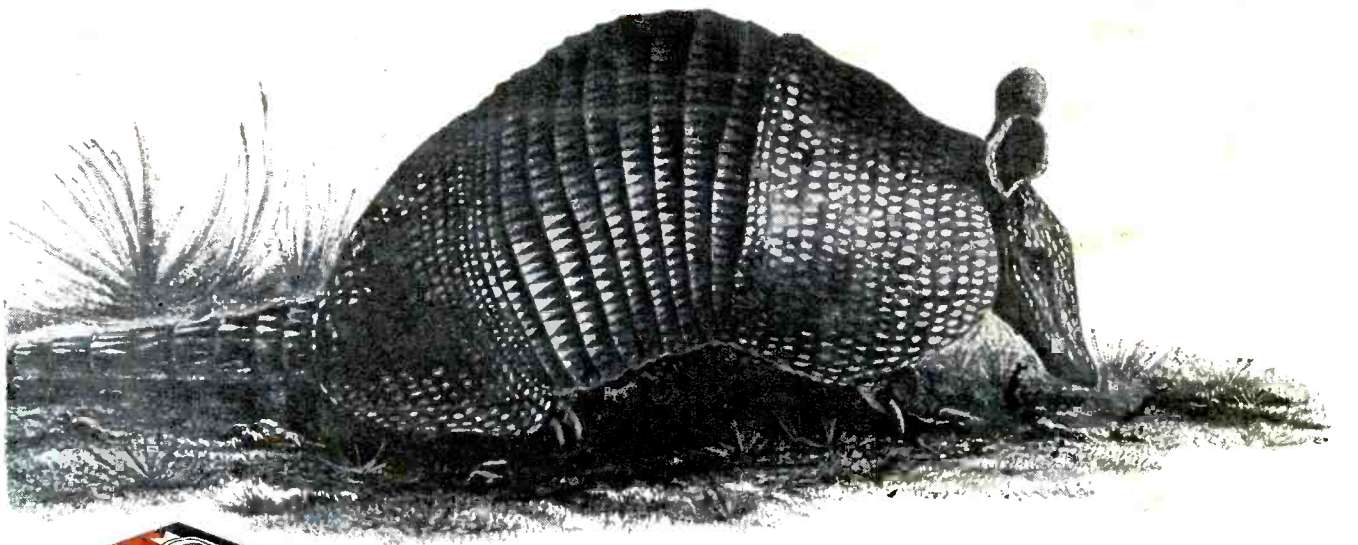

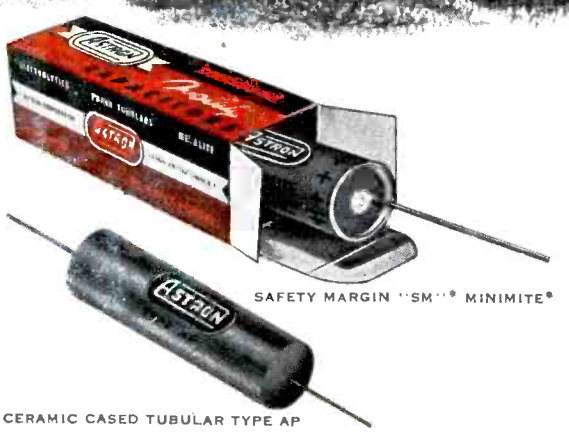

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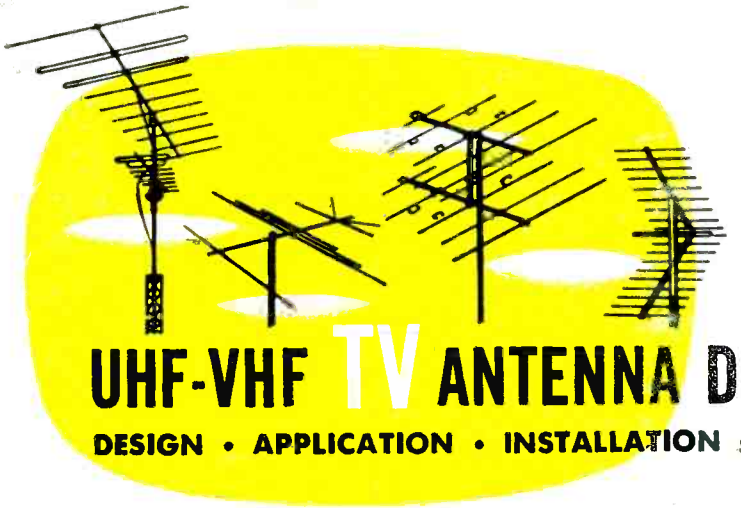
TV Antenna Replacement With All-Channel Types‡



SEVERAL MONTHS AGO a field-engineering crew conducted a study investigating the replacement of old *worn-out* antenna installations with *exact-replacement* antennas.[1] This study revealed that severe performance deterioration takes place in an antenna installation over a period of from four to six years, and that marked improvement can be achieved through replacement of the antenna, leadin and allied accessories.

The exploratory tests showed that exact replacements, antenna type for antenna type, provided substantial increases in gain, e.g., 7 db for channel 3 and 3.2 db for channel 8. The two TV stations involved in this performance check were slightly over fifty miles from the reception point.

The original, as well as the replacement antennas, employed in the *old-versus-new* project were 5-element yagis for the lowband station and 10-element yagis for the highband station, with separate leadins for each antenna and manual selection used to switch from one antenna or the other. Installations of this type were very common up to approximately four or five years ago.

Shortly after this survey was completed, it was decided to find out what improvements would obtain if the existing cut-for-channel antennas were replaced with an all-channel model which could provide not only more gain, but *full* coverage of the stations now in the area, and prepare for reception of additional channels that might be allotted.

A single *all-channel* antenna was selected for the test and installed on the same site location as the cut-for-channel array used previously.

Superior results were immediately noted. Not only was it possible to tune in more stations with consistency, but the quality of pictures from the familiar stations was better and the signal strength from the others was very satisfactory.

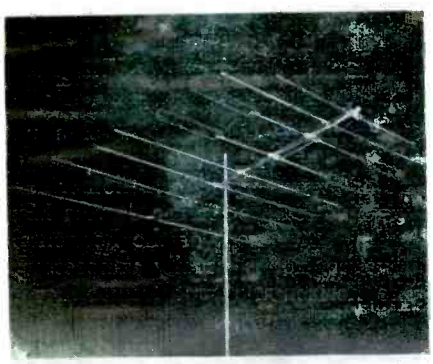
Not only did the study disclose that improved performance resulted when new type antennas were installed, but other advantages prevailed, too. It was possible to eliminate antenna switching, since one antenna provided multi-station pickup. The single antenna also removed the complex and unattractive multiple system setup; the mast now could be supported more firmly.

The original cut-for-channel installation had used a chimney mount to provide sufficient rigidity for the top-heavy installation. When the elements and feed contacts of the old antenna were inspected they were found to be heavily coated with soot which had begun to erode the metal. It was also found that the high-mast chimney installation often vibrated so violently that the vibration rumble was transmitted to all the walls of the house.

To overcome these problems the single antenna was mounted directly

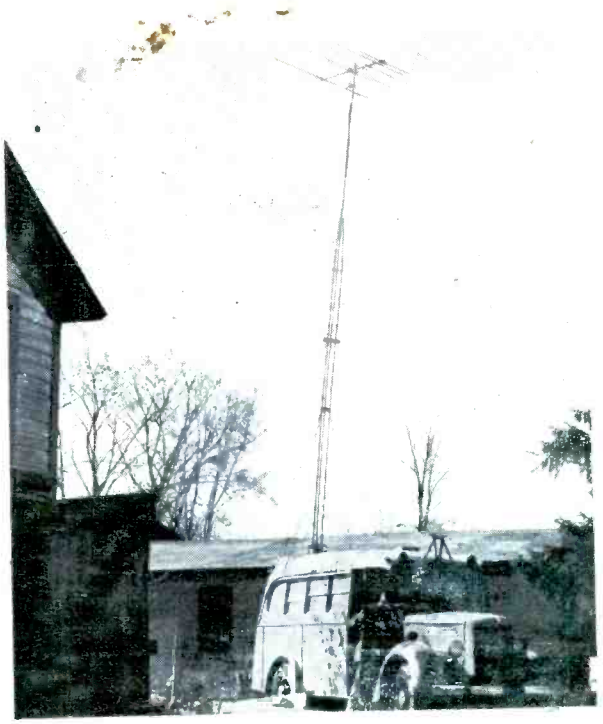
(*Continued on page 53*)

[1] *TACO Report*, SERVICE; *July*, 1957.



ANODIZED TV ANTENNA now available in single or stacked arrays. Anodizing is said to provide long-term sealing of the aluminum surface pores against corrosive elements. Antennas incorporate an improved paddle design on the driven dipoles for greater bandwidth. (Models G2540, G2550, G2560 and G2570; Technical Appliance Corp., Sherburne, N. Y.)

MOBILE TEST laboratory with all-channel vhf antenna used to study results obtained with newer types and cut-for-channel installations made several years ago.



‡*Based on an investigation conducted by the field-engineering department of the Technical Appliance Corporation.*

21-Inch Color-TV

(*Continued from page 21*)

voltage-dividing network is on a separate mounting board to which the picture-tube socket is also attached.

The sync circuits are fed from the plate circuit of the first video stage and consist of a sync separator and a sync-output stage which perform normal functions. As in past deluxe models, these color receivers employ a noise inverter circuit to insure sync stability.

Sync information is fed from the plate of the first video amplifier to the grid of the sync separator. Any noise impulse appearing in the video plate circuit will also appear in the cathode circuit. The cathode of the noise inverter is connected to the first video amplifier cathode; thus, when the grid voltage of the noise inverter is preset by the noise-inverter control any noise appearing at the cathode will appear amplified (above the preset level) at the plate of the noise inverter. This is opposite in polarity to the same noise pulse appearing at the plate of the first video amplifier. The output of the noise inverter and the output of the first video amplifier are connected to the grid of the sync separator, and since the polarities of the two noise pulses are opposite at the common point, the noise is cancelled. As mentioned, the noise inverter control sets the level at which the noise inverter operates. It should be adjusted so that over-cancellation does not take place. This would affect sync and cause the set to *lock-out* of synchronization.

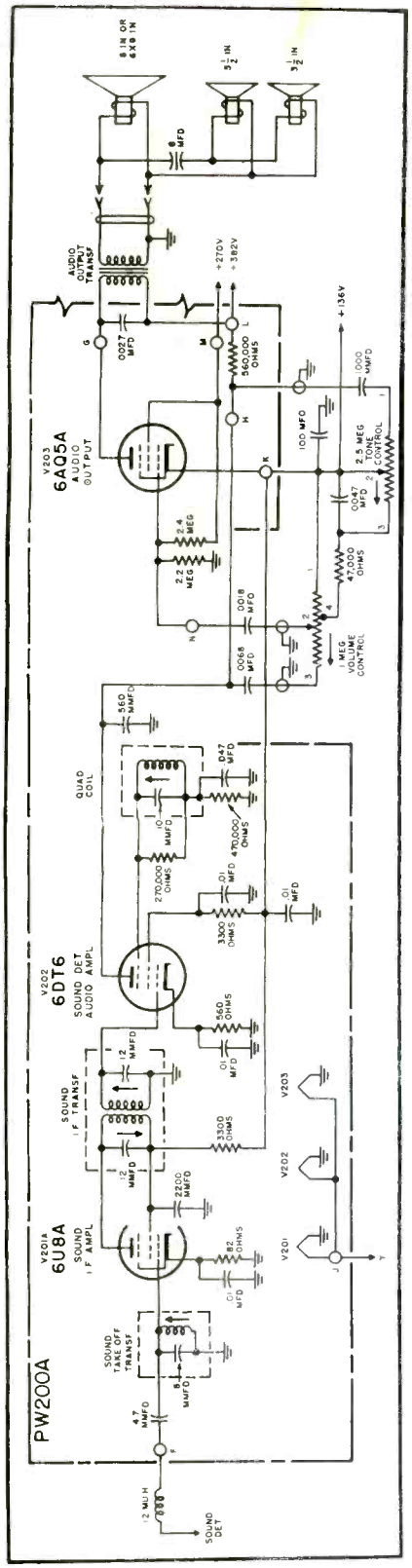
The *agc* circuit uses the triode section of the 6AW8A first video amplifier. The tube is keyed into conduction by a pulse from the horizontal output transformer. *AGC* voltage is applied to the grids of the first and second picture *if* amplifiers and the grid of the *rf* amplifier.

Preset AGC System

The *agc* system in this new line differs from previous color receivers in that the *agc* control is preset at the factory and normally requires no adjustment. If adjustment should be required it is recommended that a meter or other indicating device be connected to terminal *D* of the printed circuit video board[e] and the *agc* control adjusted to show a reading of 10 volts p-p at this point. If the *agc* control is not adjusted in this manner it is possible to degrade color renditions.

The horizontal oscillator and control stages consist of a modified *synchroguide* circuit using a 6CG7 dual triode. A stabilizing pulse is applied to this circuit from the *agc* pulse line from the horizontal output transformer. Horizontal hold is controlled by adjusting the core of the horizontal-frequency coil.

The 6DQ5 horizontal-output tube incorporates, in its grid circuit, the bias supply for the noise inverter and brightness controls. Horizontal drive is regulated by a 250,000-ohm potentiometer in the output circuit of the horizontal oscillator. Another convenience feature for the Service Man is that adjustment of the horizontal-drive control is usually unnecessary. The horizontal-output transformer is the source for horizontal pulses for *agc*, color killer, horizontal convergence, horizontal retrace blanking, burst keying in the chrominance circuits, and horizontal-sweep deflection. Other functions in the horizontal output circuit include; High voltage (22,500) for the picture-tube ultor anode, through a 3A3 rectifier and a 6BK4 shunt regulator tube; a focus-rectifier type 1V2, and the 6AU4GTA damper. B+ *boost* voltage is also supplied from the horizontal-sweep output circuit. Adjustment for high



(Left)

FIG. 5: SCHEMATIC DIAGRAM of the sound-system developed for the RCA CTC7 color-TV chassis.

voltage is provided by a variable resistor in the grid circuit of the shunt regulator.

Vertical sweep deflection is accomplished by one triode section of a 6CG7 used as the vertical oscillator and a 6AQ5A vertical-output stage. The vertical-output circuit, besides providing vertical-sweep deflection, also provides vertical-retrace blanking for the plate circuit of the second video amplifier, and from the cathode of the vertical output tube, voltage used in the vertical-convergence circuits.

Chrominance Circuitry

The chrominance circuits in this new chassis consist of two bandpass amplifiers, two demodulators, and single amplifier stages for each of the three primary color-difference signals.

The first bandpass amplifier, using the pentode section of a 6UA8, is coupled to the plate of the first video amplifier. The bandpass amplifiers are tuned to accept only that portion of the video signal containing the color

(*Continued on page 40*)

21-Inch Color-TV

(*Continued from page 39*)

signal information (the region of 3.58-mc above the picture carrier) and pass the color-signal information to the demodulators. The demodulator section uses a 12AZ7 dual triode.

The chrominance signal is fed from the second bandpass amplifier to the grids of the two triodes. Each triode operates independently, with one section as the *X* demodulator and the other as the *Z* demodulator; *X* and *Z* are arbitrary designations given to the demodulation axes, which in this instance are separated by 57.5°.

By the process of synchronous detection the modulator plate voltages vary in amplitude, continuously proportional to the amplitude and phase of the chrominance signal.

The output of the *X* demodulator is fed to the grid of the *R-Y* matrix amplifier, one triode section of a 12BH7A, and from plate of this tube to the red grid of the picture tube. The output of the *Z* demodulator is applied to the *B-Y* matrix amplifier, one triode section of a 12BH7A, and from the plate of this tube the blue color difference signal is applied to the blue grid of the picture tube. By applying a portion of the output of both demodulators to the cathode of the two mentioned matrix amplifiers, and adding a third triode having its grid at *ac* ground potential, and a common cathode resistor for the three matrix amplifiers, the *G-Y* color difference signal is developed in the plate circuit of the third triode. The *G-Y* (green) color difference signal is applied to the green grid of the picture tube.

In order for the demodulators to operate, a locally-developed subcarrier reference signal must be applied. This is accomplished by the crystal controlled 3.58-mc oscillator, a 6UA. Output from this oscillator is applied to the cathode of the demodulators, the proper phase being determined by the crystal and the reactance control tube.

Color synchronization is obtained by developing a signal which matches, exactly in frequency and phase, the color synchronization signal (burst). This is accomplished by feeding the burst signal from the output of the first bandpass amplifier to the grid of the burst amplifier. A horizontal pulse from the horizontal-output transformer is delayed to coincide with burst time in the composite transmitted signal. This follows the horizontal sync pulse at a predetermined time; thus by delaying the pulse fed to the burst amplifier grid, the tube conducts only at the time burst is present. Burst is then ampli-

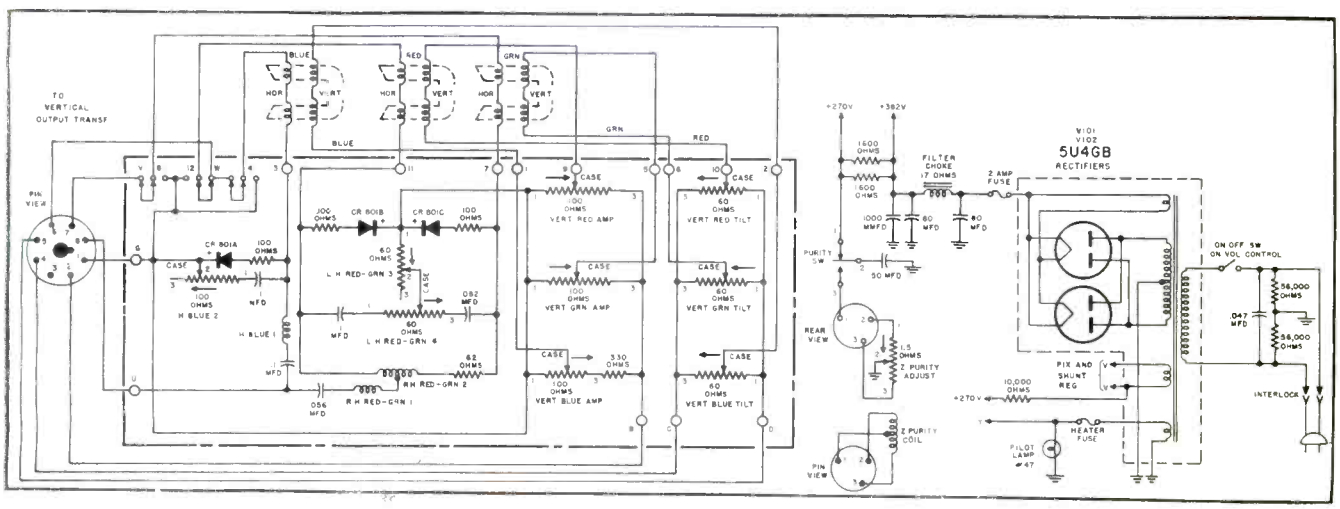


FIG. 6: DYNAMIC CONVERGENCE and power supply circuitry of RCA CTC7 color-TV chassis.

fied and fed through a transformer to the phase detectors, two diode sections of a 6BN8. At the same time, a portion of the subcarrier-reference signal from the local 3.58-mc oscillator is fed to the phase detectors. Any variation between the phase of burst and the phase of the local 3.58-mc oscillator results in an error voltage across R_{27B} and R_{27A}. The error voltage is fed to the reactance control tube which effects the necessary phase correction in the 3.58-mc oscillator. As the 3.58-mc oscillator is driven to the correct phase (to match burst phase), the correction voltage in the phase detector drops to zero and the color signals are demodulated in proper phase. When this happens, color synchronization takes place because the phase of burst and the phase of the locally-generated 3.58-mc subcarrier are the same; thus the color signal information can be demodulated to produce the original colors transmitted. All colors will appear in the picture in the same places and proportions as they do in the scene being televised.

Automatic control of the chrominance level is effected by applying a rectified version of the amplified burst signal to the grid of the first bandpass amplifier. Operation of the automatic chroma control circuit can be compared roughly with *agc* operation. As the burst signal increases in amplitude, the burst voltage from the output of the burst amplifier increases. This increased burst voltage, when rectified by one of the diodes of the phase detector, produces an increase in the bias voltage that is applied to the grid of the bandpass amplifier, and as a result, the stage provides less gain and thus limits the amplification of the color signal to the predetermined level.

A decrease in the received burst level would result in the opposite effect. Less burst would result in less bias at the grid of the first bandpass amplifier, more gain in this stage, and the color signal would be amplified to the predetermined level.

By this means, the color picture remains at a constant level regardless of variations in the strength of the transmitted burst signal.

The color killer circuit in this new chassis cuts off the second bandpass amplifier during the absence of the color synchronization signal (burst); thus color will appear in the picture only when a color signal is being received.

A portion of the output of the 3.58-mc subcarrier oscillator is fed to the

(*Continued on page* 44)

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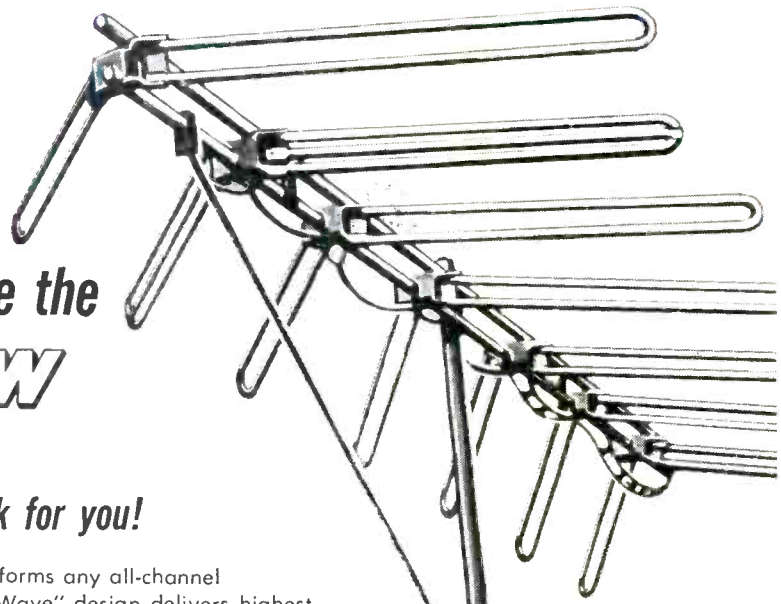

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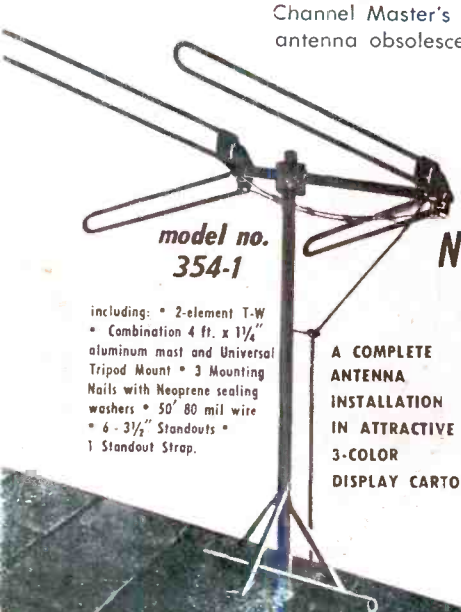

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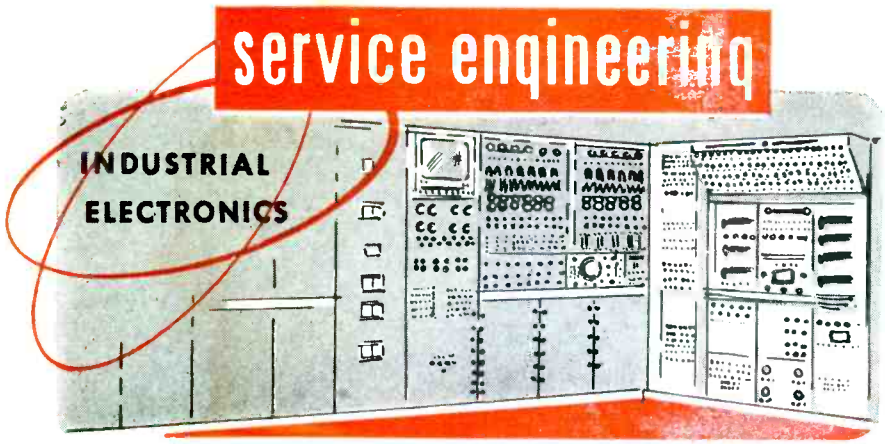


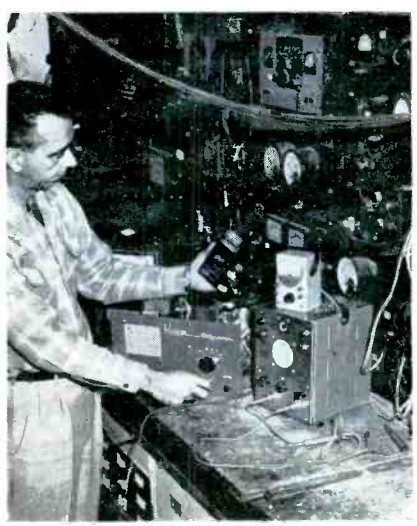
Repeater Stations, Antennas and Amplifiers for Microwave Systems . . . Test Equipment Facilities for Two-Way Installations

SINCE MICROWAVE PROPAGATION is essentially limited to line-of-sight paths, it is frequently necessary to repeat the signals. When communications are not required at repeater stations its equipment takes a very basic form. In this case the received video signal is simply reshaped and retransmitted in the same direction. Frequently, however, it is desirable to terminate some of the channels at a repeater station. The terminations may be on a party-line basis, in which case the demodulated information is reinserted into the system for further use; or the termination may be complete, in which case the channel is free to be used in the rest of the system for other purposes. The repeater with multiplex and termination units is similar to two microwave terminals connected back to back. The only additional equipment required here is called a blanking and switching unit, an electronic gate synchronized by the multiplex equipment. The gate is used to remove selected channel pulses from the train of through video pulses. It is also used to reinsert new pulses in the same channel positions with the same or new modulation for further use in the system.

Power Amplifier Operation

Power amplifiers designed for microwave applications are usually 100% grid modulated by the amplified pulses from multiplex modulators. In the output are short bursts of *rf* energy at about 20 to 30 watts peak power. These correspond to .5 microsecond pulses spaced about 4 microseconds apart which are generated, synchronized, and pulse-position modulated in the multiplex. The transmitter - modulator circuits contain pulse-shaping stages which assure that all pulses will be uniform in shape and amplitude, and free from noise. This feature is of great importance when the same pulses are repeated through many stations. Noise accumulated in transmission and reception is effectively removed at each repeater before transmission.

A single antenna is almost always used for both transmission and reception. These two signals are separated by a pair of band-pass filters called an *rf* duplexer. At 2000 mc the receive and transmit filters are coupled through a single coax transmission line to a dipole radiator backed up by a parabolic reflector. The reflector concentrates the radiated energy in the desired direction with an efficiency that leads to effective power gains of approximately one thousand.



CHECKING TRANSMITTER tuning with a grid-dip meter. The circuit tracer to the right of the marine radiotelephone serves to check receiver circuits.

(Photo by Cyril Glunk)

Two-Way Test Equipment

IN TWO-WAY service, tube testing is extremely important. Accordingly one must select instruments required for such tests with great care. The emission type will not do; testers should measure dynamic mutual conductance. Even after testing all tubes in a high-grade tube tester, substitution of tubes one-at-a-time often reveals tubes which will not provide optimum performance under actual operating conditions.

Most tube testers fail to detect grid emission, a significant cause of two-way receiver malfunction. Special grid-circuit tube testers, or general-purpose tube testers with built-in grid emission testing features, will show up tubes which are apparently okeh, but which detract from receiver performance.

Two-way equipment manufacturers generally sell special test meters for use with their equipment. These test meters plug directly into the mobile unit enabling measurement of various voltages and currents without exposure of the bottom of the chassis. Some shops, servicing several makes of mobile equipment, have built universal test meters for this purpose.

Besides adequate test equipment, more rigid servicing techniques and ingenuity are essential. Mobile radio equipment is subjected to environmental conditions far more severe than electronic devices installed at fixed locations. While most receivers employ very stable frequency control circuits, some have been known to drift off frequency when subjected to unusually high or low temperatures.

Although it is not economically feasible for a service shop to install a temperature chamber, some reports of malfunction of two-way equipment have been traced to frequency drift attributed to exposure to extreme temperatures. A mobile unit whose frequency checks out in Chicago on a spring day could be off frequency in the middle of July, as well as in January, because of the wide variance in temperature. It can be extremely

(Continued on page 48)

21-Inch Color-TV

(*Continued from page 41*)

plate and grid of the triode section of the 6BN8 killer detector. When burst is present in the received signal, as mentioned previously, the phase detector will operate. A portion of the burst signal applied to the phase detector is also applied to the cathode of the killer detector.

When the signal applied to the plate and grid of the killer detector is in phase with the signal applied to the cathode, the tube conducts and a voltage is developed at the grid of the color killer tube. This voltage overcomes the normal bias on the grid of the color killer and causes this tube to stop conducting. The output of the color killer is applied as a bias to the grid of the second bandpass amplifier; thus, when the color killer is conducting, the second bandpass amplifier is cut off. When the second bandpass amplifier is cut off, no signal is applied to the grids of the *X* and Z demodulators and as a result color picture presentation on the picture tube is not possible.

When the color-killer tube does not conduct, the second bandpass amplifier is free to operate and amplify any signal present in its grid circuit.

Thus, the voltage developed by the killer detector (happening only during the time burst is present) overcomes the killer bias, the second bandpass amplifier operates, and a color picture will be shown on the picture tube. When burst is not present, only the signal from the 3.58-mc subcarrier oscillator will be present at the plate and grid of the killer detector. The tube will not conduct, since only when burst is present will there be sufficient cathode bias to cause conduction, and the color killer will apply bias to the grid of the second bandpass amplifier sufficient to cut off its operation. In this manner, since the phase of burst and the phase of the signal from the 3.58-mc subcarrier oscillator are the determining factors for operation of the killer circuit, noise impulses cannot cause the second bandpass amplifier to operate and the black-and-white picture will be free of color caused by impulse noise. The operating level of the color killer circuit is preset by the killer-threshold control.

Horizontal-retrace blanking is accomplished by applying a horizontal pulse to the grid of one triode section of a 12BH7A, the horizontal blanking amplifier. This pulse, amplified, is applied to the cathode of the

second bandpass amplifier, causing this tube to be cut off during horizontal retrace time. In addition, the amplified pulse is coupled to the cathodes of the three matrix amplifiers. This causes these tubes to draw large currents during retrace and thus reduces their plate voltage and cuts off the picture tube. It also causes these tubes to reset the *dc* level of the color signals.

The new glass-envelope picture tube introduced in the 800 series color receivers is similar in many respects to the previously used metal-envelope tube. It features magnetic-sweep deflection, electrostatic focus and magnetic convergence.

An internal conductive coating, similar to black-and-white picture tubes, is used as a supplementary filter capacitor for the high voltage. In these receivers, high voltage is regulated at 22,500 volts.

The picture-tube accessories, which include the deflection and convergence yokes, lateral beam-positioning and purity magnets, are installed in conventional positions on the neck of the tube. Two other features are edge purity magnets and the Z purity coil.

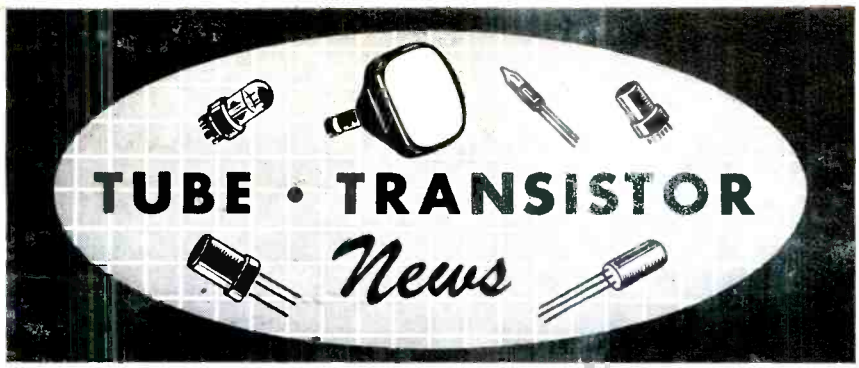
In previous color receivers the edge purity magnets were called *color-equalizing magnets*. They were installed about the periphery of the face of the picture tube and were used for correcting color impurities caused by stray magnetic fields near the outer edges of the tube. The new edge-purity magnets perform a similar function, but are installed on the picture-tube pull-up ring mounting assembly near the bell end; these edge-purity magnets are hairpin-shaped magnetized bars which are rotated on insulated mountings to achieve the desired corrective effect near the edges of the picture tube.

An auxiliary purity device is the Z purity coil. This coil consists of a few loops of heavy wire at the periphery of the picture tube. Its purpose is to correct color impurity effects caused by stray magnetic fields affecting the Z axis (lengthwise from faceplate to socket) of the picture tube.

A momentary-control push-button switch on the rear of the chassis discharges a capacitor through the coil to achieve a magnetization of metal components which will give the desired purity improvement.

Convergence Circuitry

The convergence circuits used with the glass picture-tube chassis have been designed for greater ease and accuracy of convergence. One of the most noteworthy features of the system is that convergence in the center area of the viewing screen is *clamped* at a *dc* reference level. This is accomplished by rectifying a portion of the horizontal convergence voltage and applying it to the horizontal-dynamic convergence coils. By this means the center of the screen will remain in convergence, with regard to horizontal dynamic convergence. Once adjusted, adjustment of horizontal dynamic convergence at either side of the screen can be made without materially affecting convergence at the other edge of the screen. Convergence at the center of the screen is accomplished by permanent magnets, which are in adjustable sliding mounts on the convergence yoke assembly, which is mounted over the pole piece assembly in the neck of the picture tube.



Latest Developments in Semiconductors (Diodes and Transistors) . . . Hi-Mu Triodes for FM . . . 17"-24" Wide-Angle Picture-Tube Replacements

WELDED, HERMATICALLY-SEALED, high temperature, medium-current diffused silicon-diode rectifier replacements[1] (1N253, 1N254, 1N255 and 1N256), particularly suited to rectifier applications where high inverse voltages, high forward conductance, very low leakage current and extremely high rectification efficiency are required, are now available.

The 1N253 has a peak-inverse rating of 95 *v*, and an average rectified current of 1 *a*. The 1N254 has a peak-inverse rating of 190 *v* and an average rectified current of 400 *ma*. The 1N255 has a peak-inverse rating of 380 *v* and an average rectified current of 400 *ma*, while the 1N256 has a peak-inverse rating of 400 *v* and an average rectified current of 200 *ma*.

High-Frequency Transistor

ANOTHER NEW SEMICONDUCTOR development is a hermetically-sealed diffused transistor of the germanium *pnp* type (2N274), designed primarily for *rf* amplifier service in compact mobile and communications equipment, and in entertainment-type receivers operating at frequencies covering the AM broadcast band and up into the short-wave bands. This transistor is also suitable for use as an *if* amplifier or as a mixer-oscillator.

The 2N274 utilizes shielding to minimize interlead capacitance between the collector lead and the base lead and to minimize coupling to adjacent circuit components. The resultant advantages of such shielding are of primary importance in critical high-frequency circuits where low feedback capacitance is a major design consideration.

The 2N274 also features low collector transition capacitance (1.7 mmfd) which makes possible satisfactory gains in the AM broadcast band without the use of a neutralizing network, a collector dissipation of 35 milliwatts maximum, and a power gain of up to 45 db at 1.5 mc and 24 db at 10.7 mc when used in a unilateralized common-emitter circuit with base input.

Junction Transistor

FOR HIGH-VOLTAGE *on-off* control applications, such as in neon-indicator circuits, relay-puller circuits, incandescent lamp driver circuits, and direct indicating counter circuits of electronic computers, a junction transistor (2N398) of the germanium *pnp* alloy type[2] is now available.

The 2N398 features a maximum voltage rating of −105 *v* for collector-to-base breakdown and for collector-to-emitter punch through. This value permits the design of neon-indicator circuits in which the transistor can switch the full firing voltage of the indicator lamp. Because the 2N398 has a minimum *dc* current transfer ratio of 20, neon indicating circuits can be designed to perform the functions of a logic circuit without the use of a separate logic stage.

[1] *Raytheon.*

[2] *RCA.* [3] *International Rectifier Corp.*

A 450-MA, 6.3-V TV-picture tube heater for portable receiver picture tubes which incorporates control of both warm-up time and current. Wound from a straight piece of tungsten, the heater is a double helical coil which is said to make possible the same cathode coating temperature achieved in 600 ma, 6.3-v tubes. Unlike conventional 450-ma heaters whose coils are wound from a spiral section of tungsten wire, this heater boasts a rigid mechanical structure with little tendency to sag away from the cathode cap.
(Sylvania)

Silicon Diodes

SILICON DIODES[3] claimed to be comparable in cost and electrical ratings to the 1N91, 1N92 and 1N93 germanium diodes used in power supply applications, have been announced.

The diodes (SD-91, SD-92 and SD-93) are of all-welded construction, hermetically sealed, and feature a peak-inverse-rating range of from 100 to 300 *v*. Maximum rectified *dc* ranges are from 100 to 150 *ma* at 85° C ambient. The rectifying barrier of this silicon diode is formed by the fused junction principle. Pigtail leads are welded to the terminals of an all-welded, shock-proof housing.

High-Mu Twin Triodes

HIGH-MU TWIN TRIODES (6DT8 and 12DT8) of the 9-pin miniature type[2], have been developed for application as combined oscillator-mixers and *rf* amplifiers in cathode-drive or grid-drive circuits of FM tuners.

The two units of each type are isolated from each other by an internal shield having a separate base-pin terminal. This shielding arrangement affords a reduction in antenna radiation.

Wide-Angle Picture Tubes

A WIDE-ANGLE RECTANGULAR glass television picture tube (24AHP4), having a 24" diagonal envelope, has been added to the RCA line.

The new tube has an overall length of 15⅞" and a weight of 28 pounds. Compared to tube types having the same size faceplate and 90° deflection, the 24AHP4 is 5¼" shorter and seven pounds lighter.

In addition to its wide deflection angle and short length, the tube also features a neck diameter of 1⅛",

(*Continued on page 53*)

how long would it take you to solve this service problem?

SYMPTOM:
Raster, No Sound,
No Picture,
and No Snow . . .

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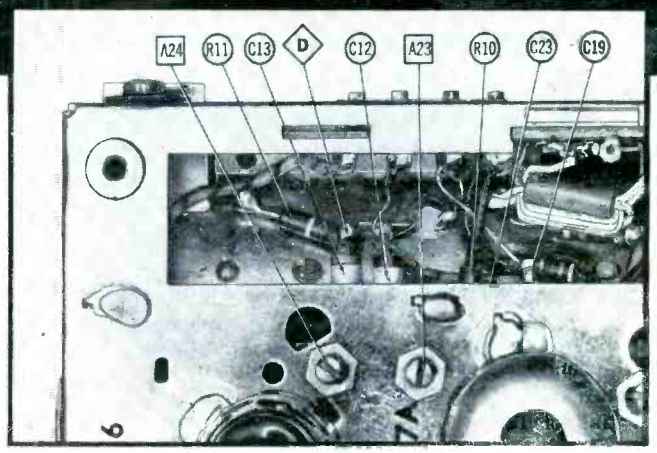


(Based on an actual case history taken from the Howard W. Sams book "TV Servicing Guide")

Let's take a look at this problem: A condition such as this can exist only when there is no signal reaching the picture tube or the audio output stage. Using the Tuner Service data (found in every PHOTOFACT TV Folder), first isolate the trouble by connecting an amplitude-modulated signal to the mixer-grid test point "D." The appearance of one or more black bars on the face of the tube would indicate that the trouble is probably in the tuner. So look for the following possible causes:

1. Defective oscillator-mixer tube
2. Defective RF amplifier tube
3. Open plate-load resistor in the oscillator stage
4. Failure of the feedback capacitor in the oscillator stage
5. Open decoupling resistor
6. Dirty or faulty contacts
7. Cold solder joint

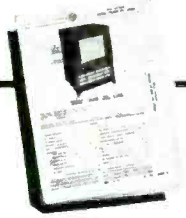
Using the applicable PHOTOFACT Folder you can trouble-shoot and solve this problem in minutes. Here's how:

Check the oscillator-mixer and RF amplifier tubes. Tubes okay?—then: Check voltages on the tube pins (they're right on the schematic) for open oscillator plate-load resistor, open RF decoupling resistor, faulty feedback capacitor, dirty switch contacts or cold solder joints.

Every PHOTOFACT Television Folder contains complete detailed information on Tuners, including separate Schematics, separate Keyed Chassis Photographs, Parts Lists, Alignment Points, Test Points, and Field Service Adjustments that will help you quickly locate the proper parts to replace and tell you how to do a touchup or thorough alignment job after making the necessary repairs. These features are a *plus* exclusive in PHOTOFACT.

Whatever your problem or favorite servicing procedure may be—you will always find all of the information you need at your fingertips in PHOTOFACT. For only *2½c per model, PHOTOFACT helps you solve your service problems in just minutes—helps you service more sets and earn more daily!

*Based on the average number of models covered in a single set of PHOTOFACT Folders.



MONEY BACK GUARANTEE!

Got a tough repair? Try this—at Howard W. Sams' own risk: see your Parts Distributor and buy the proper PHOTOFACT Folder Set covering the receiver. Then use it on the actual repair. If PHOTOFACT doesn't save you time, doesn't make the job easier and more profitable for you, Howard W. Sams wants you to return the complete Folder Set direct to him and he'll refund your purchase price promptly. GET THE PROOF FOR YOURSELF—TRY PHOTOFACT NOW!

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Service Man and Color-TV

(*Continued from page* 19)

waiting for color to be perfected are in for a considerable surprise. They are missing out on a good thing, and have been for some time. All the excuses and reasons for *knocking* color have been removed, and the only legitimate reason at this time could be: "We aren't ready or prepared for color." Now is the time to become prepared; the rest of the industry is forging ahead—don't be left behind.

Glass Envelope Color Tube

(*Continued from page* 24)

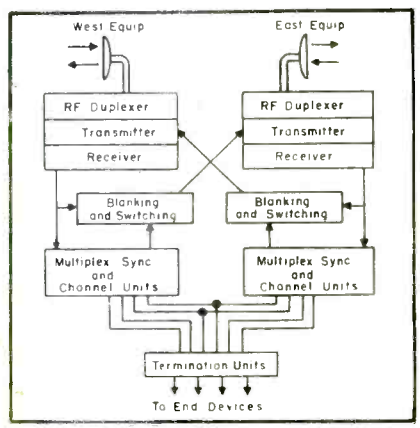
convergence correcting fields for the three different beams. This new feature makes possible the attainment of optimum convergence over the entire picture, with fewer successive approximation adjustments of the components.

Service Engineering

(*Continued from page* 43)

hot inside of the trunk of an automobile out in the sun on a summer day and very cold, especially when a two-way unit is first tuned on in mid-winter.

Thus, it would be a good idea to check equipment at room temperature and at the highest and lowest temperature, as well as other environmental conditions to which 2-way equipment will be subjected.



REPEATER with multiplex and termination units. Additional equipment required for this phase of operation is a blanking and switching unit.

Color-TV Checks

(*Continued from page 27*)

gun operating. The center of bars number 3 and 9 should be at the same brightness level as the adjacent spaces between the bars. In the next step, the red and blue guns should be biased off, leaving only the green gun operating. The center of bars number *1* and *7* should be at the same brightness level as the adjacent spaces between the bars.

If phasing is not correct, phasing should be adjusted in accordance with the procedure given in the service data.

If the phasing is correct, the approximate relative gains should be checked in the following manner:

The red and green guns should be biased off, leaving only the blue gun operating. Then the pedestal-amplitude control on the generator should be turned fully clockwise to *10* (100%). The contrast or color-saturation controls on the receiver should then be adjusted so that the center of bar number *6* has the same brightness as the adjacent spaces between the bars.

The next step involves biasing off of the blue and green guns, leaving only the red gun operating. Now the pedestal-amplitude control must be turned counterclockwise to the position at which the center of bar number 3 has the same brightness as the adjacent spaces between the bars. This condition should be obtained with the pedestal-amplitude control set at approximately 5.5 (55%).

Finally the blue and red guns should be biased off, leaving only the green gun operating. The pedestal-amplitude control should now be turned counterclockwise to the position at which the center of bar number *10* has the same brightness as the adjacent spaces between the bars. This condition should be obtained with the pedestal-amplitude control set at approximately 3.4 (34%).

ALL-GLASS picture tube used in latest color chassis.

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Written by RCA's well-known TV-service authority John R. Meagher (who also wrote the famous RCA Pict-O-Guide series for black-and-white TV), this volume is profusely illustrated with full-color photos, packed with step-by-step alignment and trouble-shooting instructions, and loaded with labor- and time-saving short cuts for *profitable color-TV servicing.*

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RCA COLOR-TV PICT-O-GUIDE CONTAINS SECTIONS ON:

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RECEIVING TUBES
RADIO CORPORATION OF AMERICA
Electron Tube Division Harrison, N. J.

FM, Drop-Out and Modulation Noise Problems in Magnetic Tape†

TAPE NOISE present during strongly recorded portions (modulation noise) is much greater than that occurring during periods when there is no recorded signal (background noise). Since this modulation noise varies with signal intensity, it is usually masked by the signal and therefore goes unnoticed.

However, if the modulation noise is sufficiently intense, it may be heard in the background of the recorded program. This is particularly true in the case of sustained tones or sine wave test signals. While modulation noise is perhaps not the most serious problem in magnetic recording, it most certainly deserves attention.

Surprisingly enough, two of the most troublesome forms of modulation noise are not magnetic in origin at all, but arise from mechanical considerations. They are frequency-modulation noise and drop-out noise.

Frequency-Modulation Noise

Tape is usually driven past the recording heads by a mechanical drive system. The free span of tape between the capstan drive and the idler roller represents a highly resonant mechanical body which is easily excited into longitudinal vibration by friction as it slides over the heads. The resultant fluctuations in tape motion cause frequency modulation of the recorded signal which may be audible as noise.

This type of noise can be demonstrated by recording a sine wave tone of about 3 to 5 kc and listening for the background noise. The fact that the origin of the noise is motion flutter can be verified by placing a small roller in contact with the tape near the point of contact with the recording or reproducing head. In most cases a sharp drop in background noise results, and the signal is noticeably cleaner.

While the small amount of FM noise present in most recording systems is not usually a problem on program material, in abnormal condition such as a sticking idler, or the tape binding in the guides may increase greatly this effect and cause it to become objectionable.

It is well known that anything which interrupts momentarily the intimate contact between the recording heads and the tape usually causes a corresponding momentary reduction in signal intensity. This interruption may be caused by an irregularity in the tape coating itself, but it is more often caused by dust and other contaminants. In some cases, a small dent in the tape can cause a drop-out. Almost without exception, a defect of this sort will cause a click or pop to appear in the recording due to the sharp drop in signal.

There is an important distinction between these noises and background noise in that, if a non-magnetic drop-out happens to occur in the erased tape, there will be no resultant noise pulse.

Modulation Noise Causes

The conventional modulation noise is caused by rapid fluctuations in signal amplitude. These are believed to result from local disturbances of the recorded magnetization in the tape due to the fact that the coating is composed of small, discrete particles rather than a continuous phase, small structural defects in the coating, such as agglomeration and the like, and gross variations due to the coating process.

The noise contribution of the latter effect is usually quite negligible, because of the long wavelengths involved which represent sub-audible frequencies in most systems.

The particle-size effect seems to be rather inherent in the nature of magnetic materials, for even if a *continuous* magnetic medium such as a metallic plating were employed, the

(Continued on page 58)

† *From a report prepared by* ***R. A. Von Behren****, Research and Development Manager, Magnetic Products Division, Minnesota Mining and Manufacturing Company.*

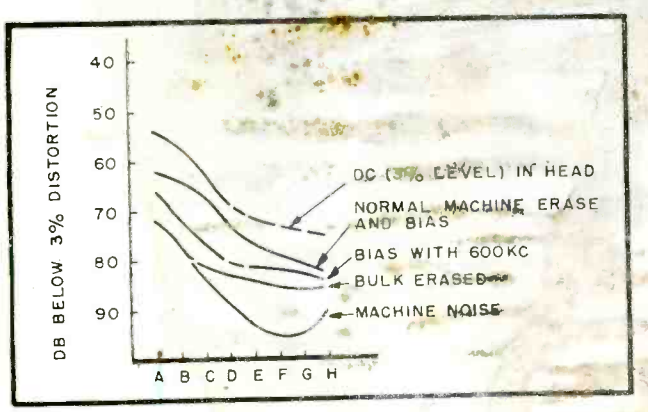


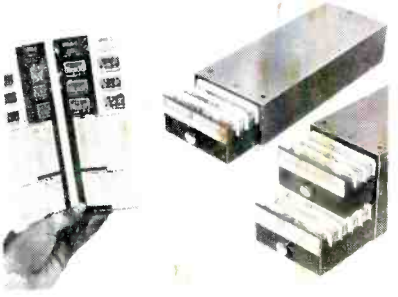
FIG. 1: PLOT OF various degrees of tape noise which obtain during several stages of erasure. A = 20-75 cps; B = 75-150 cps; C = 150 - 300 cps; D = 300 - 600 cps; E = 600 cps - 1.2 kc; F = 1.2 - 2.4 kc; G = 2.4 - 4.8 kc; H = 4.8 - 10 kc.

COMPONENTS

CERAMIC-CAPACITOR REPLACEMENT KITS

THREE CERAMIC-CAPACITOR replacement kits, *CK*-2, *CK*-3 and *CK*-4, have been introduced by Sprague Products Co., North Adams, Mass.

CK-2 contains 150 *Cera-mite* disc capacitors with ratings from 5 mmfd to .01 mfd in a two-drawer miniature cabinet. *CK*-3 includes 75 units with ratings from 10 mmfd to .01 mfd in a one-drawer miniature cabinet. *CK*-4 contains three each of four different *Universal* ceramic capacitors.



SUBMINIATURE ELECTROLYTICS

SUBMINIATURE ELECTROLYTIC capacitors, *EE* and *EM*, designed for transistorized circuits and miniaturized low voltage *dc* equipment, have been announced by Astron Corp., 255 Grant Ave., E. Newark, N. J.

Units feature low leakage characteristics for minimum battery drain. *EE* has epoxy end fill; *EM* has a spun end with rubber bushing. Both are hermetically sealed. Available in voltage ratings of 1, 3, 6, 8, 16, 26 and 50.

Also now available is a miniature *mylar* metallized capacitor, *ROL*, said to be reliable at temperatures up to 125° without derating. Units are hermetically sealed.

REPLACEMENT VIBRATORS

A LINE OF REPLACEMENT VIBRATORS, *Gold Label*, have been developed by P. R. Mallory and Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.

Units feature buttonless contact construction.

SILICON RECTIFIER CONVERSION KIT

A SILICON RECTIFIER conversion kit (M-500), said to provide additional B voltage (20 v in doubler) has been announced by Sarkes Tarzian, Inc., 415 N. College Ave., Bloomington, Ind.

Service notes describing application of the rectifiers as half and full-wave voltage doublers and in half-wave (line voltage) and step-up transformer circuits have been prepared by Sarkes Tarzian, Inc.

FLYBACK REPLACEMENTS

TWO REPLACEMENT flyback transformers, *EFR* 196 and *EFR* 197, for use in Motorola TV receivers, have been announced by Rogers Electronic Corp., 49 Bleecker St., New York 12, N. Y.

EFR 196 replaces Motorola part number 24K736488; *EFR* 197 replaces part number 24C736487. Both units are packaged in hermetically-sealed plastic containers.

Garage Door Operator

RADIO-CONTROLLED GARAGE-DOOR operator using a limited range low-frequency principle, which it is said eliminates the need for FCC licensing and the requirement for a commercial operators license for installation, repair or maintenance. (Genie Lift-A-Door; Alliance Manufacturing Co., Inc., Alliance, O.)

Parts Show Gavel Ceremony

CHARLES GOLENPAUL, new president of the Electronic Industry Show Corporation, accepting gavel of office from outgoing president, Wilfred L. Larson. Golenpaul, vice president of Aerovox Corp., will serve for a year, heading operations for the 1958 Electronic Parts Distributors Show to be held May 19-21 in the Conrad Hilton Hotel in Chicago.

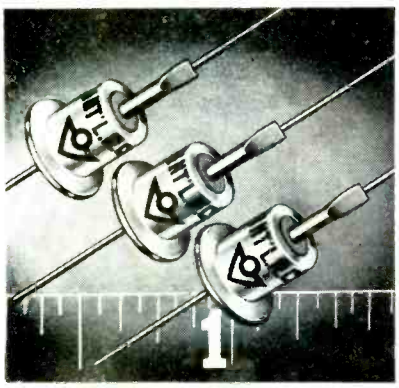
Tube-Transistor News

(Continued from page 46)

which makes possible the use of a deflecting yoke having high deflection sensitivity and permits deflection of the beam through the wide deflection angle with only slightly more power than is required to scan a tube with a 90° deflection angle.

Another design feature of the 24AHP4 is its electron gun, which is of the straight type designed to minimize deflection distortion and to eliminate the need of an ion-trap magnet.

The 24AHP4, of the low-voltage electrostatic-focus and magnetic-deflection type, has a spherical *filter-glass* faceplate, an aluminized screen measuring 21 7/16″ by 16⅜″ with slightly curved sides and rounded corners, and a minimum projected screen area of 332 square inches.



SILICON DIODES designed as alternates for germanium 1N91, 1N92 and 1N93 diodes. (International Rectifier Corp., El Segundo, Calif.)

TV Antennas

(Continued from page 37)

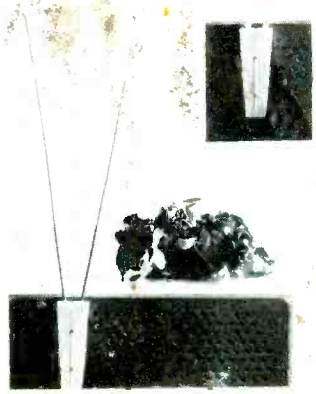
to the ridge of the roof by means of a roof mount combined with an anchoring system.

Strap Standoff

(Left)

UNIVERSAL STRAP STANDOFF that accommodates Nos. 8 or 9 standard wood screw eyes. Features a buckle which utilizes a double-seated thread lock to exert two separate tensions on the wood screw as it's tightened. This progressively increases the pressures of the outer thread and inner thread locks. Buckle is made of heavy-gauge zinc-coated steel with electro-galvanized or stainless steel strap. (Imp; JFD Manufacturing Co., Inc., 6101 16th Ave., Brooklyn 4, N. Y.)

Indoor TV Antenna



(Right)

INDOOR TV ANTENNA developed for mounting on back of console, table model or portable, which can be concealed when not in use or extended when desired. Supplied with Twin-X cable. Features two 4-section staffs which can be moved in any direction via a 360° swivel adjustment. (Model PT-R [Tuk-It Hideaway]; Snyder Manufacturing Co., 22d and Ontario, Philadelphia, Pa.)

RF Amplifier TV Stages

(*Continued from page 35*)

current between the plate and screen. Pentodes are about 3 to 5 times noisier than the same tube connected as a triode.

Pentode operation in *vhf* tuners function the same as pentode operation in any other *rf* amplifier application, except that at high frequencies, the effect of tube parameters upon circuit operation is exaggerated.

Sharp cutoff pentodes are also desired for tuners, again because of the available simple *agc* system voltage as found in inexpensive, low B+ receivers.

Typical tuner pentode amplifier tubes used today are the 3 and 6BC5, the 3 and 6CB6, and the 3 and 6CE5.

Parameters Affecting Cascode and Pentode Operation

Several important circuit and tube parameters affect both cascode and pentode amplifier performance; input impedance and cathode-lead inductance, contact potential, and cathode interface resistance.

A wide variation of input impedance in a tuner-input stage (*rf* amplifier) with *agc* variation causes the antenna-matching device to have various matching impedances looking towards the antenna from the input-tube grid. These variations in matching impedances cause various mismatches (and thus various voltage standing-wave ratios) on the antenna transmission line which gives rise to ghost images on the TV screen. These effects can be reduced by maintaining a very low grid-to-cathode capacity and low lead-inductance of the input section of the tuner *rf* amplifier.

The antenna-input matching device to the *rf* amplifier grid is usually either a balun (transformer type circuit which converts 300-ohm balanced input to single-ended unbalanced 50-ohm output) or a transformer. The purpose of each device is the same, i.e., to match a balanced 300-ohm antenna input to an unbalanced output of different impedance feeding the *rf*-amplifier grid circuit. This device should not only provide a good match to the antenna transmission line over a wide frequency range (54 to 216 mc for *vhf*); but some selectivity in combination with the input tuned circuit, and possibly some voltage gain. The typical antenna balun has a 300-ohm balanced input and a 50-ohm unbalanced output. A device (*pi network*) is usually placed between the balun output and the grid of the *rf* amplifier to raise the impedance of the tuner-input network looking in from the *rf* amplifier grid.

The antenna transformer is a simpler matching device that requires no pi network following it, because the transformer output impedance is high. The matching transformer does not have a constant input and output impedance over the *vhf* bands and therefore is more critical in respect to transmission line matching. Thus, *rf*-amplifier tubes, which have wide variations of input impedance, should not be used with matching transformers.

It has been found that pentode *rf* amplifiers have a wider variation of input impedance than do cascode stages with the same change in *agc* voltage.

Input impedance of a stage is composed ordinarily of a capacity in parallel with a resistance appearing between grid and cathode of the stage. The value of the input capacity is fairly independent of frequency and is determined principally by tube interelectrode capacities and stage gain. The input capacitance will be minimum when the impedance in the plate circuit of the stage is zero and maximum when the plate impedance is very high. Also since *rf*-amplifier stage gain varies widely with the applied *agc* voltages, the tube-input capacitance will vary somewhat with *agc* and thus

cause varying loading upon the tuned input circuit, which consequently has a degenerative or regenerative effect upon the incoming signal at various frequencies within the pass band of the tuner. This results in a distortion or *tilt* of the curve of gain versus frequency.

In pentodes, the variation of input capacitance may be as much as 3:1 from zero bias to cutoff bias, while in triodes the input capacitance variation may only be 2:1 from the zero bias to cutoff condition. This phenomenon is true at any frequency, but it is especially important at *vhf* where the tube-capacity parameters form a large part of the tuned circuits. Thus pentodes will have a larger variation of the capacitive-reactive component of its input impedance than do triodes under similar conditions.

Service Notes

(*Continued from page 29*)

that the antenna will pick up less of the incoming signal.

An *if* transistor having exceptionally high gain may cause regeneration on weak signals. The correction for this difficulty is to interchange the two *if* transistors or to replace if only one *if* transistor is used; realignment is advisable after any change of transistors in the *if* circuit.

If a type 2N140 transistor is used in place of a type 2N139 transistor, regeneration may occur; one should check for type of transistor.

Regenerative squeal has been found to be due to high internal battery resistance; a new battery will correct the trouble. In RCA model 7-BT-9 the size of the first filter capacitor (C_{15}) was increased from 25 to 45-mfd and later, two 45-mfd capacitors in parallel were used to eliminate squeal.

High-resistance riveted connections at battery leads on printed board can also cause regeneration; this can be overcome by soldering the rivets to the printed wiring.

Still another source of trouble are high-resistance connections at chassis mounting spacer. This condition is evidenced by a change in the frequency and intensity of the squeal when the tuning capacitor mounting screws are first loosened and then tightened. The spacer and the mounting screws are in the tuning capacitor *ground* circuit and electrolytic action between the copper wiring and the die-cast zinc spacer results in corrosion and high resistance joints. A 3-point wire jumper should be soldered between the three copper areas at the tuning capacitor mounting screws.

In cases of *no signal* in a transistor radio, the first step is to check battery voltage with the set turned on. New batteries are rated at 9 *v*, but transistor radios will operate on batteries with outputs as low as 6 *v*. If the battery is okeh, the terminal voltages should be checked. There can be short-circuits in transistor radios just as in any other radio. One significant difference is that in a transistor radio, there is insufficient power to burn out a resistor. Transistors have no filaments to burn out, but lead wires can be broken. Battery leads and phone jack leads are the most likely source of such trouble. Transistors themselves should be the last item suspected.

If a quick check of terminal voltages indicates that a short-circuit is not the cause of trouble, it is suggested that signal injection be used to localize the defect as being in one specific stage. There can be breaks in printed wiring which would cause signal stoppage; but any such breaks, which would not materially affect terminal voltages, are highly unlikely.

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†*Based on service notes prepared by the RCA Service Co., Inc.*

GUEST ROOM at the Trenholm Motor Lodge, near Rochester, N. Y. equipped with a tilt-type surface-mounted speaker, five-program selector and off switch, with individual room volume-control switch.

COMPLETE SOUND SYSTEM recessed in one cabinet in the wall behind the reception counter of the Trenholm Motor Lodge. Note bank of four individually-controlled AM-FM radio receivers. At the left of the counter is a paging microphone.

INSTALLING TUNER-AMPLIFIER in sound-system cabinet used in Trenholm system.

Motel Sound-System Installation

by L. A. RANDALL

Special Products Div., Stromberg-Carlson, Division of General Dynamics Corp.

THE ADVENT OF FLEXIBLE SOUND systems capable of providing multiprogram channel music and paging facilities has expanded the uses of such networks. Today, such systems have been installed in a wide variety of places, including a growing number of motels. Just south of Rochester, New York, near a New York State Thruway interchange is an interesting example of a recent new-look motel[1] sound-system installation which provides five program channels (four radio and one record changer) to each of 44 guest room and 9 public-room speakers, or group of speakers, as in the restaurant. Voice paging to the public rooms and parking lot speakers originates at the registration desk from the microphone. Operation of a microphone switch provides direct current to a relay that cuts off all program lines to the public room speakers, and connects the output of the paging amplifier to all the public room speaker lines. To avoid music in the parking lot the speakers are connected directly to the output of the paging amplifier.

In the preliminary stages of developing a sound package of this type, careful planning in selecting equipment and an analysis of the installation problems are necessary. Those handling sales must consult with the installation-service crew, whose experience regarding pitfalls that might be encountered, and suggestions concerning the best equipment to provide the required services, will enable an accurate estimate to be prepared and will gain customer confidence.

The installing crew can make a better estimate of the cost of their portion of the project after they have reviewed the plans and specifications. They can determine adequate speaker coverage, location of antenna conduit for leadin, space required at the equipment cabinet location for proper installation and service, ventilation and possible future expansion. They can review the input and output conduit and offer suggestions for terminating the conduit in the floor beneath the equipment cabinet, or at the top of the cabinet, for an installation that is neat, rather than one with terminal boxes at the rear of the cabinet with lossy connections due to loose and unsightly flexible cables.

In the Rochester-area installation all cabinet-assembly equipment was analyzed for technical and physical features. An AM-FM radio tuner-amplifier[2] was selected because of its wide FM frequency response (20 to 20,000 cps) and AM response of 20 to 7500 cps. Other features of this unit are an interstation whistle filter providing 29-db rejection at 10 kc. Antenna connections include FM (72 to 300 ohms) for use with a dipole antenna and AM (high impedance) for a short antenna. In addition to tuning and selector controls, the unit has a bass control providing 15-db boost and 20-db droop at 30 cps and a treble control which provides 12-db boost and 20-db droop at 10,000 cps. Also included in this combination tuner-amp is a loudness control that gives gradual increasing bass and treble boost as loudness is decreased to compensate automatically for normal hearing deficiencies at low volume levels so essential in a motel installation.

Drift has also been found to be a very important factor affecting quality of reception, particularly where no attendant is available to retune the radio section as in a motor court system. Accordingly, this fact was considered, too, before the tuner-amp was selected. The model chosen has been designed to minimize drift so that no retuning is necessary. Also the unit meets RETMA (now EIA) specifications and the proposed FCC regulations to prevent interference with other services using the air channels.

Other tuner-amplifier factors that had to be studied, were output regulation which could provide absolute

(*Continued on page* 60)

[1] *Trenholm Motor Lodge.*
[2] *Stromberg-Carlson SR-405.*

TO BRING OUT THE BEST IN EVERY HI-FI SYSTEM...

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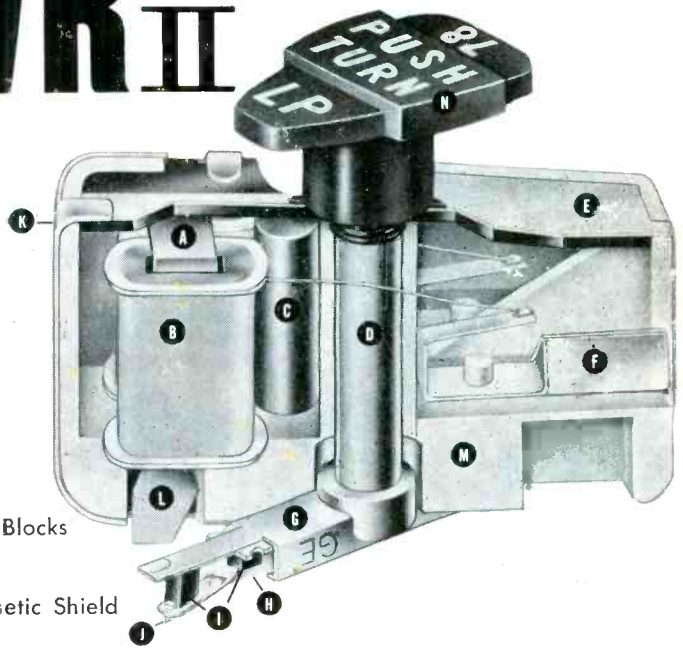

- A Highly permeable laminations
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- F Plug-in Terminals
- G "T"-Channel
- H VR II Clip-In-Stylus
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Instant Clip-In-Tip Stylus—Stylus replacements can be made at home without removing cartridge from tone arm. There's no need to discard an entire dual assembly when only one tip is worn.

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Audio

(*Continued from page* 51)

inevitable magnetic domain structure would result in some considerable degree of *graininess*. This fact has been borne out by experiences with metallic wire, the noise problems of which are well know.

It is in the microstructure of the magnetic coatings that the greatest strides have been made in the reduction of noise in magnetic tapes.

Early tapes manufactured in this country employed a paper base which, owing to the porous and fibrous surface, were a rather poor support for a magnetic coating. The coarse microstructure of coatings on paper gave rise to high modulation noise level.

The next significant advance came with the introduction of plastic film base. Early acetate base tapes with unoriented coatings were some 10 db improved over the paper tape. It is interesting to note that noise in the highest frequency bands actually increased in going from paper to plastic base, presumably because of the improved head contact and playback resolution.

Since about 1950, particle orientation has been employed to reduce the modulation noise level and increase the sensitivity of magnetic tape. The decrease in modulation noise averages about 5 db for oriented tapes.

Thus far we have dealt only with modulation noise which appears when signals are recorded on the tape. The problem of background noise is perhaps of much greater concern in magnetic recording. In the absence of any recording on the tape, noise in the system is, of course, much more noticeable.

The best of current theories on tape background noise indicates that it is due principally to the random orientation of the spontaneously-magnetized domains in the tape. In the usual case, these domains are actually the particles of magnetic oxide in the coating. There is much experimental evidence to corroborate this theory.

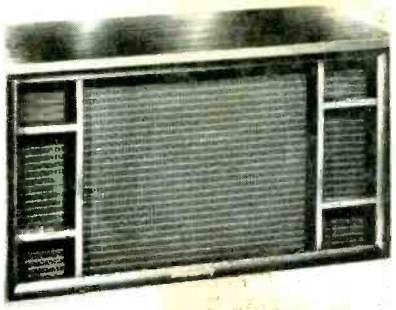
Erasure Problems

The matter of preventing the tape from subsequently becoming magnetized requires some considerable care. The most frequently encountered troubles involve residual magnetization in the heads and guides. These are well known offenders, and the practice of periodic demagnetization of heads and other machine parts is well established in the industry. However, for the highest quality work, it would be well to check these very carefully.

One quick test for a magnetized playback head is to turn up the playback gain to maximum and tap the head gently with the fingernail, or the wooden part of a pencil. If a click is heard in the play channel, the head is magnetized and is responding to magnetostrictive modulation of its own field.

Another quick test for playback head magnetization is to *play* a paper leader tape across the head and listen for magnetostrictive noise as described above. Other parts of the machine can be tested by passing a few inches of bulk-erased tape over the part and comparing the relative noise levels. By application of these tests, it is often discovered that the method being used to demagnetize heads and guides is not accomplishing its purpose, and other techniques can be tried.

The problem of adequately erasing tape and preserving the zero signal portions in a neutral state during recording is not easily solved. This is illustrated in Fig. 1 (p. 51). The same



ULTRA-LINEAR speaker systems said to feature room-balanced design, permitting installation either in a corner or flat against a wall. (University Loudspeakers, Inc., 80 South Kensico Ave., White Plains, New York.)

standard tape[1] with plastic base and oriented coating was used throughout, and the conditions of erasure of the tape varied to give the results plotted.

The tape was first bulk erased and played on the machine to determine the *lowest* background noise level. The tape was then erased and biased on a properly adjusted commercial recording machine (with no input signal and the gain turned back to zero) and the noise level was seen to rise about 10 db.

Upon further investigation of this phenomenon, it was determined that both 60-cycle and 100-kc bias frequency were recorded on the tape. The 60-cycle recording was audible and could be easily verified by speeding up the tape. Incidentally, the application of only the erasing function (recording head disconnected) also resulted in the recording of some 60-cycle signal. It was suspected that the 60-cycle signal was coming through as a modulation on the bias-erase signal.

Recent advances in the art of video recording indicate that much shorter wavelengths can be recorded than formerly supposed. Moreover, short-wavelength magnetization may actually be recorded in the tape without necessarily being detected because of limitations in the reproduce head.

In order to verify the fact that the 100-kc bias was being recorded, an external bias source of 600 kc was also tried. This lowered the noise level by some 4 db, indicating that some improvement could be gained by going to a higher bias frequency. Some 60-cycle signal was recorded, however, in spite of precautions taken in the

(*Continued on page 63*)

[1] *Scotch No.* 111.

Motel Sound-System Installation

(Continued from page 56)

stability with any combination of resistive, capacitive or inductive output loading, since the number of guest and public room speakers in operation at any one time can vary greatly. The output impedances must be such as to provide the correct output tap for the distribution lines so that the speaker-line transformer will draw the correct amount of audio power to operate the speakers at the desired level.

Experience has proved that on an average about 50% of the guest room speakers are in use at one time and as a rule the speakers operating are equally divided between the program channels provided. On this basis, since 50% of the 44 guest room speakers equals 22 and five channels are involved, the average number of guest speakers on any one channel at one time is 4 or 5. When highly efficient speakers and line transformers with minimum loss are used, the maximum allowable audio power drawn by a guest room speaker is approximately ¼ watt; this wattage has been found to be loud enough for the room, but not too loud to annoy those in adjoining rooms. Therefore, with an average of five guest room speakers operating at one time, 1¼ watts minimum has been found to be adequate for each program channel. The tuner-amplifier chosen has a 12-watt (undistorted) output, providing ample audio power for the guest rooms, plus the public space speakers. When special events are broadcast, such as important news events, political conventions, world championship boxing or world series ball games, and the speaker load on any one channel would exceed the average, two or more radio tuners can be tuned to the same broadcasting station and the speaker load divided among the distribution channels.

To secure the ¼-watt power at each guest room speaker or a little more audio power for the public-room speakers the following computations can be applied:

$$\frac{\text{Ohms at the Amplifier}}{\text{Ohms at the Speaker}} \times \text{Audio Output} = X$$

In this motel project the 16-ohm output tap of the tuner-amplifier and the 625-ohm primary tap of a line transformer[3] were selected. From the foregoing equation, we have:

$$16/625 \times 12/1 = X$$
$$192/625 = X \text{ or } .307$$

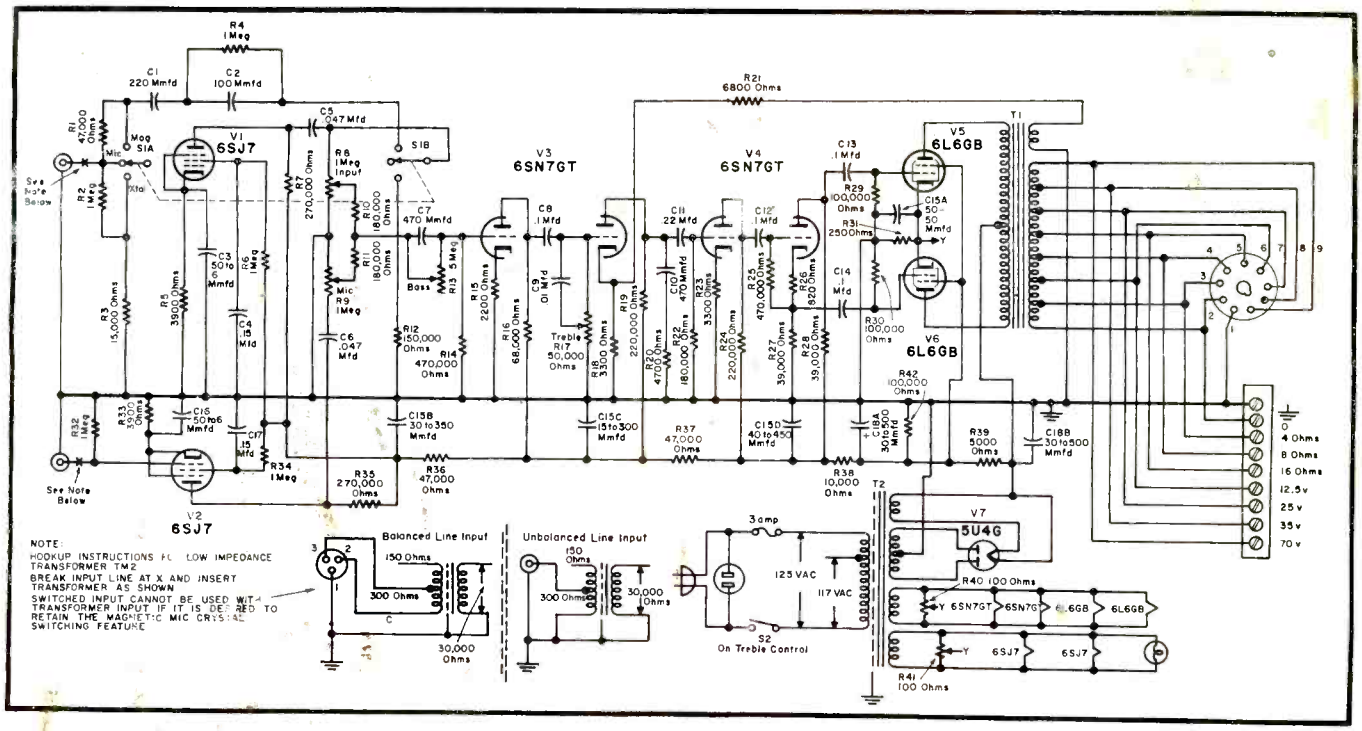
Two 25-watt amplifiers[4] were selected for use as the phonograph and paging amplifiers. Using the 16-ohm output tap and the 625-ohm primary tap of the speaker transformer, and the amp-speaker formula, the speaker draw will be found to a little over .60 watt. The difference between the .30 watt drawn from the tuner-amplifier is 3-db, and hardly noticeable, but even this difference can be adjusted by an input gain control on the amplifier.

The equipment cabinet assembly has been supplied with a monitor speaker panel with meter and selector switches so that the output of each program channel can be checked and monitored for volume and quality before individual switches are connected to send the programs to the channel transmission lines. Below this panel were located four AM-FM tuner-amplifiers, a record changer, and phono and paging amplifiers; the paging amplifier has been equipped with a low-impedance microphone input transformer. At the bottom of the cabinet is a power *on-off* panel with indicating lamp.

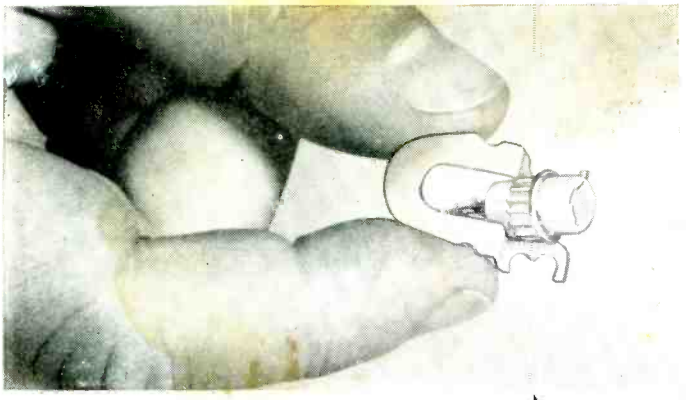
Included in the assembly is a timer that turns the power to the system on-off at times designated by manage-

(Continued on page 62)

[3]*Stromberg-Carlson TR-13.* [4]*Stromberg-Carlson AU-58.*

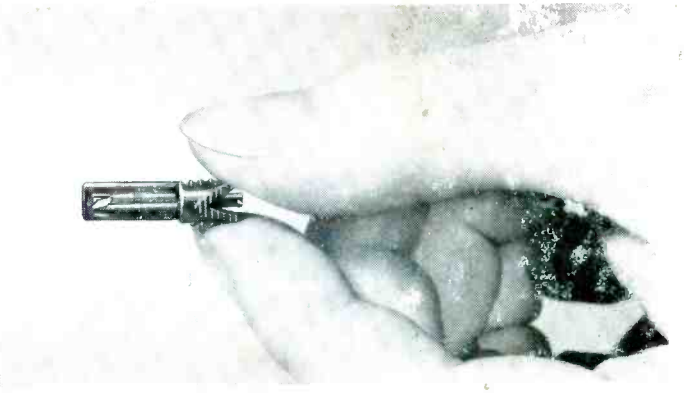


SCHEMATIC OF STROMBERG-CARLSON amplifier included in Trenholm sound-system installation.



ONCE YOU INSTALL [illegible]
POWER-POINT
MOUNT...

THIS WILL HAPPEN
AGAIN AND
AGAIN AND AGAIN...



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ONE Installation Instead of Many WITHOUT a Drop in Cartridge Replacement Business!

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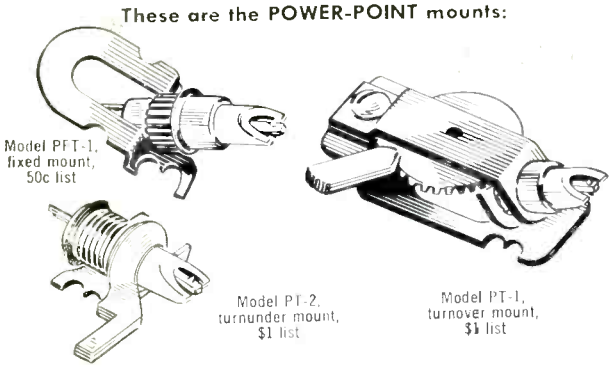
POWER-POINT (U.S. Patents D108347, 2793254) is the unique miniaturized unit containing BOTH a fresh ceramic cartridge and jeweled playing tips. You sell a POWER-POINT for less than the cost of a separate cartridge or comparable needles alone! Most Models, $3.95 list.

Only ¾" long and less than ½" in diameter, POWER-POINTS are color-coded, blister packed in plastic to keep them fresh, clean and easy to handle.

These are the POWER-POINT mounts:



Model PFT-1, fixed mount, 50c list

Model PT-2, turnunder mount, $1 list

Model PT-1, turnover mount, $1 list

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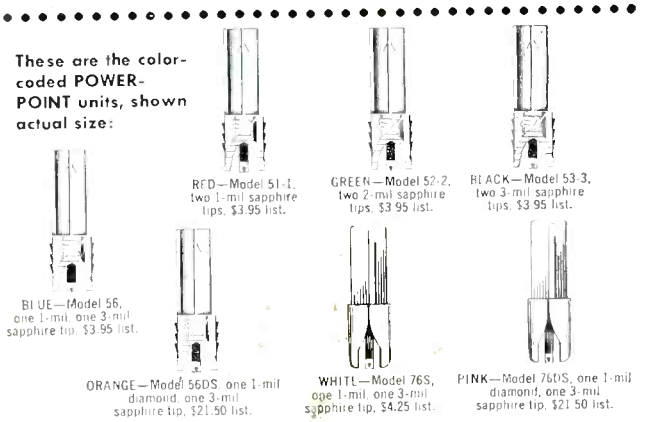
These are the color-coded POWER-POINT units, shown actual size:



RED—Model 51-1, two 1-mil sapphire tips, $3.95 list.

GREEN—Model 52-2, two 2-mil sapphire tips, $3.95 list.

BLACK—Model 53-3, two 3-mil sapphire tips, $3.95 list.

BLUE—Model 56, one 1-mil, one 3-mil sapphire tip, $3.95 list.

ORANGE—Model 56DS, one 1-mil diamond, one 3-mil sapphire tip, $21.50 list.

WHITE—Model 76S, one 1-mil, one 3-mil sapphire tip, $4.25 list.

PINK—Model 76DS, one 1-mil diamond, one 3-mil sapphire tip, $21.50 list.

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Motel Sound System

(*Continued from page 60*)

ment, so that under ordinary conditions the system requires no attendant. A small-power supply provides 24 *v dc* to energize the paging relay, equipped with a suppressor across the coil terminals to reduce objectionable clicks in the public-room speakers when the relay is energized by the paging microphone.

The paging relay has sets of *break-make* spring combinations. In normal or non-operative position, the *make* contacts to swingers are connected to the output of the program amplifiers; the swingers are connected to the individual public-room transmission lines, and the *make* springs are connected to the output of the paging amplifier. In non-operative position the output of the program sources is connected to the channel distribution lines. In operative position the program source is broken and the distribution lines connected to the output of the paging amplifier.

Internal wiring features the use of twisted-pair shielded with overall insulation for balanced line operation. Separate output terminals are provided for guest room and public room transmission lines.

Antenna Systems

Another problem in any installation is the choice of the antenna and its location. Neither the architect nor the owner want the antenna on the roof, normally the location for strongest signal pickup, claiming such an installation is unsightly. However, the fact that the right location for an antenna is a very important link in providing quality and noise-free reception must be stressed, with tact, of course. Both architect and motel operator can be convinced that only a rooftop-installation is the logical approach.

In this project an ommidirectional FM antenna and a 50′ flat top for AM pickup were located on the roof and a lightning arrester grounded to a cold water pipe. An antenna transformer, as recommended by the antenna manufacturer, was located in the flat-top antenna; leadin from both antennas was RG-59/U coax.

Leadin from the FM section was connected to the FM terminal at the tuner-amplifier and the shield to ground on the chassis. The flat top leadin was connected to the *hi*-antenna connection on the chassis through a 25-mmfd capacitor, the shield being brought to the chassis ground. Six twisted pair cable (one spare) were installed for program lines to the speakers.

Guest room speakers[5] were surface mounted and equipped with a six-position (5 *on*, 1 *off*) selector switch and volume control; both the selector switch and volume control rotate 360°. The speaker cabinet, of the tilt-type is equipped with a cone speaker[6], having an 8″ cone and a frequency response of 55 to 13,000 cps. The line transformer is rated at 2.5 watts with 2 and 8-ohm tapped secondary and a tapped primary in steps of 3 db at 312, 625 and 1250 ohms.

Public space speakers using 8″ cone units are surface mounted, with a frequency response of 45 to 14,000 cps.

In the lobby, a floor-standing cabinet employing an *acoustical labyrinth* is used. The speaker, a coax type[7], has a 12″ low-frequency radiator and a 2″ tweeter with a dividing

[5] *Stromberg-Carlson RS-81D.* [6] *Stromberg-Carlson RC-27.*

[7] *Model RF-471.* [8] *Model TR-20.*

network. Its frequency response is 30 to 14,000 cps. As a line transformer, a model[5] having a power handling capacity of 12 watts was selected; this unit, with a tapped primary of 625, 312, 156 and 78 ohms makes it possible to draw ¼, ½, 1 or 2 watts from the program lines as required for coverage of the lobby.

Where multiple speakers are used in the same room, such as in the restaurant, care must be taken to see they are properly phased; the cone of each speaker should pull in and out at the same time. This is accomplished by momentarily connecting a 1½-v dry cell across the voice coil terminals which will move the cone in. Speakers are, of course, connected in parallel.

After any system has been checked out and is operating correctly, plenty of time should be spent instructing the customer and his staff how to operate the system properly. "A stitch in time saves nine" as the old saying goes, and the time given to such instruction will be money well spent, as many service calls are due to incorrect operation. Reducing those *free* service calls will more than pay for the extra time devoted to familiarizing management with the operation of the system.

The job installation-service file should include a block diagram of the system showing the program lines and line transformer taps used at each speaker, along with the wiring diagram of the equipment cabinet and model numbers of the equipment. It will reveal promptly what lines are loaded to capacity and where to connect more speakers in the future. A *sound system* is like a chain; a chain is only as strong as its weakest link. Likewise a sound system is only as strong as its weakest link.

Audio

(*Continued from page* 59)

selection of a push-pull oscillator and amplifier for the 600-kc source.

In the course of these experiments, a simple test was devised to detect the presence of *dc* (or long wavelength) magnetization in the tape. If the tape is torn through (to eliminate the possibility of inadvertently magnetizing it from a razor blade or scissors), and the end drawn past the reproduce head, an audible *thump* will be heard in the speaker if there is any *dc* or long wavelength magnetization in the tape.

This is due to the concentrated magnetic pole which appears at the end of the torn tape. The tape must be held against the head with the finger or a pressure pad to maintain contact to the very end. The indication from long wavelength magnetization (i.e., 60 cycles having a wavelength of ¼" at 7.5 ips speed) varies, of course, depending upon the exact location of break with respect to a recorded cycle.

The upper curve of Fig. 1 (p. 51) shows the effect of a considerable amount of *dc* magnetization in the tape, such as might be caused by a leaky coupling capacitor or a very bad bias waveform. It is interesting to note that the noise output of the tape may vary by as much as 20 db, depending upon the conditions under which it is recorded. It is also apparent that extra precaution in setting up the recording equipment may be well rewarded in terms of consistently low-noise level recordings.

In summary, it seems apparent that at the present state of the art, the tape-quality factors which bear on the noise question are primarily those affecting modulation noise.

Progress in achieving lower tape noise can come only through the concerted efforts of machine manufacturers, tape manufacturers, and tape users.

CERAMIC PHONO cartridge with side-to-side needle movement used to govern response. Two models are available: Turnover with sapphire needle for both 78 and 45-33 speeds; and single-needle (with sapphire) for either 78 or 45-33 speeds. (5 Series; Sonotone Corp., Elmsford, N. Y.)

SUBMINIATURE CARTRIDGE models designed for narrow-arm record changers. Two models feature outputs of 3 v with a frequency range of 30-11,000 cps, and .75 v with a frequency range of 30-13,000 cps, and a compliance of 1.2. Still another model, designed as a replacement in Philco changers, features an output of 3 v and a frequency range of 30-11,000 cps. (Models 120TS, 118TS and 124TS; Astatic Corp., Conneaut, O.)

ACCESSORIES

TV TUBE RESTORER

A TV TUBE RESTORER, *K-10*, has been announced by Perma-Power Co., 3100 Elston Ave., Chicago 18, Ill.

It is claimed to locate and correct open cathode, heater-cathode short, grid control, grid-cathode short, emission and combinations of these

UHF CONVERTER

A UHF CONVERTER, *UH-2* Champion, featuring continuous tuning over the entire *uhf* band, has been developed by Granco Products, Inc., 36-07 20th Ave., Long Island City 5, N. Y.

Unit features preselection, vernier tuning and coax frequency control.

PORTABLE PLUG-IN INVERTERS

PORTABLE INVERTERS, which plug directly into the cigarette lighter receptacle of autos or other vehicles, have been introduced by American Television and Radio Co., 300 E. Fourth St., St. Paul 1, Minn.

Units are designed for operating standard *ac* dictating machines, record players, incandescent lamps, and electronic test equipment. All units have 110 *v ac* 60 cycle output with output wattages ranging from 30 to 150 watts.

DEGAUSSING COIL

A DEGAUSSING COIL for demagnetizing color picture tubes and chassis, has been announced by Bushnell Electric Co., Bushnell, Ill.

Coil has 425 turns of No. 20 *hf* magnet wire bound with plastic tape. Comes with a 10' type *sv* cord with feed-through switch.

TEST INSTRUMENTS

MIRRORED-SCALE VOM

A MULTI-RANGE MIRRORED-SCALE *vom*, *120M*, said to eliminate parallex, has been announced by Precision Apparatus Co., Inc., 70-31 84th St., Glendale 27, N. Y.

Unit has ½% tolerance multipliers and a separate function selector position for *—dc* volts and *—dc* milliamperes. Polarity switching is accomplished by changing the function selector; test leads need not be reversed. Sensitivity is 20,000 ohms/volt *dc* and 5,000 ohms/volt *ac*.

Has 44 ranges; range selection is accomplished with 18-position, positive-detenting selector equipped with low resistance, silver-plated contacts. Accessories available include a 30 *kv* safety probe, *TV-2B*; leather instrument case, *LC-3*; and snap-on foldaway tilt stand, *ST-1*.

RF POWER METER

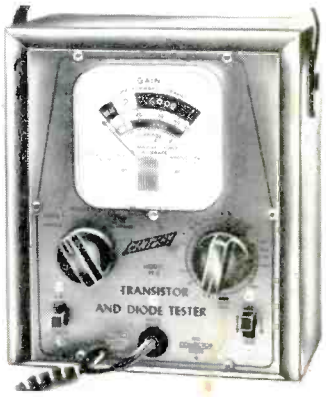
AN RF POWER METER, *PM-1* (kit), for sampling *rf* field in the vicinity of marine, mobile or fixed transmitters, has been announced by Heath Co., Benton Harbor 11, Mich.

Unit is placed in a location close to transmitter to pick up *rf* radiation from transmitter antenna. Provides a continuing indication of transmitter operation. Detects dropping off of transmitter power by comparing past meter indication with that obtained at any other given time. Operates with transmitter having output frequency between 100 kc and 250 mc. Sensitivity is .3 *v rms* full scale, with an adjustment control on the panel. Meter is a 200 *ua* unit.

TRANSISTOR TESTER

A TRANSISTOR TESTER, *TT-2* (kit or wired), for checking transistors and diodes, has been introduced by Century Electronics Co., Inc., 111 Roosevelt Ave., Mineola, N. Y.

Unit is said to check transistors for current gain, leakage, opens, shorts, cut-off current; check diodes for forward to reverse current gain. Power supplied by 6-*v* battery.



ADVERTISERS IN SERVICE

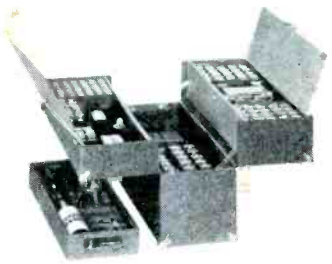
OCTOBER, 1957

BENCH-FIELD TOOLS

TUBE CADDY

A TUBE CADDY, *TC-5* (24" w x 16½" h x 8½" d), with a separate removable tool tray, has been introduced by Argos Products Co., Genoa, Ill.

Designed to hold not only tubes, but tools, soldering gun, meter and accessories.



* * *

SERVICING LAMP

A SERVICING LAMP, *Magna-Lite*, with a magnetic base that permits placement on metal surfaces or flexible-joint arm, has been announced by R-Columbia Products Co., Inc., Highwood, Ill.

Available in two models: 300 with standard shade, plug and bulb; and 350 with flood shade and standard plug (less bulb).

* * *

WOOD TOUCH-UP FINISHES

PUSHBUTTON, AEROSOL-TYPE, satin-finish stains, said to permit spraying of a matching touch-up color on damaged wood furniture, have been developed by Press-N-Spray Div., Saco Chemical Corp., 527 Lexington Ave., New York, N. Y.

Four colors are available: Brown and cordovan mahogany, walnut and blonde.

* * *

ADJUSTABLE HIGH-INTENSITY LAMP

AN ADJUSTABLE INCANDESCENT flexible lamp, *Kold*, for close work requiring a high light intensity, has been introduced by the Faries Lamp Div., General Lamps Manufacturing Corp., Elwood, Ind.

Constructed with a flue effect said to draw off heat with a fast up current. Lamps extend from a minimum of 12" to a maximum of 38".

* * *

ALUMINUM SAFETY-STEP LADDERS

ALUMINUM LADDERS, with steps made of extruded aluminum, have been announced by Ballymore Co., West Chester, Pa.

Ladders have ball-bearing casters which automatically retract when ladder is stepped on. Handrails are offered on 3- and 4-step models.

PERSONNEL

GEORGE GEMBERLING, former general district manager of The Alliance Manufacturing Co., Inc., Alliance, O., is now sales manager for the consumer products division. . . . *Ray Buhrman*, advertising manager, has been named assistant sales manager for the consumer products division and still retains his duties as ad manager.

Gemberling

Buhrman

CONRAD R. ODDEN has been appointed to a newly created post of manager, general quality control, RCA Victor Radio and Victrola Division. Odden has been serving for the past three years as manager of commercial service for the RCA Service Company, Inc.

BROCK P. HAYES has been named Syracuse district manager for the CBS-Hytron Sales Corp., Danvers, Mass. *Roy A. Juusola* is now manager, marketing administration, of CBS-Hytron.

LARRY STINEMAN is now chief engineer of Gramer-Halldorson Transformer Corp., 2734 N. Pulaski Road, Chicago, Ill. *Stineman* was formerly chief engineer for Merit Coil and Transformer Corp.

ROGER A. SWANSON has been appointed a sales engineer for the semiconductor division of Sylvania Electric Products Inc., 1740 Broadway, N. Y. 19, N. Y.

LYNN LOCKWOOD has joined the Finney Co., 34 W. Interstate St., Bedford, O., as a special factory rep. *Donald Wells* has been named special development engineer for Finney. *Richard Linnert* is now a special sales engineer for Finney.

C. GRAYDON LLOYD has been named general manager of the General Electric specialty electronic components department, Auburn, N. Y.

RICHARD G. FREEMAN has been elected vice president of Todd Products Co., Inc., Mt. Vernon, N. Y. Freeman was formerly vice president and director of purchasing of Empire Coil Co.

BOB HODGES has been named sales engineer of the catalog products division of Chicago Standard Transformer Corp.

ROBERT E. GIANNINI has been appointed western regional manager for distributor sales of General Electric electronic tubes and other components. The regional office has been moved to the Los Angeles headquarters at 11840 Olympic Boulevard.

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The new Philco Universal ... and ... Bar Generator, like all Philco Test Equipment, was designed by expert engineers who ... service work best. Built by trained technicians ... and high quality standards for more dependable, more accurate ... work on the job.

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- Visual marker signal to identify color bars.
- Regulated power supply.
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QUIET

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RCA Quality-Control Procedures include MICROSCOPIC INSPECTION OF POPULAR TV RECEIVING TYPES! These types are closely examined for possible poor welds, weld splatter, bad crimps, damaged stems, improper assembly, and many other factors that can affect top quality, long-term performance. Though the tubes may pass all electrical tests, such defects could slip by and mean the difference between a profitable service call and a costly callback.

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