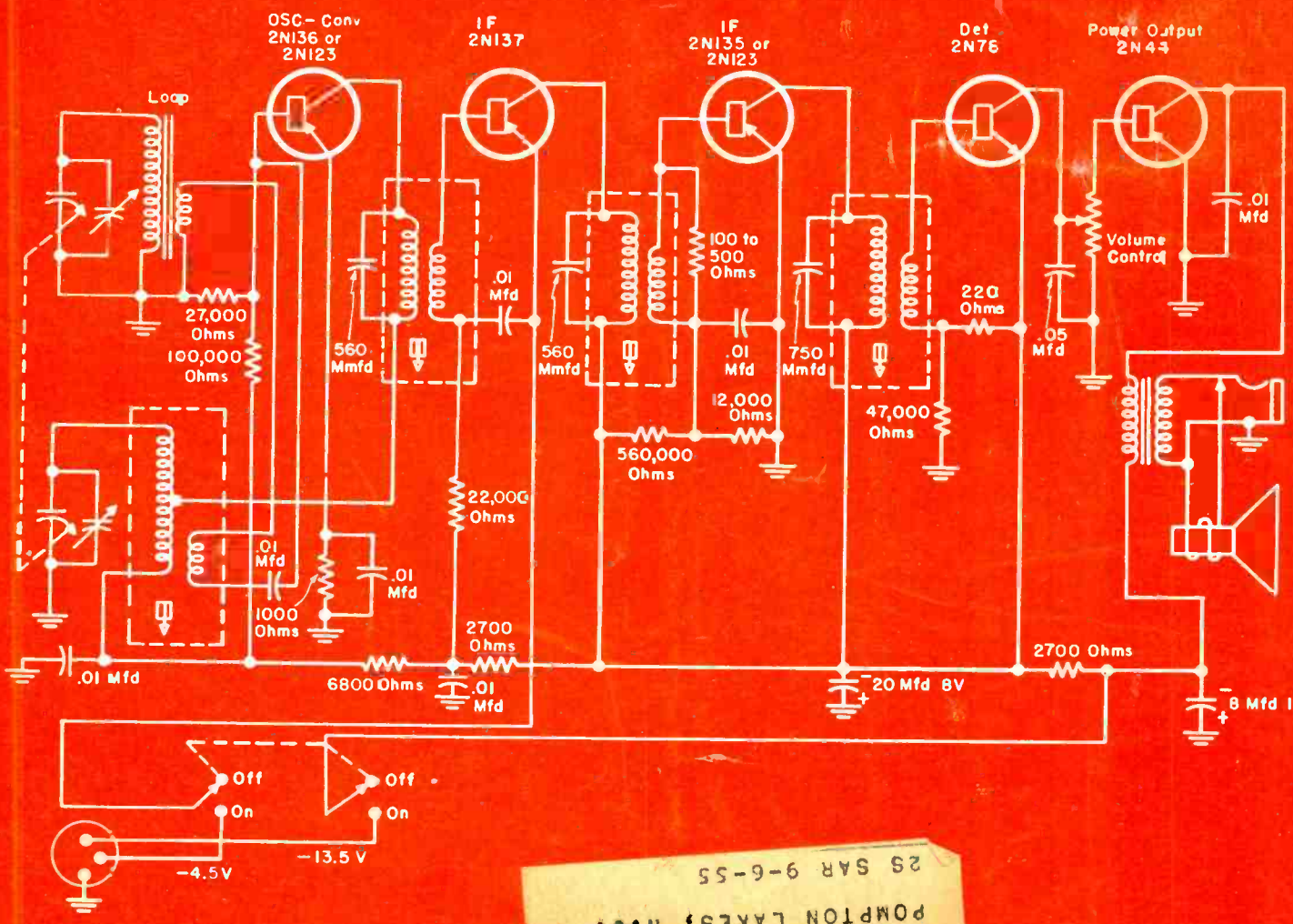
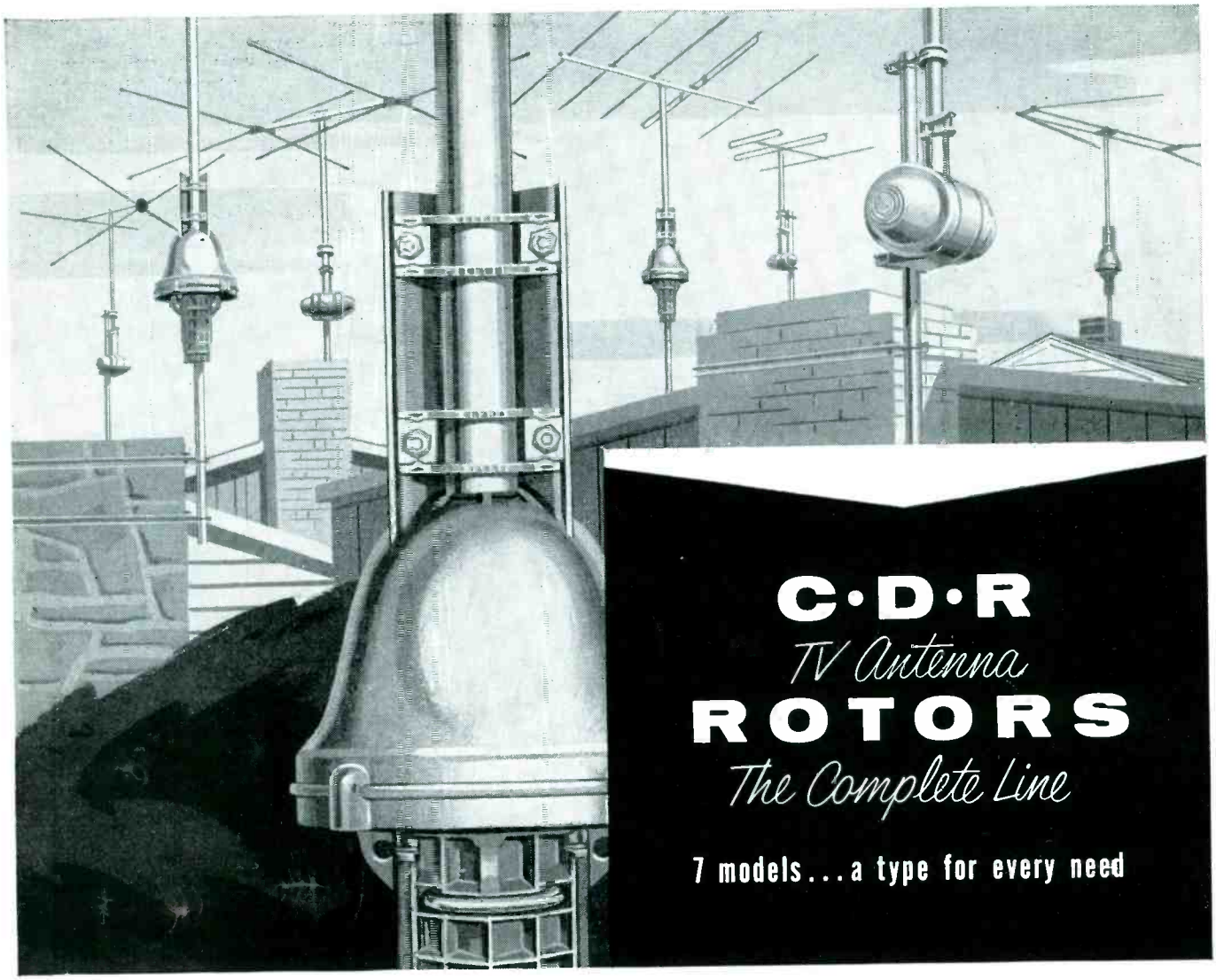
OCTOBER, 1955

SERVICE

The Technical Journal of the Television-Radio Trade



Transistorized pocket radio with fused junction-type transistors. See circuit analysis, this issue



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ROTORS
The Complete Line

7 models... a type for every need

featuring C·D·R automatic ROTORS

Here they are .... the fastest selling line of rotors ... complete in every detail ... including three models in completely AUTOMATIC rotors! The AR-1 and AR-2 and the AR-22 which is the automatic version of the famous TR-2. ALL FIELD TESTED AND PROVEN BY THOUSANDS OF SATISFIED USERS!

TR-2 The heavy duty rotor with plastic cabinet featuring "compass control" illuminated perfect pattern dial... uses 8 wire cable.

TR-12 Complete rotor INCLUDING thrust bearing. Handsome modern cabinet with meter control dial, uses 4 wire cable.

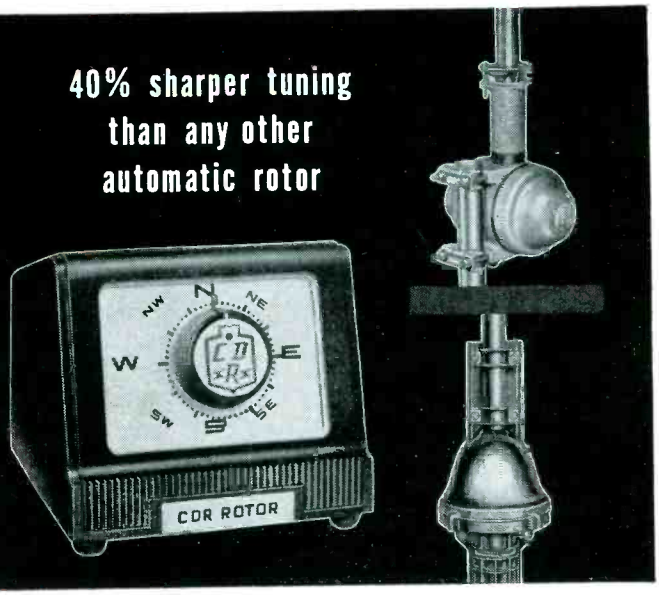
TR-4 The heavy duty rotor complete with handsome new, modern cabinet with METER control dial, uses 4 wire cable.

TR-11 Same as model TR-12 without thrust bearing.

pre-sold

PRE-SOLD to millions with the greatest concentration of TV Spots in our history.

40% sharper tuning than any other automatic rotor



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SOUTH PLAINFIELD, N. J.

THE RADIART CORP.
CLEVELAND 13, OHIO

Vol. 24 No. 10

SERVICE

October, 1955

The Technical Journal of the Television-Radio Trade

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COVER CIRCUIT

FEATURES

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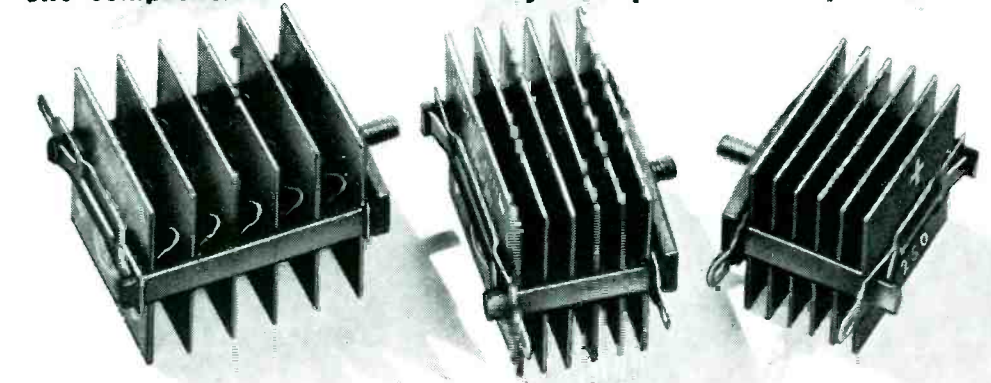
-one comprehensive line for virtually all replacement requirements!



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Max. Output ma	Max. Input volts	RCA Type
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100	130	206G1
150	130	201G1
200	130	207G1
250	130	208G1
300	130	202G1
350	130	209G1
400	130	203G1
500	130	204G1
400*	130	210G1
500*	130	211G1

*Special thin types for use where available space will not permit the use of type 203G1 or 204G1.

RADIO CORPORATION of AMERICA
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more profit for you in "Silver Screen 85's"

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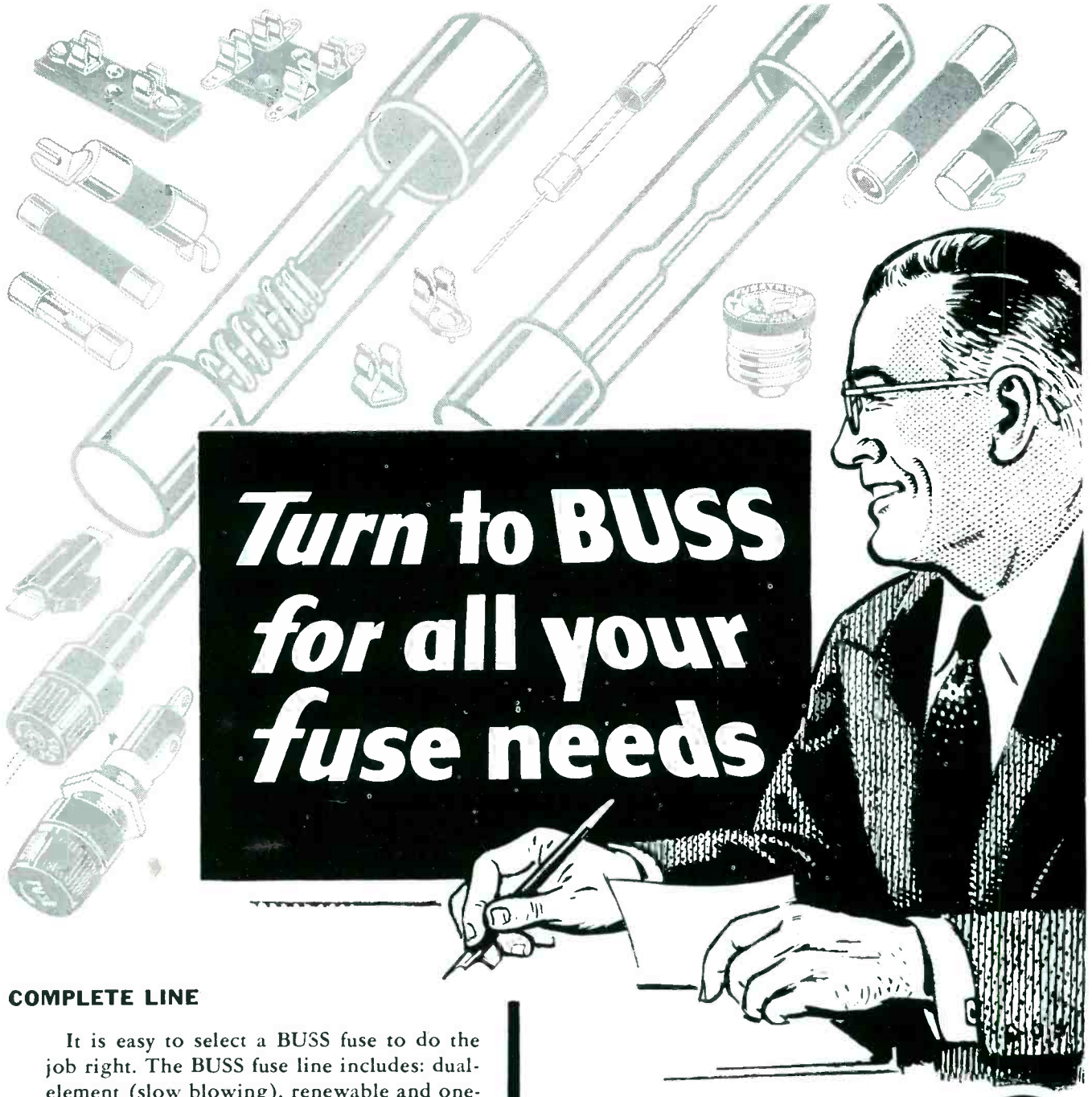

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It is easy to select a BUSS fuse to do the job right. The BUSS fuse line includes: dual-element (slow blowing), renewable and one-time types — in sizes from 1/500 ampere up . . . plus a companion line of fuse clips, blocks and holders.

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S-1055

Makers of a complete line of fuses for home, farm, commercial, electronic, automotive and industrial use.

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"Super-scribbled" — with Channel Master's trigger-fast Snap-Lock Action.

Never before—an antenna with such utterly . . .

Fantastic front-to-back ratios

Low Band: from **20:1** to **50:1** relative VOLTAGE
(2500:1 relative power)

High Band: up to **13:1** relative VOLTAGE
(169:1 relative power)

CHANNEL MASTER'S new "K.O." all-channel antenna

Knocks out venetian blinds and co-channel interference!

Channel Master's new "K.O." has the highest front-to-back ratios ever recorded for any TV antenna! The sensational "K.O." actually sets up an INVISIBLE BARRIER to signals coming in from the rear. Working with supreme efficiency on both VHF bands, it totally REJECTS rear signals, preventing venetian blinds and other picture problems caused by co-channel interference.

Spectacular High Gain!

Low Band, 7 to 9 DB, single bay; High Band, 8.5 to 10.5 DB, single bay. True Yagi performance, combined with completely independent High and Low Band operation for maximum efficiency.

Available 3 ways!

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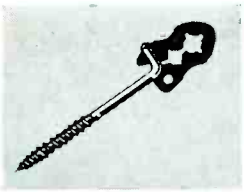
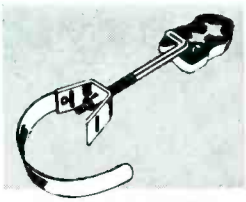


TELCO E-Z "SWING IN" STAND-OFF

Wood screw type, 3½", UHF-VHF

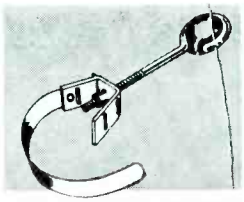
No. EZ-8027 $4.80 C



TELCO E-Z "KANT-STRIP" STAND-OFF

"Swing In" type, 3½", 9" strap

No. EZ-8253 $0.13



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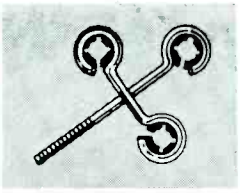
Round insulator, 3½" 9" strap

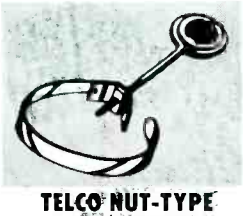
No. 8253 NET $0.11



TELCO 3-WAY STAND-OFF

For 3-line use, 7½" wood screw

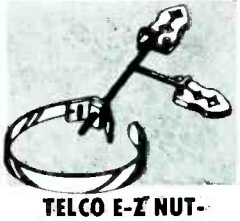
No. 8397 NET $0.21



TELCO NUT-TYPE STAND-OFF

Welded 10-23 nut, 3½", 9" strap

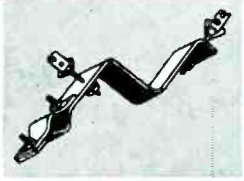
No. 8253-N $0.12



TELCO E-Z NUT-TYPE STAND-OFF

Tougher inline duplex, 7½", 9" strap.

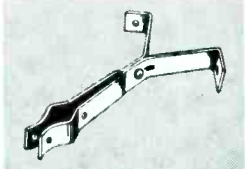
No. EZ-8258-N $0.24



TELCO CHIMNEY QUICK MOUNT

Easy to install, complete

No. 8005 NET $1.35



TELCO SNAP-IN CHIMNEY MOUNT

Fits masts to 1¾" complete.

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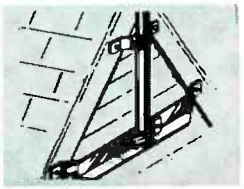
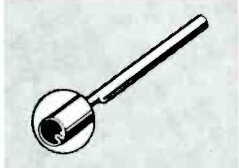


TELCO PEAK MOUNT

Masts to 1¾" 30" lower support

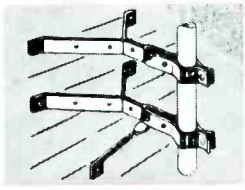
No. 8625 NET $2.37



TELCO GALVANIZED ANTENNA MASTS

1¼" OD x 5' crimped end

No. 9013 NET $0.78



TELCO DELUXE SNAP-IN WALL MOUNT

Extra sturdy, 12" clearance

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TELCO UNIVERSAL LIGHTNING ARRESTOR

Easy to install, UL approved

No. 8642 NET $0.75

TELCO UHF-VHF GLOBE-TENNA

Handsome 12" globe plus built-in antenna

No. A-9265 $11.97

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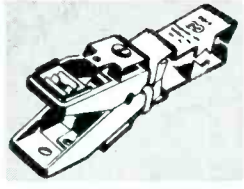

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For straight side or plug-in

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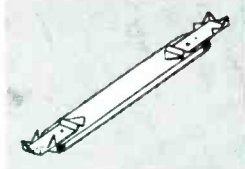

TELCO LOW-LOSS LINE KLIP

All one piece, plastic, metal ends

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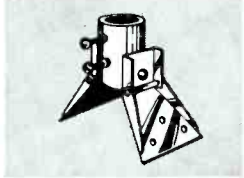
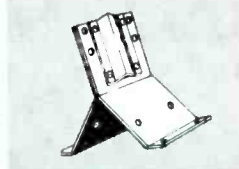


TELCO HINGED TYPE RIDGE MOUNT

Fits masts to 1½" assembled

No. 9021 NET $1.17



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Fits masts to 1¾" use every where

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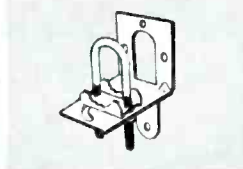

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For masts to 1½", extra support

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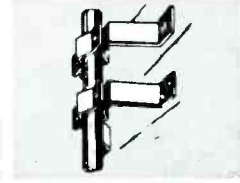

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For close-in (4") mounting.

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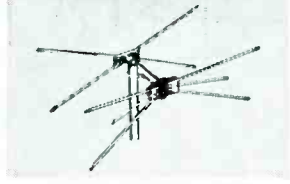
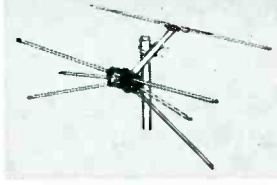


TELCO MASTER-LINE VHF CONICAL ANTENNA

Single bay, 10 element, all-channel

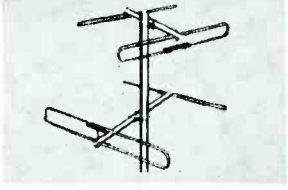
No. A-8700 $4.20



TELCO RANGER COLOR CONICAL ANTENNA

Single bay, 8 element, VHF-UHF

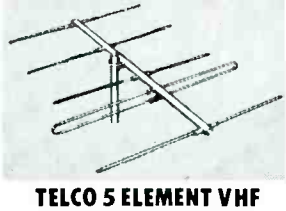
No. A-110 NET $3.45



TELCO HI-LOW DIPOLE ANTENNA

VHF, covers channels 2 to 13

No. A-250 NET $4.41

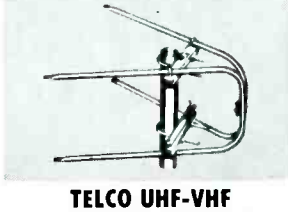


TELCO 5 ELEMENT VHF YAGI ANTENNA

12 models, custom cut to each.

No. A-302 Ch. 2 **$7.35**

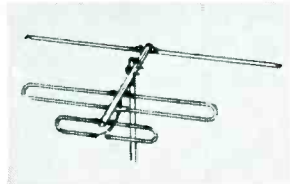
No. A-313 Ch. 13 **4.35**



TELCO UHF-VHF DOUBLE V ANTENNA

Covers channels 2 through 83.

No. A-9017 $3.15



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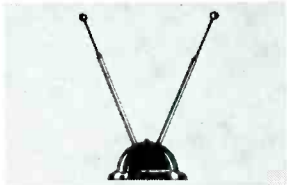
Channels 2-13; ¼" seamless elements.

No. A-9046 NET $5.97



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DeLuxe brass, nickel-plated elements

No. A-8160-TP $2.97

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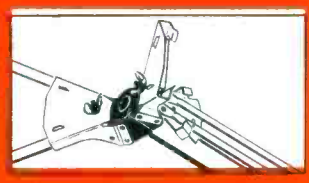
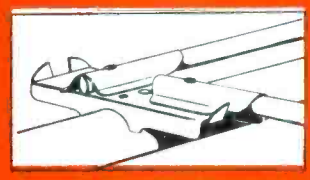


Insta-Lok Head—216% more resistance to vibration and breakage. Flip out elements—they're locked in place.



Insta-Lok Clamp—Swing elements into position—that's all!

TRIO Model 74 Sharpshooter CONICAL

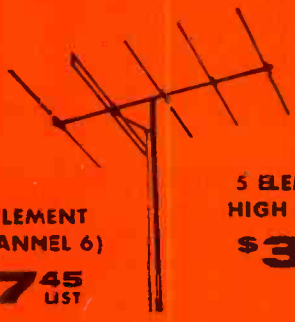
$3.95 LIST

14 POPULAR MODELS —ALL COMPLETELY PRE-ASSEMBLED

Quality materials plus advanced TRIO automation give you the finest conicals ever built.

Sharpshooter's Quality Features Obsolete Un-assembled Antennas

TRIO Sharpshooter YAGI



5 ELEMENT (CHANNEL 6) $7.45 LIST

5 ELEMENT HIGH BAND $3.95 LIST

10 ELEMENT (CHANNEL 6) $13.65 LIST

10 ELEMENT HIGH BAND $6.88 LIST

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INSTA-LOK CLAMPS—Perfect alignment, positive lock, superior strength, lessened vibration and breakage. No finer yagis regardless of price!

EFFICIENT ELECTRICAL DESIGN—TRIO high channel models use a ratio type dipole for better impedance match, higher gain, sharper directivity.

RIVETED CONSTRUCTION—Introduced by TRIO for faster assembly, better picture quality.

BETTER VALUE—Because TRIO produces practically every part used in their products, including their own aluminum tubing.

Ask your distributor for complete literature on the new SHARPSHOOTER Conicals and Yagis.

TRIO® Manufacturing Company
GRIGGSVILLE, ILLINOIS

EXPORT SALES DIV., SCHEEL INTERNATIONAL INC., 4237 N. Lincoln Ave., Chicago, U.S.A. Cable Address: HARSCHEEL

Associations

ARTS, Chicago, Ill.

A SCHEDULE of fall and winter lectures has been prepared by the Associated Radio and TV Servicemen, Chicago. One of the talks will feature a report by *Emerson J. Morris*, vice-president of the National Bank of Commerce of Chicago, on installment financing for the small radio and television service shop, and what to know about selling on credit.

Richard Harasek, of the radio division of Motorola, will appear at another meeting and discuss printed circuits and how they are produced. He will offer pointers in the servicing and repair of such circuits.

L. J. Couch, sales service engineer of Sylvania Electric Products, Inc., will be a speaker at another lecture and cover transistors; what they are, how they work, and where they may be going.

° ° °

TISA, Chicago, Ill.

THE TELEVISION Installation Service Association, Chicago, Ill., has changed its name to the Television Electronic Service Association or TESA-Chicagoland.

° ° °

ETA, Jamestown, N. Y.

TO ACQUAINT set owners with the unusual problems encountered in servicing, the Electronic Technicians Association, Jamestown, New York, have prepared a *friendly-message* card, explaining service guarantees, which is left at home or distributed in the shop by all members.

The card tells set owners that ETA members take pride in their work and strive at all times to do a top-flight job. Noting that ETA members guarantee parts and workmanship against normal service failure for a period of 90 days, customers are also informed that due to the complexity and nature of electronic equipment, many defects which seem identical can be caused by one of several individual parts or circuits; thus they explain it is not possible to assume responsibility for any portion of the instrument (parts, tubes or circuits) on which service has not been performed.

The invoice, the ETA card points out, shows work performed and parts replaced on which the guarantee is based.

Plane-load of Detroit service association delegates who attended recent uhf **antenna clinic session at Taco's plant in Sherburne, N. Y.:** Ralph L. Carew, **University Radio and TV Service, (Electronic Service Association);** Leander R. Rivard, **Triangle Television, Inc., (Macomb County Electronics Association);** F. William Vigelius, **Electronic Service Co., (Oakland County Electronics Association);** Mike Mosier, **Berkley Electronics, (South Oakland County Television Association); and** William O. Mattingly, **Matts Radio and TV Sales and Service,** Charles D. Judd, **Judd Electronics, and** Jack Barton, **Barton's Radio and TV Co., all representing Television Service Association of Michigan. Also on the plane was** Ralph E. Sloan, **director of publicity of the operations committee of the Detroit Educational TV Foundation operators of the** uhf **station in Detroit (channel 56) and Taco rep** John Merchant. **Technical sessions were directed by Kendrick H. Lippitt, Taco's chief engineer, assisted by Norman Rea, field engineer.**

PRSMA, Philadelphia, Pa.

RICHARD G. DEVANEY will serve as president of the Philadelphia Radio Service Men's Association for '55-'56.

Devaney has been a member of the PRSMA advisory board and previously served two terms as vice president.

Samuel Brenner has been elected vice president; *James T. Daly*, recording secretary; *Stanley W. Myers*, treasurer: and *William P. Humes*, corresponding secretary.

* * *

RTTG, Miami, Florida

IN A REVIEW of the positive and negative aspects of licensing, in a recent issue of a monthly bulletin issued by the Radio and Television Technicians Guild of Florida, *Charles Pierce* declared that a majority of Service Men, recently polled, noted that they would be in favor of a properly written and administered licensing law.

Commenting on the present situation, Pierce said that now there are no duly authorized and appointed TV Service Men. Noting that there is no recognized authority to appoint master Service Men and allgrades in between down to apprentice, the RTTG member said that this condition does not bring about public confidence and trust. All respected professional trades have had licensing by examination for some time it was emphasized, and are much better off because of it.

The license law proposed would be administered by the county or state; not individual cities. According to the measure, there would have to be a master Service Man in charge of each shop who would be held responsible for the work performed by that shop; licensed journeymen doing bench work and making service calls; apprentices working under the supervision of masters and Service Men. A license would be granted after successfully passing a theoretical as well as a practical examination given by examiners qualified to render such exams. No one could apply for examination, it was stressed, who has not been a resident of the county for more than six months. All examination papers would be made available to any and all interested parties up to 30 days after taking such examination, so that qualified men will not be kept out and unqualified men will not get in through some political means. All persons now in business legitimately would be granted a license under the proposed law.

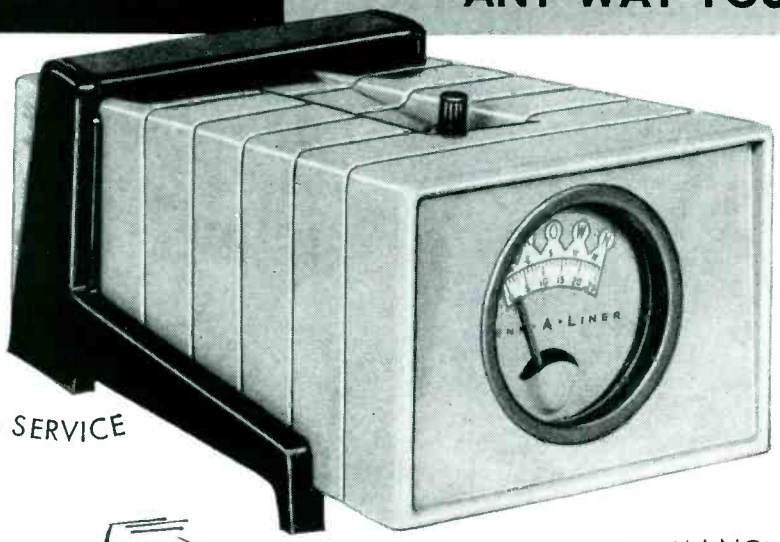
TEN YEARS AGO IN SERVICE

THE TREMENDOUS installation-servicing demands that the projected large-scale housing programs will create were viewed as a boon to the Service Man by industry and associations. This big job, association officials pointed out, will require extensive facilities, such as complete single-manned shops for each building and larger community operations to handle many buildings. To expedite repairs, it was suggested that shops feature specialists on receivers and antennas, and use portable and fixed instrument setups for apartment or bench multiple-set servicing. The instruments, housed in a rack mounting, could be so arranged, it was noted, that they would be plugged into position for fixed use or removed, via multi-pin plug jacks, for portable work. . . . Many types of miniature radios, of the pocket-sized style, using multi-element tubes and hearing aid earpieces were, it was disclosed, scheduled for a big push by manufacturers; a number of instrument makers were described as planning compact testers to check the new small tubes and components included in these tiny portables. . . . The first May parts and equipment show, sponsored by the parts division of the RMA, NEDA, Association of Electronic Parts and Equipment Manufacturers and the Sales Managers Club (Eastern Division), was announced for the Hotel Stevens, Chicago; the dates, May 13, 14, 15 and 16, 1946. . . . Newark Electric Company added 7,000 square feet of floor space to its store in Chicago. . . . *R. B. Stuart* was appointed sales manager of the Radel Manufacturing Co., Cleveland, O.

CROWN TENN-A-LINER ROTATORS

BEST

IN ANTENNA ROTATION ANY WAY YOU LOOK AT IT!

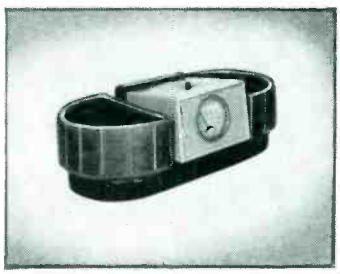


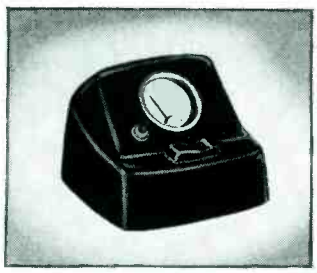
. . . SERVICE

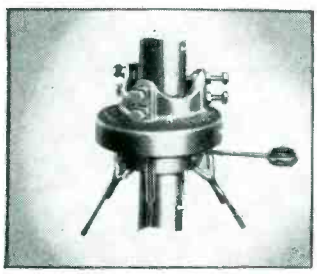
PROFIT . . .

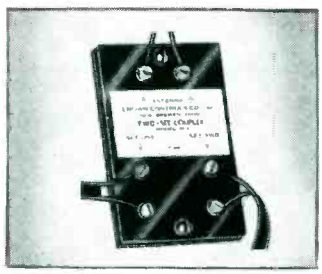
PERFORMANCE . . .

. . . CUSTOMER SATISFACTION









Right now is the time to get ready to cash in during the peak selling season ahead . . . get the complete story on the bigger profits possible with Crown Tenn-A-Liner Rotators. Available in two decorator-styled models, Crown Tenn-A-Liners give you the highest profits in the TV antenna rotator field. Crown's ruggedness and dependability increase customer satisfaction and reduce profit-consuming call backs . . . in fact, only 1.06% of all Crown units sold require service. A guaranteed product, Crown's exclusive replacement policy keeps customers happy.

Crown also provides a complete line of TV accessories — the Crown TV Planter for use with the CAR6B Tenn-A-Liner, the Roller Bearing Guy Ring, and the Two Set Coupler — sure ways to make those extra sales that come from impulse buying.

For bigger profits this year . . . SELL WITH CONFIDENCE, SELL CROWN!

CROWN® CONTROLS Co., Inc. NEW BREMEN, OHIO

Canadian Subsidiary Crown Controls Mfg. Ltd. Export Division, 15 Moore St., New York, N. Y., Cable–"Minthorne"

Auto-Radio Technicians:

DELCO RADIO

TRAINING COURSES MEAN MORE BUSINESS FOR YOU

Working in small groups under factory-trained Delco instructors, alternate lecture and lab periods keep radio technicians up to date on latest radio and repair developments at a General Motors Training Center Delco Radio course.

Typical of the thirty General Motors Training Centers across the country is this one at Tigard, Oregon, a Portland suburb. Ample parking areas help to make this center popular throughout the Northwest.

Week-long courses for experienced service technicians provide latest radio and repair information—enable you to do the job faster and more efficiently.

Quick, accurate auto radio diagnosis and repair to factory specifications boosts your profits. That's why so many qualified auto radio technicians attend these Delco Radio training courses at no cost for tuition, school supplies, or equipment.

Factory-trained instructors, using latest equipment and instruction methods, conduct these intensified week-long courses, designed to familiarize repairmen with modern auto radio developments and factory-approved repair techniques.

The Delco Radio diploma, awarded only to those who successfully complete the course, is proof that you're equipped to give more and better service to more people—and that means more business.

If you're an auto radio service dealer, come yourself, or send your technicians. There's one of 30 GM Training Centers near you. Apply through your local Delco Electronic Parts Distributor or write Delco Radio Division of General Motors, Kokomo, Indiana.

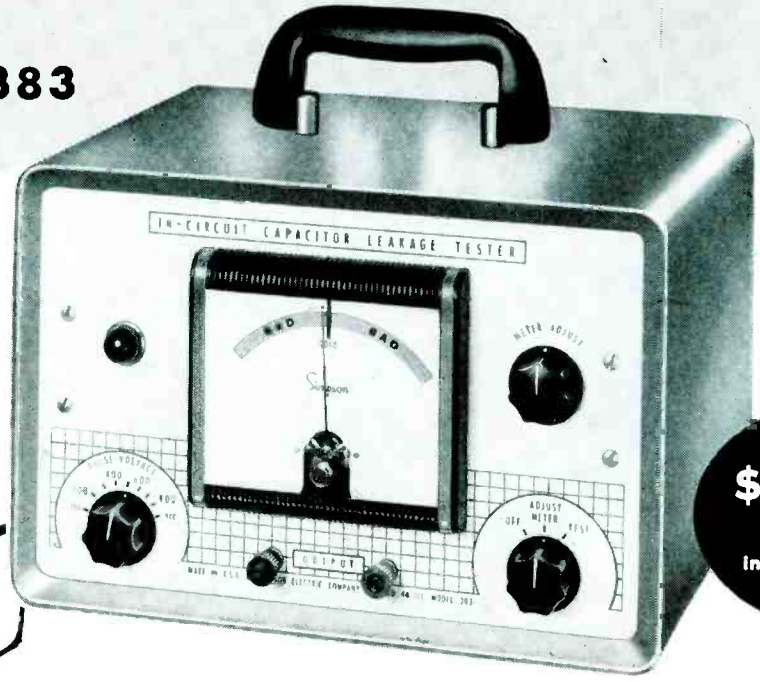
DELCO RADIO
DIVISION OF GENERAL MOTORS
KOKOMO, INDIANA

HERE'S THE COURSE OF STUDY — (1) Circuitry differences between home and auto radios. (2) Dead radio trouble-shooting procedure and lab. (3) Noisy radio trouble-shooting and lab. (4) Weak radio trouble-shooting and lab. (5) Distorted radio trouble-shooting and lab. (6) Intermittent trouble-shooting and lab. (7) Push-pull lock-up tuner lecture and lab. (8) Mechanical operation of Signal Seeking Tuner. (9) Electrical operation and trouble-shooting of Signal Seeking Tuner. (10) Autronic-Eye operation trouble-shooting procedure and lab. (11) Autronic-Eye installation and adjustment procedure. (12) Transistors and printed circuits.

NEW!

Simpson IN-CIRCUIT CAPACITOR LEAKAGE TESTER

model 383



only $79.95
including probe leads and manual

World's first tester that truly checks paper, mica, and ceramic capacitors . . . WITHOUT DISCONNECTING THEM FROM THE CIRCUIT!

Here's a new dimension in electronic instrumentation. Detects leakage in paper, mica, or ceramic capacitors, while connected in the circuit. No disconnections of any kind. Checks leakage, *even when the shunting circuit resistance is only 1% or less of the leakage resistance value.* Uses a new Simpson discovery (patent applied for).

Only two simple test leads to apply. Indication is on a "Good-Bad" scale—your customer can see *why* new capacitors are needed. Tests capacitors from 1 uuf to 0.25 uf in a jiffy. Indicates leakage resistance from "shorts" to hundreds of megohms. Also detects the presence of unstable *resistors* right in the circuit.

Be the first technician in your area to cash in on this fabulous Simpson tester. Sell *preventive* maintenance . . . fix "dog" sets in one-tenth the usual time. Double . . . yes, even triple your service income.

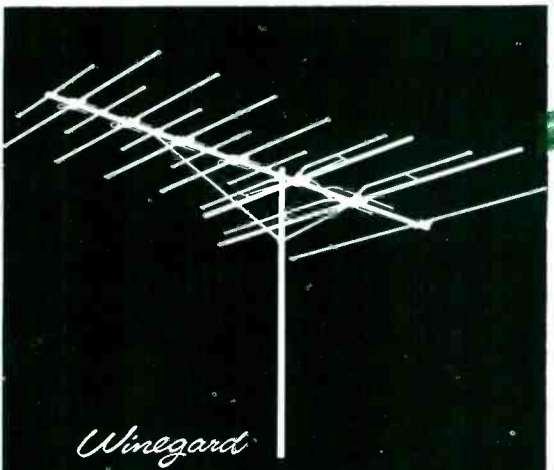
ask your jobber, or write . . .

Simpson ELECTRIC COMPANY
5220 W. Kinzie St., Chicago 44, Illinois
Phone: EStebrook 9-1121
In Canada: Bach-Simpson Ltd., London, Ontario

WORLD'S LARGEST MANUFACTURER OF ELECTRONIC TEST EQUIPMENT

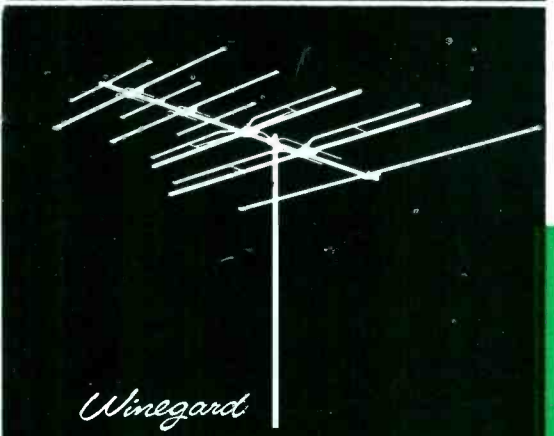
WORLD'S MOST *Exciting* TV ANTENNAS

Originals by WINEGARD



Winegard

SUPER-INTERCEPTOR — designed for superior performance in extreme fringe areas. Gleaming gold finish or regular aluminum.



Winegard

INTERCEPTOR* — world's most imitated all-channel Yagi. Available in beautiful metallic shades of red, blue, green and gold.

 *Patent No. 2700105

Colors so Bright... They Sell on Sight

When it comes to antennas, you, as a technician, are naturally interested in gain, directivity, front-to-back ratios — all of the electrical and mechanical features that make antennas tick. But think of it from your customer's viewpoint. He is interested in only two things: (1) performance — getting the best possible pictures on his TV set; and (2) appearance — how the antenna looks on his roof. ***Only Winegard Interceptor TV Antennas give you both unequalled performance plus neat, colorful appearance.***

Color is something people understand and *want!* That's why you should start installing Winegard anodized Interceptors NOW! Wait till people see these shimmering metallic colors sparkling in the sun! One installation and you'll have the whole neighborhood talking — asking who did the job. ***You'll sell at least a dozen Winegard Interceptors from each one you install!***

Ask your jobber or clip coupon

Mail Today

WINEGARD COMPANY, Dept. B
3000 Scotten Boulevard, Burlington, Iowa

☐ Please rush bulletin No. WL21455 on Anodized Antennas

☐ Send complete technical information on Winegard Interceptors

FIRM NAME _____

ADDRESS _____

CITY _____ STATE _____

SIGNATURE _____

WHAT

have you got that other TV-Radio servicemen haven't got?

When you are a *Raytheon Bonded Electronic Technician*, the answer is simple. You have the exclusive tool, the *only* tool in the industry that creates customer confidence — *draws customers to your shop.*

Under the Raytheon Bonding plan, your work and parts guarantee is backed by a Bond issued through one of America's largest insurance companies. Customers appreciate the value of this extra protection and, all else being equal, give their business to the Raytheon Bonded Dealer.

If you can qualify for the Raytheon Bond, it won't cost you a penny. Call your Sponsoring Raytheon Tube Distributor today for the whole story.

RAYTHEON®
Excellence in Electronics

RAYTHEON MANUFACTURING COMPANY
Receiving and Cathode Ray Tube Operations
Newton, Mass., Chicago, Ill., Atlanta, Ga., Los Angeles, Calif.
RAYTHEON MAKES ALL THESE:
RECEIVING AND PICTURE TUBES • RELIABLE SUBMINIATURE AND MINIATURE TUBES • SEMICONDUCTOR DIODES, POWER RECTIFIERS AND TRANSISTORS • NUCLEONIC TUBES • MICROWAVE TUBES

SERVICE
The Technical Journal of the Television-Radio Trade

Prepare Now for Color TV

COMBINED EFFORTS of the TV network and set manufacturers, which went into high gear this fall, have lifted color TV off the ground and ushered in a field bouncing with opportunities for the Service Man.

Set makers are now planning to produce nearly a quarter of a million color chassis during the next twelve months. And a year from now industry experts believe that both the tube and set manufacturers will be sorely pressed to supply the demand. In '57 the production of nearly a million and a half units is expected. Beyond that year no one can be found who will hazard a guess as to the upward trend of output and sales.

Everyone is equally as optimistic regarding costs, noting that prices will drop and bring sets within reach of the buying potential of a large percentage of the present b-w TV set owners.

All of this means big business for the Service Man. Those aware of these enormous possibilities are preparing themselves *now* for this gala color era.

Since early summer, SERVICE has been paving the way for the color push, offering complete information on sets and instruments. Next month, the *prepare-now* program will receive headline attention; SERVICE will publish an exclusive technical color-TV progress report that will reveal for the *first* time new circuitry trends for sets and test gear, new color picture and receiving tube developments and the latest bench-field installation-repair techniques.

Don't miss this all-important field report, exclusive in SERVICE.

A Must for Phonos: Periodic Inspection and Service

IN NO SYSTEM in the electronic family is periodic inspection and service so vital as in the phono, because of its network of expendable components. Here practically every item has a wear factor, requiring policing and replacement on a consistent basis.

Up front in this replacement chain is the needle; even the diamond finds itself roughed up by the abrasive action of a record. In the cartridge there are a number of items that can deteriorate with age, one of the most critical being the damping material. When this becomes damaged due to aging, peaking and subsequent distortion occur. Then there is the speaker, whose cone is always affected by changes in temperature and humidity, as well as dust particles in the air. And, of course, the motor and turntable are always suspects for wear and tear.

In a number of phonos, capacitors and resistors, packed tightly in contained areas and enveloped by tube heat, are also subject to aging breakdown.

Every element in the phono chain is actually an expendable part that demands the closest periodic inspection and complete replacement to insure fidelity results that will match the quality output originally available.

The Readers Run the Show

EACH YEAR, at this time, we observe an important anniversary; the birthday of *ABC*, the Audit Bureau of Circulations, in which we have had a long-time record of continuous membership for over twenty years.

We belong to ABC to give advertisers an independently audited circulation count and an accurate description of the circulation audience they reach when their sales messages appear in our journal.

While the major objective of the bureau is to give advertisers accurate, verified information about the net paid circulations of all publisher members, its work has also a very real importance to our readers.

Our *ABC* reports serve us as editorial guides. The reports reveal the business or occupation in which our readers are engaged, and thus we can arrange our editorial coverage to serve their interests most effectively.

All of the other factual information in the report serves to guide us in our editorial planning—to bring our readers a useful, interesting publication of the type they want.

The needs of our readers keep us on our editorial toes; we must help and serve them to merit their continued patronage.

By subscribing, by renewing their subscription and by reading SERVICE, our readers keep us on top, as an editorial leader—to make sure that they will always agree that to them, we are worth the price of admission.—L.W.

*Design-application field reports on needles, cartridges and motors, detailing how they should be screened for every phono job, appear in this issue on pages 42 to 49.

SERVICE...The National Scene

PICTURE TUBE REPLACEMENT MARKET SOARING--The 30-odd million TV sets that have been in the field for over a year--many have been in use for nearly five years--have developed a bulging market for replacement picture tubes, that next year is expected to create a demand for over 60 per cent of all of the tubes being made. . . . Production records of this year and last dramatically reveal this marked trend. Currently, about a 50-50 basis obtains for the manufacture of pix tubes for replacements and original equipment. A year ago, almost 70 per cent of the tubes were being made just for new chassis. . . . The recent significant advancements in tube design, offering a parade of improvements in picture quality, are also serving to generate growing interest in replacements. And, in addition, industry spokesmen have disclosed, their superior performance is highlighting the advantages offered by nationally-advertised standard-brand tubes. Commenting on this important fact, one specialist said that in these tube plants, not only is every process supervised with meticulous care, but all materials are subjected to critical quality control, and every piece of equipment used in tube fabrication is closely guarded and kept hospital-clean to avoid any air or liquid contamination that could affect the life and results.

EXPERIMENTAL POST-ACCELERATION RECTANGULAR COLOR PICTURE TUBE DEMONSTRATED--A lab type 22-inch rectangular three-gun post acceleration color tube, using electron optical masking rather than shadow masking, was unveiled recently at a progress-report demonstration. In this tube electron beams, directed at vertical color-phosphor stripes inside the face of the tube, were, it was pointed out, accelerated after passing through an array of parallel wires located close to the screen. . . . The grille of parallel wires, called a color-selecting electrode, was described as having a high transparency, permitting a substantial percentage of the electrons ejected from the gun to strike the screen, thus contributing to picture brightness. For equal high-voltage power input, it was said, this tube theoretically offered about six times more brightness than the shadow-mask tube. . . . Since the three beams are all in one plane, both static and dynamic convergence are required for only the two outside beams. This design, it was felt, would reduce the relative complexity of the convergence problem in each of the four functions of horizontal dynamic amplitude, horizontal phasing, vertical amplitude and vertical tilt. . . . Scientists on the project estimated that at least another year of development work would be required before the tube would be ready for the set market.

VHF CALLED SUPERIOR BAND BY FCC COMMISSIONER--The veryhigh channels were recently viewed as the best bet for overall reception by a member of the Federal Communications Commission. He based his opinion on nationwide results which indicated that the vhf signals can travel further than the ultrahighs without deteriorating and are also easier to control at the transmitter and receiver. . . . To capitalize on these features, the Commissioner proposed an extension of vhf to 342 mc and movement into the 132-174 mc bands, shifting present tenants to above 500 mc. This might be done, he said, by relaxing the present separation rules and also creating another TV service providing for low-power stations in small-town areas.

TV AUDIO SPURS INTEREST IN FM--The exceptional quality available from the sound channel of TV receivers, thanks to FM, has sparked new interest in FM receivers. . . . As a result, Service Men are now being called on with greater frequency not only to maintain and repair FM sets, but recommend new models designed to provide that better sound on FM's wide-band noise-free channels. . . . Many feel that FM, often tagged the faltering medium, is really out of the woods and on its way to popularity row where it belongs.--L. W.

All New!

RCA WO-91A 5" 'SCOPE FOR BLACK and WHITE and COLOR TV

Only $229.50 User Price (Optional)

RCA WO-91A 5" OSCILLOSCOPE
Complete, ready-for-use, including new WG-300A low-capacitance, dual-purpose probe, shielded input cable and instruction book.

NOW—AN ALL-NEW OSCILLOSCOPE with features usually found only in more expensive instruments. It has all the 'scope functions you need to do both black-and-white and color TV service work . . . speedily and with top-grade results! Check a few of these work-simplifying features . . . "low-capacitance/direct" probe . . . preset "V" and "H" sweep positions . . . automatic probe-disconnect calibration control. And look at the added features of this instrument:

- *Dual-band response. Response flat to 4.5 Mc in wide-band position.*
- *Voltage-calibrated, frequency-compensated, 3-to-1 step attenuator for "V" amplifier.*
- *Simplified, semi-automatic voltage calibration for simultaneous voltage measurement and waveshape display.*
- *VTVM-type graph scales marked in peak-to-peak volts—read voltage amplitude directly from screen.*
- *Vertical-polarity reversal switch for "upright" or "inverted" trace display.*
- *Sturdy one-piece low-capacitance/direct probe minimizes circuit loading.*
- *Z-AXIS input facilities permit direct modulation of the cathode-ray tube grid.*
- *Preset "V" and "H" sweep positions for speedy, automatic lock-in at "vertical" and "horizontal" frequencies.*
- *"Plus" or "minus" internal-sync selector.*
- *Shielded vertical-input connector and shielded cable for minimizing hum and stray field pick-up.*
- *Positive-lock internal sync.*

FREQUENCY RESPONSE: Wide-band position, within-1 db from 10 cps to 4.5 Mc; Narrow band position, within-1 db from 10 cps to 0.5 Mc; within-6 db at 1.5 Mc.

SENSITIVITY: 0.05 volt peak-to-peak per inch (0.018 volt rms) in narrow-band position; 0.15 volt peak-to-peak per inch (0.053 volt rms) in wide-band position.

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

See the ALL-NEW WO-91A at your RCA Distributor. Order now for early delivery.

The Independent Service Man

A Field Study of the Complete

by the Small

(Left)

Delivery car, which doubles as a sound truck. Horns are mounted on a detachable carrier and are removed when vehicle is used for delivery purposes.

SMALL-TOWN SERVICING is no longer a limited operation. Today, shops in the smaller communities are involved in installing, maintaining and repairing almost the same lineup of equipment found on big-city service benches. For instance, in our shop we not only service table model, console, portable, auto and straight battery radios and TV sets of all sizes, shapes and kinds, old and new, but transistorized gear, phonos, from *kiddie-players* up through home consoles to hi-fi rigs. And we've also been called on to take care of home movie projectors, intercom and pa systems, wire, tape and disc recorders, radio-operated garage door openers, and an assortment of electronic devices, ranging from complicated gas-fired boiler controls with photocells, to simple *moisture-meters* used in testing lumber for dryness. The list is a long one, and covers all phases of the art; one must be prepared to tackle any kind of a job, no matter how far away he lives.

Radio-TV dealers in the small town seldom maintain their own service departments; most of them prefer to use the facilites of the independent Service Men and their seasoned experience. The practice has not only been found to be technically superior to an on-the-premise operation, but a wise one economically. Most of the small-town radio-TV merchants are actually appliance and hardware dealers handling white goods, stoves, refrigerators and radios, with TV as a sideline; their installation-service volume is rarely sufficient to warrant the expense involved in setting up and operating a special service department. Therefore, the independent Service Man profits by doing this work for them.

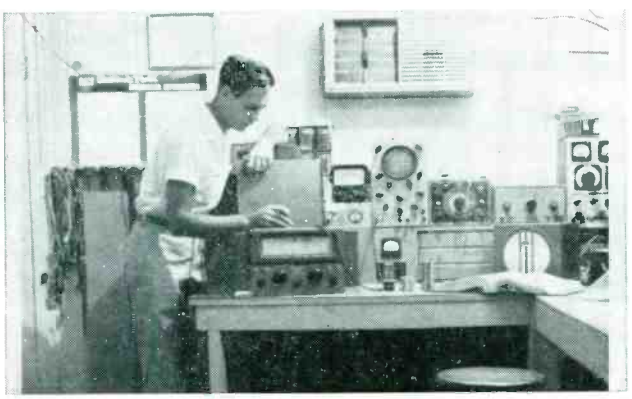
In our town, where there are five service shops, two specialize in handling installation and repair for dealers.

Dealers are generally given discounts on service calls and installation work, and calls made for warranty work; such discounts range from ten to twenty per cent. Some dealers pick up sets and bring them to the shop, also delivering them; others merely call the Service Man and turn the call over to him.

Replacement of parts and tubes on warranty can be a headache, unless one is very careful. New parts must be replaced from stock, the defective parts being turned in to the state distributor, located in another city. This requires packing and shipping at least once a month. If this practice is neglected, one can sustain a serious loss, for the warranty period could expire and the parts are then unreplaceable. It has been found that the best way to handle this problem is to issue a charge for all parts used to the dealer, allowing a good discount, and then let him take care of the packing and shipping. When parts are replaced to the dealer, credit can then be applied on the current month's bill.

Rural Service Men are also faced with the long service-call problem; ten or twenty miles out of town. While there is no universal solution, we have found that the practice of charging on a call-charge plus-mileage basis works out very well. Our fees, in this area, are $5.00 for an out-of-town call, plus ten cents per mile, both ways. In our territory,

Corner of rural service shop where test equipment for radio repair is mounted.

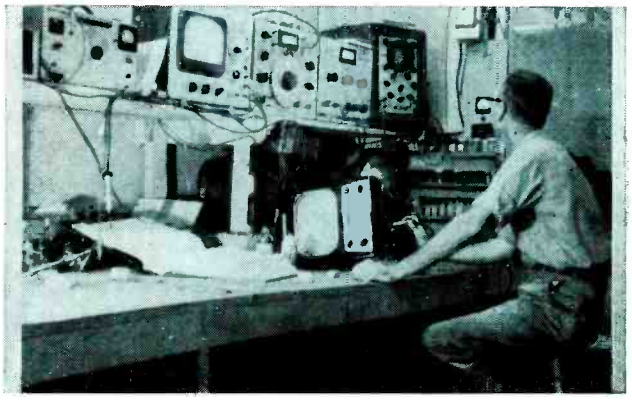


Checking sets in over the counter. Shop is visible through picture window behind operator.

In The Rural Areas

by JACK DARR

Facilities and Services Provided Town Radio-TV Shop



(Right)

The TV service bench section of Darr's shop, with its complete lineup of test instruments.

many customers bring their sets to the shop.

With the growth of TV, small-town Service Men have been faced with the same situation which appeared in big-city shops a few years ago; conversion of the shop from radio to radio plus television. This has necessitated not only a change in education, but in the physical layout of the shop. Instrumentation, tools, service bench and data department; all must be worked over, if the shop is to operate at maximum efficiency. Our own old shop, for instance, was well set up for general radio repairing. The bench was 9′ long, and 20″ wide; test equipment was mounted in panels, about 6″ above the bench, fixed more or less permanently in place. Six fluorescent lamps, in two fixtures, gave adequate illumination. This was fine, until the first TV sets came in. The huge chassis hung precariously off the edge of the bench, while the pix tube completely obscured the test equipment; we were forced to peer around the ends of the chassis to read meters! We completely redesigned the service bench to cope with this changed set of working requirements.

Our new bench is 19′ long, with a four-four *L*-shaped section at the back. Equipment is no longer fixed in place, but rests upon a shelf, two feet wide, at a height of two feet above the bench. This has provided us the needed clearance to see over TV chassis; if it is necessary, pieces of test equipment may be rearranged at any time, to facilitate checks and repair. The old bench was faced with a panel board on which were mounted test-speaker jacks and meters. These had to be moved and now occupy individual small panels, placed near the spot where they will be used. Total width of the new bench is exactly four feet; the shelf covers two feet of this, but is open underneath, so that TV sets can be pushed partially under it. Even so, it could have been at least six inches wider; this might have made it difficult to reach the test equipment, so that the final width is more or less a compromise.

An isolation transformer and wattmeter have been mounted on the wall at the TV end of the bench; this enables the servicing of *line-connected* chassis without too much shock hazard. For convenience, receptacles connected to this are brought down the bench to two different locations. The wattmeter is fused, with a 5-ampere unit, for protection against against overloads.

At the back of the bench, on the *L*-shaped section, radio test equipment is located. These instruments are on a lower shelf, about 8″ high, for added convenience. This provides the needed separation for the two *branches* of the work, and allows us to leave TV sets on the bench, while doing radio work. Before, one TV set covered up practically all of the available space, and had to be moved, if anything else was to be done.

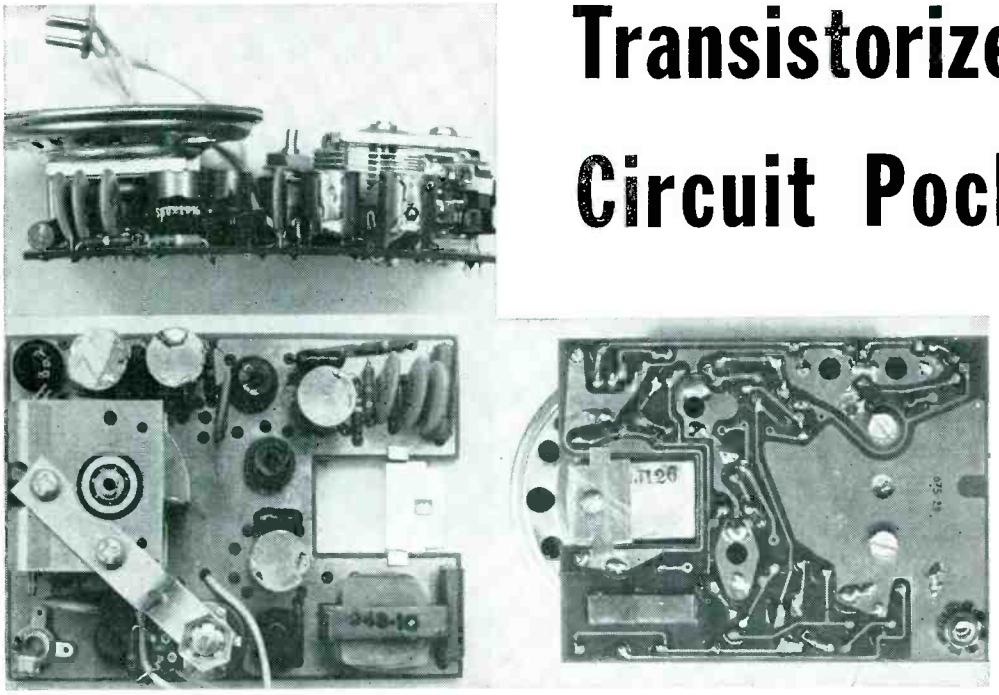
A drastic change in instrumentation was also necessary; instead of one *vtvm*, two are now in use. One is used for radio (the older model) and a newer model (equipped to read peak-to-peak voltages with center zero-scale for *dc*) is used for TV service work. Added equipment included a sweep generator and another 'scope. The new 'scope was selected for TV work; the older model is used for radio alignment work, testing vibrators, etc. In between the two *departments,* we installed a microvolter signal-generator and a frequency-deviation monitor for two-way FM communication system repair and maintenance.

The special gadgets, which we had in the old bench, were transferred to the new one and remounted. These include a universal test speaker, with a set of extension jacks at three different positions, an auto-radio power supply converted to handle either 6 or 12-volt radios, and an auto-transformer which, in conjunction with a small electric battery eliminator, is used to test battery radios. There are

(*Continued on page* 50)

Another section of shop in which service manuals and technical data files are kept, and supply of tubes and batteries are stocked.

Transistorized Printed Circuit Pocket Radio



[See Front Cover]

(Left)

Side, top and underside views of transistorized pocket set.

THE DEVELOPMENT of hermetically-sealed fused junction-type transistors, for all-stage use in radios, has made it possible to design and produce completely transistorized pocket-sized receivers, with a number of circuitry innovations, as illustrated on the cover and in Fig. 2.‡

In this model five transistors are used; four *pnp* and one *npn* type. These are almost identical, except that the direction of all currents and voltages is reversed. The *npn* transistor corresponds to an electron tube with ordinary (negative) electrons as charge carriers; the *pnp* transistor corresponds to a tube that would have positive instead of negative electrons. In this set the *pnp* transistors function as oscillator-converter (2N123 or 2N136), *if* amplifiers (2N137; 2N135 or 2N123), and audio output (2N44), while the *npn* transistor serves as the detector (2N78).

Oscillator-Converter

The oscillator-converter (2N136 or 2N123) stage is similar in operation to the vacuum-tube converter circuit shown in Fig. 1. As in all superhet circuits, the *if* transformer accepts the proper frequency from the many frequencies in the output of the converter and passes this frequency to the first *if* stage. In this chassis a built-in tuned iron-core loop antenna feeds received signals into the oscillator-converter.

IF Amplifier

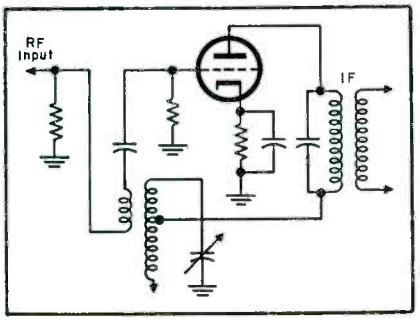
It is relatively simple to design a multi-stage *if* amplifier for vacuum tubes, because there is relatively little reflection from the output side to the input side of each amplifier.

A transistorized *if* amplifier is a little more difficult to work out since the input side is closely coupled to the output side through the transistor. Actually, any change in the final output circuit will be reflected to all of the preceding stages. Also, the input impedance of a transistor stage is much lower than its output impedance.

Tuned Primaries

In this model only the primary of the *if* transformers is tuned. The *if* transformer primaries are high impedance and are slug tuned. The secondaries are low impedance to match the transistor input impedance, and are not tuned.

Fig. 1. Vacuum tube oscillator-converter circuit, which is basically similar in operation to that used in transistor radios.



As mentioned, any change in a transistor circuit will be reflected to all previous stages. Because of this, a change in the second *if* stage will be reflected back into the first *if* and converter stages. Thus, we can see that the 100-470 ohm resistor (R_7), in the grid of the second *if* amplifier (2N135 or 2N123) will affect the overall gain of the *rf* and *if* system of the receiver. Therefore, the value of R_7 in each receiver has been chosen so it is high enough for maximum gain, but not too high to cause the *rf* and *if* system to regenerate.

The first *if* amplifier (2N137) has a fixed emitter bias so that the *agc* control on the collector and base will control the gain of this stage. A pair of resistors (560,000 and 12,000 ohms; R_8 and R_9) form a voltage-divider network to bias the base of the second *if* amplifier (2N135 or 2N123). Another pair of resistors (47,000 and 220-ohms; R_9 and R_{10}) form a divider network to furnish bias for the base of the detector (2N78).

Second Detector and Audio Output

The second detector (2N78) is similar in operation to a vacuum tube plate detector. The base is biased at nearly *cutoff* so that the transistor will only conduct when a signal is applied between the base and the emitter, and then only on the positive half of the *rf* cycle. This, of course,

*Based on information prepared by the Technical Publication Group, Radio and Television Department, **General Electric Company**.*

‡*G. E. model* 675.

gives us rectified *rf* in the collector circuit, which is bypassed to ground leaving only the intelligence containing envelope.

This audio voltage is applied across a 5,000-ohm volume control (R_{11}). Because the 2N78 detector draws current while receiving a signal, there will be a voltage drop across the volume control, the polarity of which is negative, and the amount in proportion to the setting of the control and the strength of the received signal. This negative voltage biases the base of the 2N44 output transistor and delivers the audio signal to this stage.

Thus we can now see that the 2N44 power-output stage will draw current directly proportional to the strength of the received signal and the volume-control setting. The output of the 2N44 is taken from its collector and fed through the output transformer (T_8) to the loudspeaker. The transformer is necessary to match a 16-ohm speaker to the high output impedance of the 2N44.

Automatic Gain Control

The purpose of *agc* in a radio receiver is to maintain the carrier voltage at the second detector approximately constant. Its function is to counteract strong signals by reducing the gain of the *rf* or *if* amplifiers. In a vacuum-tube radio this is accomplished by biasing the grids of the

Analysis of New G.E. Circuit Developed For Portable Chassis Using Fused Junction PNP and NPN Transistors.

by WYN MARTIN

tubes in these stages with a *dc* voltage derived by rectifying the carrier. An increase in signal increases the negative bias, which reduces the gain of the unit and vice versa.

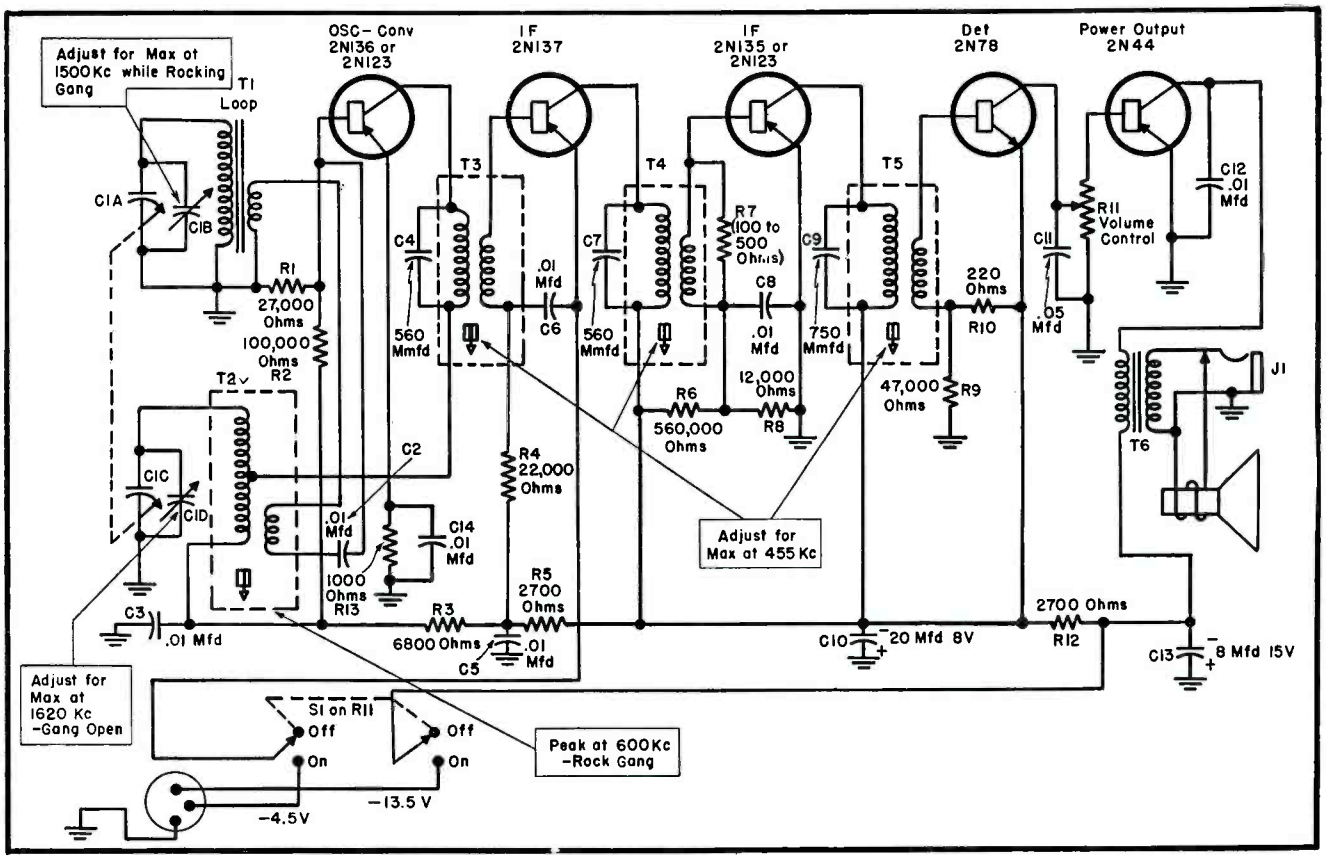
In a transistorized radio receiver the *agc* system must perform the same duty as in a vacuum tube set, but, because of the transistors, it must be accomplished in a different manner.

In the 2N78 detector stage, the emitter bias comes from the B– supply (–13.5 *v*) through a 2,700-ohm resistor (R_{12}). The 2N78 does not draw current until a signal is received. Therefore, with no signal the voltage drop across the 2,700-ohm resistor is created only by the current drawn by the previous *rf* and *if* stages. When a signal is received, the 2N78 draws current proportional to the strength of the signal, and the voltage drop across the 2,700-ohm resistor will increase. Effectively then, the bias (negative) to the converter and *if* amplifiers will be less negative on a strong signal than it is on a weaker signal. This changing bias supply will change the gain of the 2N137 first *if* amplifier greatly, since it changes the bias of the base and collector, with respect to the emitter which has a fixed bias from the battery. On the other hand, the converter (2N136 or 2N123) and second *if* amplifier (2N135 or 2N123) will only be controlled slightly since the bias on all elements of these transistors change in unison.

Thus we find that when a strong signal is received the 2N78 detector will draw more current, increasing the drop across the 2,700-ohm resistor and lowering the bias for the converter and *if* amplifiers. The first *if* amplifier (2N137), having a fixed emitter bias, will be controlled by

(*Continued on page* 51)

Fig. 2. Schematic diagram of G.E. 675 transistorized portable radio.



Power Wire-Wound Resistors

Their Construction . . . Application . . . Tips on Installation

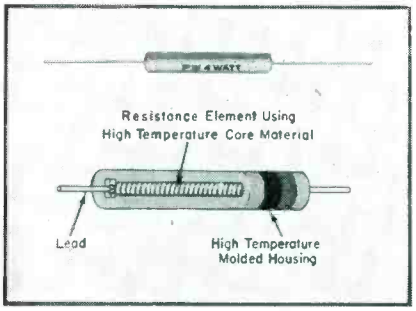
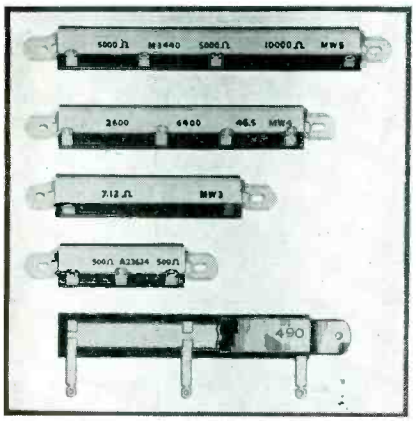


Fig. 1. Molded 4 watt power wire-wound resistor and its construction.

Fig. 2. Flat type molded power wire-wound resistors.



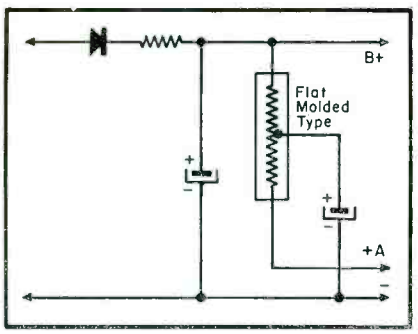
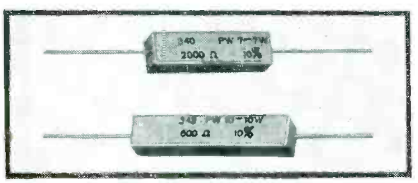


Fig. 3. Partial schematic showing application of flat molded-type power wire-wound resistor as the resistance element in a resistance-capacitance filter and as a voltage dropping resistor for the series filament string in a typical 3-way portable radio.

Fig. 4. Examples of 7 and 10 watt cement-embedded type power wire-wound resistors.



POWER WIRE-WOUND resistors are used in radio, TV and communication receivers, as well as industrial electronic equipment, where a power dissipation of more than 2 watts is required. Normally they are large enough to permit a manufacturer to stamp his part number and the resistance value and wattage rating on the unit. Besides coming in a multitude of colors (such as blue, green, gray, red, and sand), the resistors also come in a variety of shapes, as solid cylinder, round-tubular, oval-tubular, square, flat-rectangular, and *dog-bone*.

Molded Power Wire-Wound Types

Where the power dissipation is near or greater than two watts, under high ambient temperature conditions, it is necessary to use molded wire-wound resistors that are rated at 4 watts. One such type is illustrated in Fig. 1. Typical applications include *r-c* filter networks, used in auto sets where the ambient temperature is high.

A second version of this type is shown in Fig. 2. Here the resistance element consists of a strip of insulation over which wire is wound; the wire size and the amount of turns produce the resistance desired. Terminals are attached to both ends of the strip and the completed subassembly is then molded.

This version is manufactured in body lengths of from two to five inches, and covers a power range of from approximately 4 to 10 watts in free air, and approximately 8 to 18 watts when mounted on an average-sized television chassis. The resistor is mounted by means of a metal strip which holds the flat side of the resistor firmly against the chassis. This is done to provide better heat dissipation through the chassis, and accounts for the increase in this resistors' power rating over that of one in free air.

Still another version of this type of resistor has an additional resistance element encased in a metal housing with a strip of insulating material separating the resistance winding from the housing. Such resistors are used extensively in 3-way portable receivers as both the resistance element of an *r-c* filter network and a voltage-dropping resistor for series filaments. A typical circuit using this type of resistor is shown in Fig. 3.

Cement-Embedded Type

There's another type of resistor which uses a resistance element similar to that of the molded power wire-wound type, but instead of being molded, it is first encased in an open-sided ceramic shell and then completely embedded in a special cement. This allows operation at a much higher temperature, which, in turn, permits its overall size to be relatively small (for a given resistance). Typical 7-watt and 10-watt sizes are shown in Fig. 4.

In another version of this type, the resistance element is placed within a ceramic tube and the ends are sealed with cement. Cement-embedded resistors are used extensively in hi-fi equipment, as well as radio-TV receivers.

Round- and Oval-Tubular Types

The round-tubular type of resistor is familiar to old timers, since it has been used in electronic gear for more than 25 years. The internal construction of the oval-tubulars is similar to the round-tubulars, with a winding

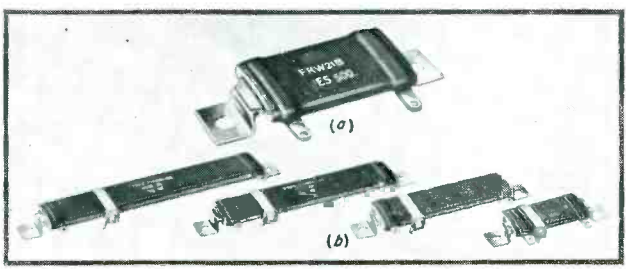
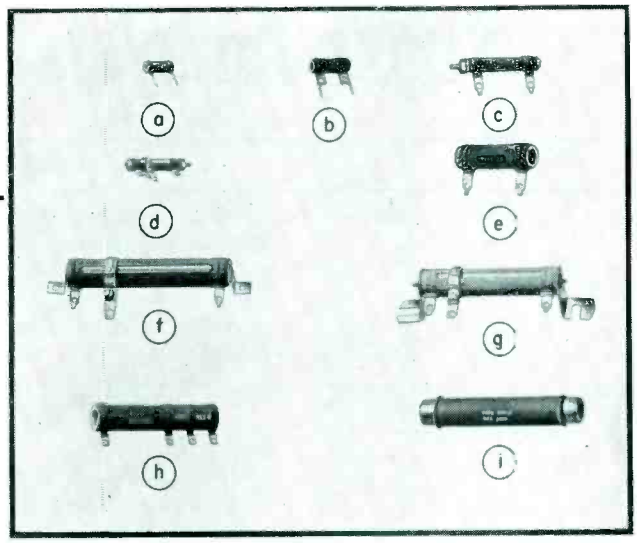


Fig. 5 (right). Oval tubular-type power wire-wound resistors found in all types of electronic equipment. In a a 22-watt model is illustrated (this model is also found in a 15-watt size with a 1¼" long core and in all other sizes shown in b for the adjustable type); 63, 47, 37 and 22 watt models are shown, from left to right in b.

by ESMOND E. JOHNSON

Service Engineer, International Resistance Company



(Right)

Fig. 6. Typical sizes, types and methods of mounting for round tubular type power wire-wound resistors. A 5-watt model is shown in a; in b is an 8-watt unit; a 10-watt type with single end mounting is shown in c; a 10-watt adjustable model with single end mounting appears in d; e shows a 20-watt model; f illustrates a 50-watt adjustable model with 3 types of mounting; g is a 45-watt adjustable model with through-bolt type mounting; a 40-watt tapped model is shown in h and in i is a 50-watt model with ferrule terminals for clip-type mounting. Models shown in c and d are also used with same terminals as 5- and 8-watt sizes.

forming the resistance element (as in the cement-embedded type). The windings are covered with a special coating to protect them from mechanical damage, as well as environmental conditions, such as temperature and humidity.

The larger-sized units of both types can be provided with taps, so that they can be used as voltage dividers, or with an open slot and slider which make them adjustable.

The round-tubular types come in sizes ranging from 5 watts, with a dimension of 1″ x 5/16″ *od* (outside diameter) and a maximum resistance value of 3000 ohms, to 225 watts with a dimension of 12″ x 1⅛″ *od* and a maximum resistance of approximately .5 megohm.

The oval-tubular type is provided in sizes of from 1¼″ core length, for a power rating of 15 watts and a maximum resistance of 15,000 ohms, to a 6″ core length, for a power rating of 75 watts and a maximum resistance of .14 megohm. Figs. 5 and 6 show typical examples of round- and oval-tubular sizes, types, and methods of mounting.

The oval-tubular resistor is used where high power dissipation is required, such as in bleeder circuits, and where there is limited space. This is made possible by using the mounting bracket as a heat conductor to the chassis. These resistors can also be stack-mounted, as illustrated in Fig. 7.

In some electronic circuits a power-type resistor with a low inductance value is required. When manufactured by standard methods, both the round- and oval-tubular type power wire-wound resistors have very high inductances. However, when a special type of winding, the Ayrton-Perry winding, is used (Fig. 8) low inductance obtains. Two windings are used here, with the total resistance of both windings twice the required resistance. One winding is wound in an opposite direction from that of the other, and both windings are connected in parallel. This results in a reduction of the two inductances, since the magnetic fields set up by each winding oppose each other, thus reducing the effective inductance.

Tips on Installation

It must be remembered that the power wire-wound resistor operates at a very high surface temperature and can give a very painful burn upon contact. Also, it may damage the wiring or other component parts if it is mounted too close to them. Fig. 9 shows a typical temperature rise curve versus percentage of rated load for round- and oval-tubular types. This plot reveals that when these resistors are operated at their full rated load, a temperature rise of approximately 300° *C* prevails. This,

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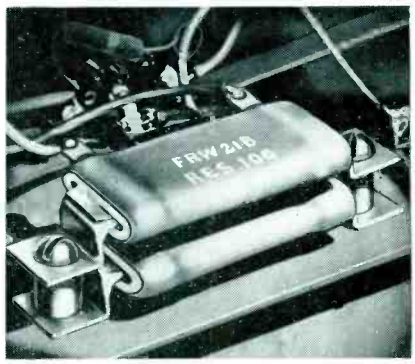


Fig. 7. Method of stacking oval tubular type power wire-wound resistors to obtain higher power dissipation in a limited space

Fig. 8. Ayrton-Perry method of winding round and oval tubular-type power wire-wound resistors to reduce inductance.

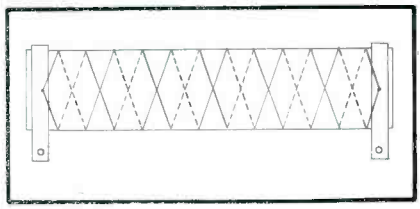


Fig. 9. Approximate temperature rise for power wire-wound resistors mounted in free air

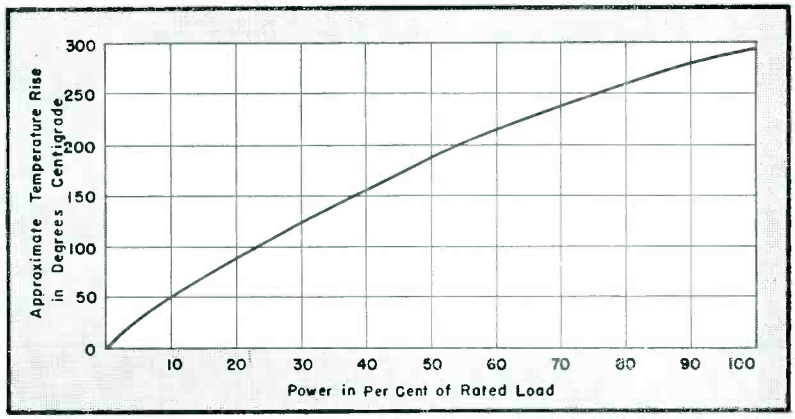


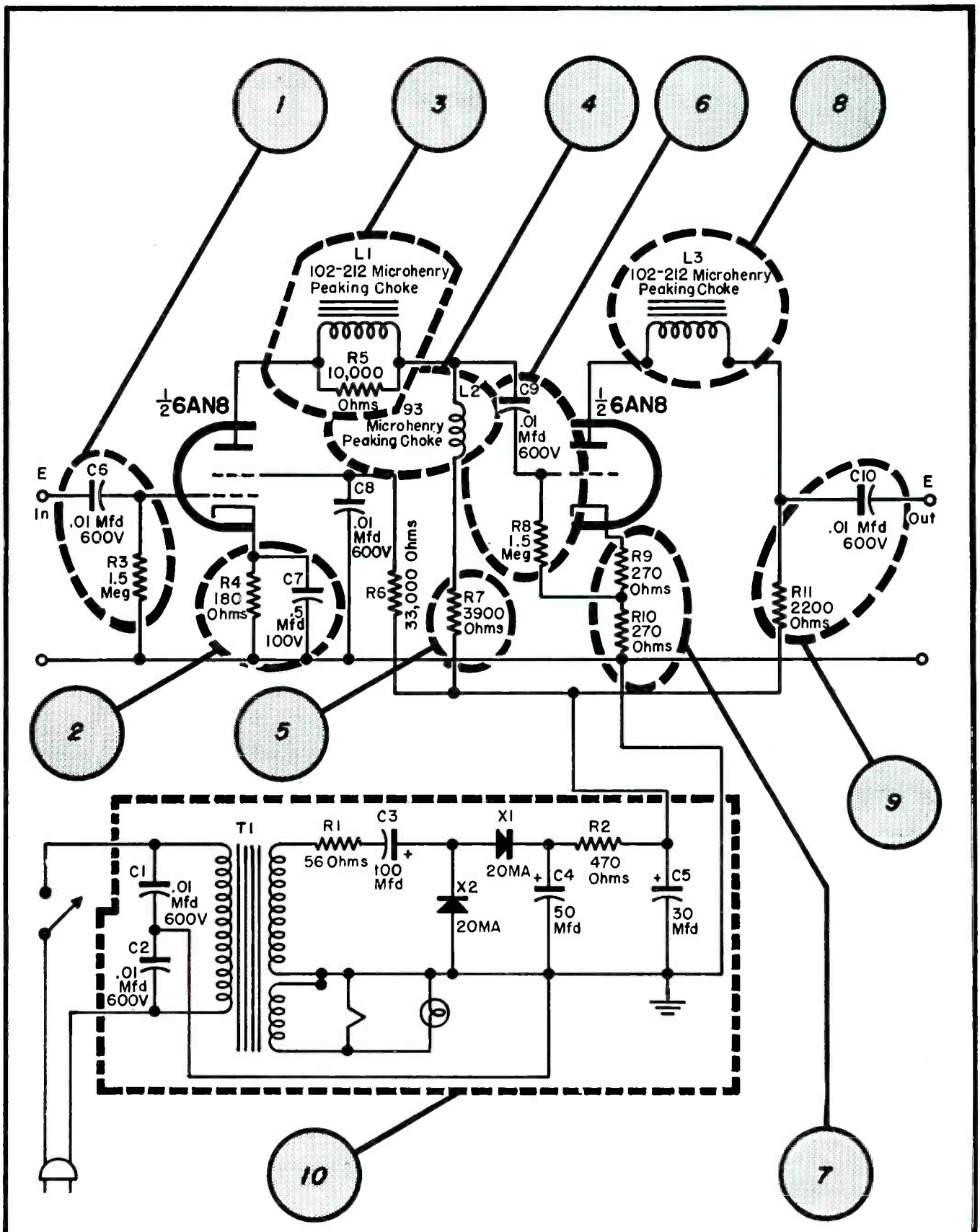
Chart Analysis of Wide-Band Chroma

Design Features	Purpose in Amplifier	Performance Factors
Input coupling network. (1)	A series coupling capacitor prevents the entry of *dc* voltage to the grid of the 6AN8, which would disturb the operating bias. The capacitor permits application of the *ac* chroma signal to the grid.	The value of C_6, with respect to the value of R_3, determines the lowest frequency which can be applied without attenuation to the grid. When C_6 is doubled in size, the low frequency limit is extended by a 2-to-1 factor. **See circuit at right; circle (1).**
Cathode bias network. (2)	Space current through the 6AN8 produces a voltage drop across R_4 which is utilized by the circuit as cathode (grid) bias. C_7 provides a low-impedance *ac* path to ground, thus avoiding degenerative signal attenuation.	The value of R_4 is chosen to provide an operating point at the middle of the linear portion of the grid-plate characteristic. The value of C_7 must be larger than C_6, because R_4 is smaller than R_3. **See circuit at right; circle (2).**
Series peaking network. (3)	L_1 holds up the mid-band response of the circuit, by resonating with the circuit capacitance in the 2-mc region. Damping resistor R_5 broadens out the response to provide the required spread of the resonant peak.	An adjustable core in L_1 permits the peak response to be shifted somewhat, to obtain maximum uniformity of response, in spite of manufacturing and tube tolerances. **See circuit at right; circle (3).**
Shunt peaking network. (4)	L_2 resonates at a frequency somewhat above 4 mc, and holds up the high-frequency end of the response. Its inductance is correspondingly smaller than that of L_1.	L_1 and L_2, in combination with the plate and grid circuit capacitances form a low-pass filter network, which has a practically flat pass band up to the cut-off frequency between 4 and 5 mc. **See circuit at right; circle (4).**
Plate load resistor. (5)	R_7 determines the low-frequency response of the chroma amplifier, up to .5 or 1 mc.	The value of R_7 is somewhat critical, and the low-frequency response changes rapidly with change in value of R_7. A ±5% tolerance is advised. **See circuit at right; circle (5).**
Coupling network to triode section of tube. (6)	Purpose of network is same as noted in (1).	The same performance factors apply as noted in (1).
Cathode bias and feedback network. (7)	The cathode resistor is center-tapped to provide a suitable grid bias to the triode section of the tube. The unbypassed resistor provides negative feedback in circuit.	It will be noted that the *ac* signal from the grid does *not* flow into R_9 and R_{10}, because R_8 has a high value; 1.5 megohms. Only a *dc* voltage path exists between grid and cathode. Negative feedback helps to linearize the triode. **See circuit at right; circle (7).**
Series peaking coil. (8)	Purpose of network is the same as noted in (3).	The same performance factors apply as noted in (3). The second stage is utilized to obtain the desired gain figure. **See circuit at right; circle (8).**
Load resistor and output circuit. (9)	The purpose of the network is basically the same as noted in (5). However, the load is connected directly to the series-peaking coil because the relatively large value of output capacitance makes use of series-peaking coil of small advantage.	A series-peaking coil cannot be used to advantage unless the ratio of input to output capacitances in the circuit are suitable to low-pass filter response. The output circuit is somewhat load-sensitive, particularly with respect to capacitance. The value of R_{11} shown provides flattest response for a capacitance of 10 mmfd, when looking into the probe or other device being driven. **See circuit at right; circle (9).**
Power-supply circuit. (10)	A small voltage-doubler power supply utilizing selenium rectifiers is used in the interest of compactness.	The value of the output voltage determines the signal swing which can be handled by the chroma amplifier. However, the upper limit is determined by the rated dissipation of the 6AN8. **See circuit at right; circle (10).**

‡*From a field report submitted by* ***Robert G. Middleton****, Simpson Electric Company.*

Signal Amplifier for COLOR-TV

by G. S. RYANT



Circuit of wide-band chroma amplifier used as preamp for demodulator probe and similar preamp applications. Response is flat within ± 1 db from 7.5 kc to 4 mc, and gain is approximately 35 times. When bypass and coupling capacitors are appropriately increased in value, preamp response is lowered and is flat ± 1 db from 60 cycles to 4 mc, and can be used for low-frequency work.

by T. L. GILFORD

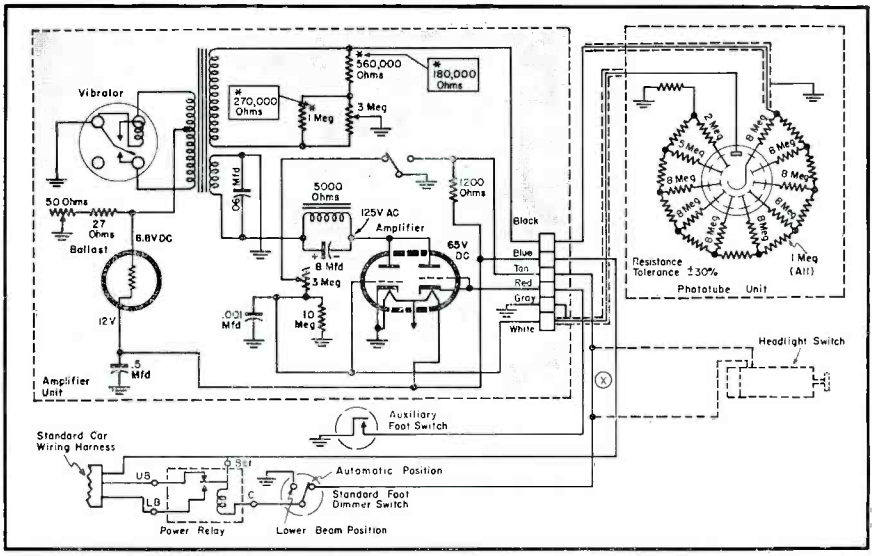
EVER since electric headlamps were first used on autos, glare has been a problem. A beam illuminating the road far ahead for safe driving is too bright for an approaching driver. At first there were only one-beam lamps which were dimmed by switching a resistance in and out of a circuit. Later lamps were designed with two beams; an upper beam for clear road driving and a lower beam for reducing glare when approaching another car at night. Over the years headlamps have been standardized and improved in accuracy, and inspection and service facilities developed until the glare problem has become one of proper headlamp usage by the driver. However, many drivers are not willing to devote the close attention and rapid reaction required under present highway conditions.

In studying the situation it was found that it would be necessary to develop a device that would automatically control dimming of the lower beams at a safe distance. Satisfactory sensitivity was achieved by using a multiplier phototube, which is capable of about one million times the sensitivity of standard phototubes. As sensitivity was increased, it was found that extreme variations in brightness of oncoming headlamps was not nearly as serious as anticipated, because few roads are straight and level for any great distance. However, as sensitivity was increased, other problems in the fields of optics and electricity had to be solved.

One problem encountered was the variation in the reflectivity of road surfaces. Headlamps illuminate the road ahead and the road brightness reflecting back to the driver varies from almost nothing from wet asphalt to a considerable amount from dry gravel or fresh snow. A device sensitive enough to retain the lower beam after an approaching driver dims, would necessarily be sensitive enough to be greatly affected from road reflection, unless the downward response angle was carefully controlled. If too much light from the road were permitted to reach the phototube, the device would stay on the lower beam. At the same time, the sensitivity response angle must extend enough below horizontal so that the device will function properly under conditions of normal car loading. These problems were solved through the development of the *Autronic Eye* which employs a lens and mask system to provide a sharp lower cutoff. The cutoff is aimed as low as possible without incurring interference from road reflection. This aim is low enough to stand the upward tilting caused by normal car loading without bundle loss in sensitivity.

Most electronic devices require a moderate warmup time, and during this period they do not provide automatic control. This period of no control must be considered in design, because usually vehicles are operated in areas of opposing traffic during the warmup period and it is desirable to have a fixed lower beam until the automatic control is functioning. In the *Autronic-Eye* 10 to 15 seconds warmup time is requred for the rectifier and amplifier tubes. The rectifier tube controls the high voltage to the phototube, and the amplifier tube provides the current to a sensitive relay; this relay is in the lower beam position when the amplifier tube current is *off*. The rectifier tube circuit has been so designed that the tube warms up ahead of the amplifier tube, so that the phototube is in control before the amplifier tube can operate the sensitive relay to the upper beam position.

Fig. 1. Modified Autronic Eye circuit, in which the hv rectifier has been eliminated. Point X illustrates wire break in system when used in Oldsmobile; new wiring is shown by dotted lines. Automatic operation is made available at headlight switch. The starred resistors, 270,000 and 180,000 ohms, also appear in the modified circuit, replacing the 1-megohm and 560,000-ohm units used originally.



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‡*Based on copyrighted data appearing in the Instruction and Training Manual Guide for the* ***Autronic Eye****, published by the* ***Guide Lamp Division of General Motors Corp.***

mary of the transformer. The dimming distance varies ±5%.

Energy for the automatic control is provided by the car electrical system through the standard light switch. This voltage is applied through an *amplifier disconnect block* and the ballast tube to the primary winding of the transformer, and then through a vibrator to the ground. The transformer has two secondary windings, one producing approximately 1150 volts *ac* and the other approximately 150 volts *ac*. The higher voltage is rectified to produce approximately 1000 volts *dc* across a load resistor network.

A high voltage control is adjusted to supply the necessary voltage for the phototube unit. A sensitivity control in the phototube unit adjusts the high voltage to compensate for variations in phototubes. The voltage is applied to the various dynodes in the phototube through a voltage divider network.

The 150-*v* secondary winding of the transformer supplies power for the amplifier tube and the sensitive relay. In the absence of light on the phototube, the amplifier tube passes enough current through the sensitive relay to close it. Light causes the phototube to pass a current through a load resistance which develops a negative bias voltage on the amplifier tube control grid. This causes the amplifier tube to reduce the current through the sensitive relay. When the current is reduced sufficiently, the sensitive relay opens. When the sensitive relay opens, a much larger load resistance is switched into the phototube circuit and the device thus becomes about ten times as sensitive in the lower beam position as it is in the upper beam position.

The optical system of the phototube unit consists of a condensing lens which focuses light through an amber filter and through an opening in a mask to a multiplier phototube. The condensing lens is corrected for spherical aberration and focuses the light from approaching headlamps to a point in the plane of the mask.

The vertical and horizontal angles through which the device responds to light are limited by the size of the opening in the mask, and the sensitivity cuts off abruptly when the point of focused light passes the edge of the mask opening.

Modifications

In the early part of this year a few modifications were made to the original control circuit, and the schematic of the altered system is shown in Fig. 1.

A high-voltage rectifier was eliminated. The *ac* voltage is now connected directly to the phototube, so that when light strikes the phototube it acts as a half-wave rectifier during the negative half of the *ac* cycle. In this manner, negative *dc* voltage is still applied to the grid of the amplifier tube. A capacitor is connected between the grid and ground to reduce ripple.

Shielding Now Used

Since *ac* voltage is present in the black high-voltage lead, inductive interaction between this wire and the white wire leading to the grid of the amplifier tube would result, without proper shielding. The negative half of the *ac* cycle induced into the white wire would be great enough to apply enough negative voltage to the grid to shut off current through the section of the tube, putting the headlamps on continuous low beam regardless of the light on the phototube. To prevent this, an improved shielding system is now provided between the black and white wires.

To increase further the shielding possibilities, all circuits of the amplifier tube section return to ground instead of the 12-*v* line. The armature of the sensitive relay is now grounded instead of being connected to the 12-*v* line, requiring a new power relay. One side of the coil of the new power relay is connected internally to the 12-*v* line or battery terminal. The other side is connected to a *C* terminal. Current flows through the power relay, when the *C* terminal is connected to ground through the *automatic* position of the standard foot dimmer switch, tan wire and to the armature of the sensitive relay, when in *open position*. *Lower beam* terminal of the standard foot dimmer switch is also connected to ground. When the standard foot dimmer switch is in the *lower beam* position, the terminal of the power relay is grounded, thus putting the headlamps on lower beam.

Oldsmobile now offers a *manual-automatic* control at the light switch by providing a means of breaking the tan wire. In *manual* position the tan wire is open and the terminal of the power relay cannot be grounded through the armature of the sensitive relay. In this condition the standard foot dimmer switch provides manual operation of the headlamps.

The *dim* and *hold* sensitivity adjustment procedure for the new circuit is in reverse to previous models

(*Continued on page* 30)

Modified Circuitry for Automatic Auto-Headlight Control‡ . . . Curbing 90° Deflection Problems . . . Vertical Hold Improvements

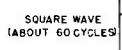
INPUT TO VIDEO AMPLIFIER	SHAPE OF OUTPUT WAVE SEEN ON SCOPE SCREEN	EFFECT ON TELEVISION PICTURE	DEFECT	CHECK THESE CIRCUIT COMPONENTS
SQUARE WAVE (ABOUT 60 CYCLES)		PICTURE NORMAL	NO DEFECTS. GOOD LOW-FREQUENCY RESPONSE AND NEGLIGIBLE PHASE SHIFT	
		GRADUAL CHANGE IN PICTURE SHADING FROM TOP TO BOTTOM OF PICTURE. (THIS EFFECT CAN BE MINIMIZED BY DC-RESTORER ACTION).	LEADING LOW-FREQUENCY PHASE SHIFT. (USUALLY ACCOMPANIED BY A LOSS OF LOW-FREQUENCY GAIN.)	COUPLING CAPACITORS, SCREEN AND CATHODE BY PASS CAPACITORS, LOW-FREQUENCY COMPENSATION CIRCUITS, SCREEN AND GRID RESISTORS.
			LAGGING LOW-FREQUENCY PHASE SHIFT. (USUALLY CAUSED BY OVER COMPENSATION.)	
SQUARE WAVE (ABOUT 25 KC)		PICTURE NORMAL	NO DEFECTS.GOOD HIGH-FREQUENCY AND TRANSIENT RESPONSE.	
		PICTURE DETAIL IS POOR; SHARP CHANGES IN PICTURE SHADING ARE FUZZY.	POOR HIGH-FREQUENCY RESPONSE	PEAKING COILS, LOAD RESISTORS, LEAD DRESS OF PEAKING COILS AND COUPLING NETWORKS.
		FINE VERTICAL BLACK AND WHITE STRIATIONS FOLLOWING A SHARP CHANGE IN PICTURE SHADING.	EXCESSIVE HIGH-FREQUENCY RESPONSE AND NON-LINEAR TIME DELAY; ALSO HIGH-FREQUENCY CUTOFF MAY BE TOO SHARP.	PEAKING COILS, LOAD RESISTORS, DAMPING RESISTORS SHUNTING PEAKING COILS, LEAD DRESS.
		WHITE BORDER FOLLOWING A BLACK-TO-WHITE TRANSITION; BLACK BORDER FOLLOWING A WHITE-TO-BLACK TRANSITION.	EXCESSIVE OR NOT ENOUGH MID-FREQUENCY RESPONSE AND NON-LINEAR TIME DELAY.	PEAKING COILS, LOAD RESISTORS, DAMPING RESISTORS SHUNTING PEAKING COILS, LEAD DRESS.

Fig. 2. TV troubleshooting guide chart featuring use of 'scope and square-wave patterns. (Courtesy RCA).

Servicing Helps

(*Continued from page 29*)

which had a fixed *dim* grid resistance at the grid of the amplifier tube, with the *hold* resistance variable. The modified *hold* resistance is a fixed 10-megohm resistor, while *dim* resistance is varied by a *dim* control connected in parallel with the resistor in the *closed position* of the sensitive relay. The *hold* must be adjusted first and can be adjusted only by the potentiometer which adjusts the high voltage applied to the phototube. This potentiometer is called the *hold control.* After *hold* is adjusted the *dim* may be adjusted by the *dim control.*

Shortly after production started on 1955 models a minor change was made in the amplifier wiring circuit. The 47-ohm, 2-watt filament resistor was removed from the section-one filament (pin 5) of the amplifier tube. The section-two filament (pin 4) of the amplifier tube, was disconnected from the regulated 6.8-*v* line, and the ground connection removed from the filament center tap (pin 9).

The two filaments have been connected in series across the 12-*v* line. The two resistors have been changed to 270,000 and 180,000 ohms, 2 watts.

90° Linearity Adjustments[1]

ADJUSTMENT of picture size and linearity, require close control of horizontal drive, width and linearity. These adjustments affect not only horizontal linearity, but *vertical linearity. B-boost* voltage, a product of the horizontal flyback circuit, is the supply voltage for the vertical oscillator.

Faulty horizontal adjustment can cause excessive current in the horizontal output tube, resulting in fuse burnout, early tube failure and component failure in the horizontal output circuit.

In adjusting these controls the width core should be placed at the maximum counterclockwise position. Then the horizontal drive trimmer should be moved counterclockwise two turns from tight position, or until an overdrive line appears; then clockwise until it just disappears.

A 0-500 *ma* meter should then be inserted in place of the high-voltage fuse and the horizontal-linearity control adjusted for minimum indication on the meter. After this the horizontal drive trimmer should be readjusted once more. The width core should then be adjusted so that it slightly overscans the picture area. If an over-

[1]Based on notes from *RCA Service Co.*

drive line appears the drive should be decreased.

In models without a horizontal-linearity coil the width core should be placed at the maximum counterclockwise position, and the driver trimmer turned counterclockwise two turns from tight or until just before the overdrive line appears. The width core should then be adjusted for sufficient width to overscan slightly the picture area, and the drive trimmer adjustment repeated.

Since these adjustments may have an effect on other controls, the vertical height and linearity, and centering adjustments, and position of the ion trap should be checked after horizontal setup.

As an alternate method of obtaining minimum current in the horizontal-output tube, a pilot lamp may be inserted in the plate lead of the tube. This can be done at the point where the plate lead is connected to the cap on top of the tube. A number *45* or *44* pilot lamp, connected in this manner, will light up and become bright when the current is maximum, or dim when the current is minimum. If the light becomes dim at two settings of the linearity control, the one indicating minimum current should be chosen.

Vertical Hold Control Improvement

DUE TO RESISTOR TOLERANCES in the vertical circuitry of Stromberg-Carlson X 21-22 sets, it has been noted that the vertical controls in some receivers had a tendency to move electrically near one end of the control. A production change has been made to remedy this condition; effective with serial number *T48914*. Resistor R_{222} (820,000 ohms/½ *w*) has been changed to 1 megohm/½ *w*.

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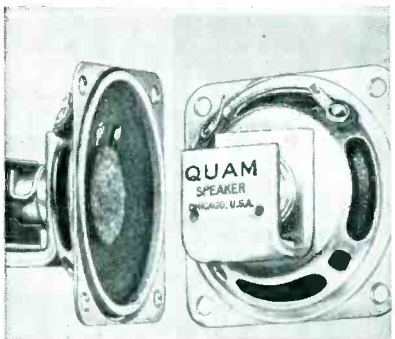
REPLACEMENT SPEAKERS



Two and one-half inch replacement-improvement speaker for personal portable radios, intercom equipment and other applications. Speaker is 1¼" deep. Maximum input is 2 watts. Has .65 ounce alnico V magnet and four mounting holes on rim. Voice coil impedance is 3.2 ohms. (Model 25A07; Quam-Nichols Co., Chicago, Ill.)

A Preview Report

by F. M. RANDOLPH

The NCTA Western Regional Conference

TAKING THEIR cue from the first National Community TV Association Western regional meeting, held last fall in San Francisco, planners of the second annual conference and exhibition at Colorado Springs have arranged two days of sessions[1] where informal open forum discussion will be the rule.

Among the discussion topics scheduled to generate lively *give and take* at the conference sessions is the challenging subject of illegal-reradiator operation, particularly in the Pacific Northwest where controversial satellites and boosters have been most active in recent months. NCTA spokesmen at the meeting will spell out the competitive advantages of community television, operating entirely within the framework of legal regulations, as the most practical and economical means of bringing quality reception and program choice to walled-in areas.

The use of common carrier microwave relay facilities will be explored as an increasingly widespread means of making TV available to those operating, in many cases, far from signal sources. *Closed circuit* operation, in which a cable company may lease an otherwise unused channel of its system to another firm interested in local program origination, will also come in for its share of attention. Such service is being contemplated by community operators whose systems serve those towns and cities where there is no outlet for local TV, and no apparent prospect for TV broadcasting activity to fill such a need. In this instance the program-originating company would specialize in catering to local needs and interests, without diminishing the amount of *outside* program fare being distributed to subscribers of the cable company.

Representatives of community-TV equipment manufacturers will deal with such technical posers as radiation measurement and control, while other sessions will be devoted to business aspects of the industry.

George J. Barco[2] will serve as moderator of a discussion based on the new NCTA-sponsored code of business ethics for community-TV operators. Other aspects of business to be discussed will include recommended advertising and promotion efforts aimed at expanding cable service to new subscribers.

Legal aspects of the community television industry will be reviewed by E. Stratford Smith, NCTA executive secretary as well as the association's general counsel.

All sessions of the first day's conference will be presided over by NCTA president *Martin Malarkey*.[3] *Bill Daniels*,[4] NCTA vice prexy, will preside over the concluding sessions.

The problems of *preventive maintenance*, of such intense interest at the annual meeting in New York, will receive additional coverage at the western session. Up for discussion will be a number of the points stressed by *Caywood Cooley*.

At the New York meeting, it was noted that three basic measurements on amplitude distortion, signal-to-noise ratio, and picture resolution should be established in a p-m program, and then one can proceed toward the system extremities beginning at the antenna site. The objective in such a check would be to locate any obvious sources of troubles, eliminating these, so that the first measurements at the system extremities would be indicative of those we could expect on a properly operating system. As we proceed, it was brought out, it would then be desirable to record and log all input and output levels; such a step serves to measure the attenuation of all cables and the associated accessories. All feeder line inputs and termination voltages should also be measured. These measurements would provide a guide on troubleshooting required, if and when, such a move becomes necessary.

A tube-maintenance program, also proposed by Cooley, will be examined further at the western meeting.

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[1] *Tuesday and Wednesday, October 25 and 26; Antlers Hotel, Colorado Springs, Colorado. Equipment will be on view in the General Palmer Room.*

[2] *Meadville Master Antenna, Meadville, Pa.*

[3] *Pottsville Trans-Video Corp.*

[4] *Community TV System of Wyoming.*

Officers and members of the board of the National Community Television Association, left to right: Bill Daniels, **NCTA vice prexy;** Glenn H. Flinn; Fred J. Stevenson, Martin F. Malarkey, **prexy of the association;** George J. Barco; A. J. Malin; W. Randolph Tucker, **and** Ned W. Cogswell.

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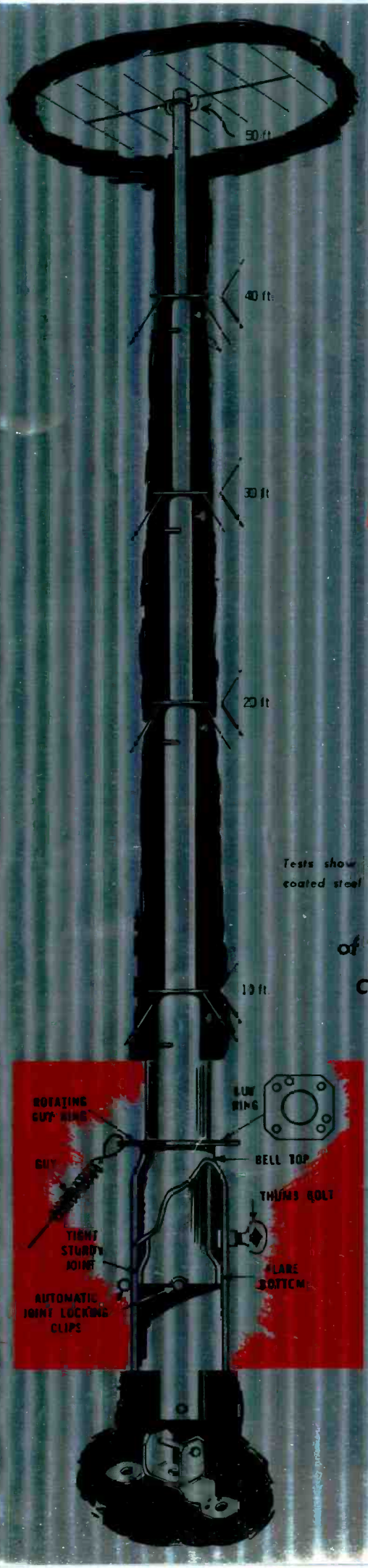

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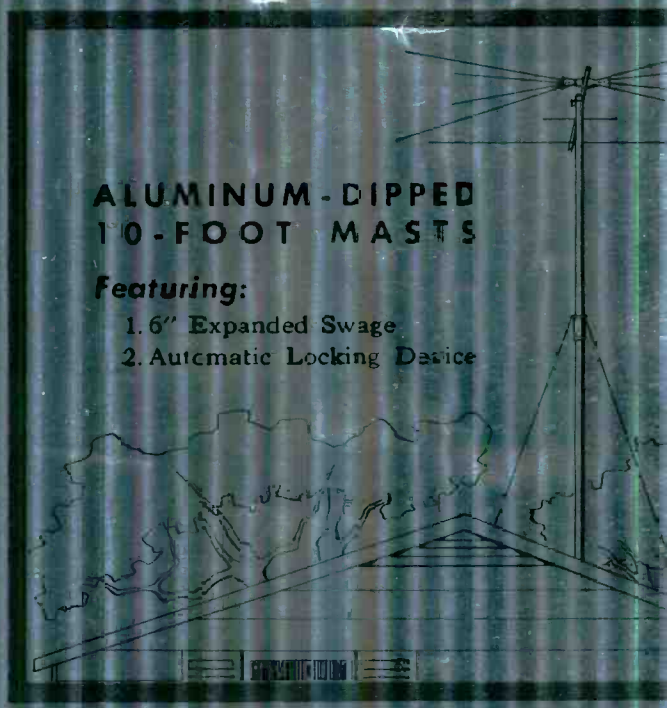

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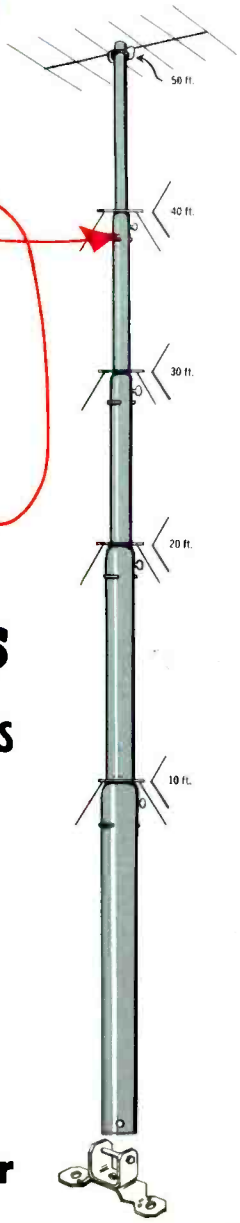

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Service Engineering — field and shop notes

by ALBERT R. SINCLAIR

Communication Engineer, General Electric Company

IT WASN'T TOO long ago when only hams used frequencies above 100 megacycles. Tubes wouldn't oscillate in this region, amplifier efficiencies were low and many other drawbacks prevented commercial use of these frequencies. However, the development of new types of *vhf* tubes and circuits have solved a number of these problems. And today we have 2-way commercial *vhf* gear that is not only extremely reliable, but not too difficult to maintain and service. Of course, servicing *vhf* communications equipment may not be as easy as radio and TV repair, but the assignment is easier to handle now than it was in the past.

The *vhf* receivers used in 2-way systems are very unique. There has been a trend since '46 to provide more selectivity, instead of more sensitivity.

In addition, fixed receivers have been designed so that they are interchangeable with the mobile unit. This makes it unnecessary to stock a special spare for large or small systems. Also, it is now possible to change from wide band to narrow band operation when the FCC so directs. And the current type receiver does not receive adjacent or neighboring channel signals nor can it be desensitized by them. Receivers also have *if* and *rf* transformers that are very stable. A receiver that incorporates these features is illustrated in Fig. 1.

Tuned Circuit Front End

Neighboring signal troubles have been solved by using a front end (*rf* amplifiers and high *if* stages) with tuned circuits where they do the most good. In the receiver diagrammed there are two tuned circuits before the first *rf* grid and three between the *rf* amplifier and the mixer. These tuned circuits have very high *Q* and have been designed to minimize the desensitization from nearby channels. Another advantage of high-*Q* tuned circuits at this particular point is that intermodulation is minimized in the front end. Earlier, in these reports, intermodulation was described as the mixing of two signals to form the third. This mixing takes place in a non-linear circuit such as an *rf* amplifier. So if we can reject as much of the first two signals, then very little intermodulation will be present.

A comparison of the selectivity that obtains in the new models and those made in '54 is shown in Fig. 2 (p. 36); the curve is for the antenna transformer as compared to cavity resonators. In the high band set of curves, at ±2 mc using the '54 approach, it will be noted that the selectivity is only down .2 db, while the '55 design affords an increase of approximately 17 db or over 7 times that of typical '54 receivers. Two *rf* stages have been used in the past, primarily to obtain high image response ratios, rather than for gain requirements. In the new receivers this is not necessary, due to new antenna circuits. The gain is more than sufficient to override first converter noise and the selectivity provides better than 100 db image rejection. Delayed *agc* has been used to reduce intermodulation. This has been accomplished by biasing the tube so that it will operate on the linear portion of its E_gI_p curve. The *agc* is delayed so that full *rf* gain is available for reception of threshold signals.

The receiver features the use of a multiplier in the first conversion oscillator, which is unusual. By using a fundamental crystal in the 12-mc range, instead of one which operates on a mode, it has been found possible to obtain better stability with ample rubbering (ability to vary the crystal frequency). The oscillator output is multiplied three times four, twelve times in all, to reach the injection frequency.

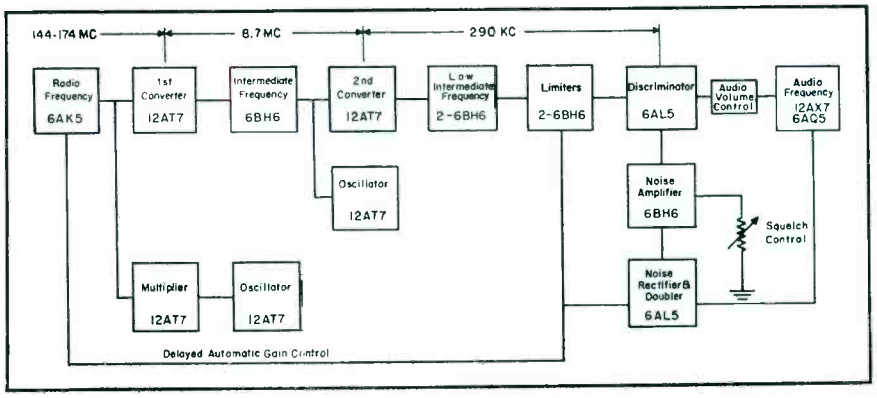
A high intermediate - frequency amplifier has been incorporated; it is tuned to 8.7-mc. It consists of a four coil transformer, a 6BH6, and a two-coil transformer, coupling the output into the second converter. The combination of selectivity and the right amount of gain in the front end makes it extremely difficult for off-channel signals to desensitize the second converter.

Low IF Amplifier

The receiver employs two stages of *if* amplification at 290 kc. Most of the gain and selectivity is built into the low *if*'s. A six-coil transformer is utilized to obtain most of the selectivity. Inasmuch as each circuit in the six-coil transformer is tuned to center frequency, each coil is resistive at resonance and loads the adjacent tuned circuits. This loading provides the broad response needed

(*Continued on page* 36)

Fig. 1. Block diagram of G.E. Progress **receiver designed for 2-way installations.**



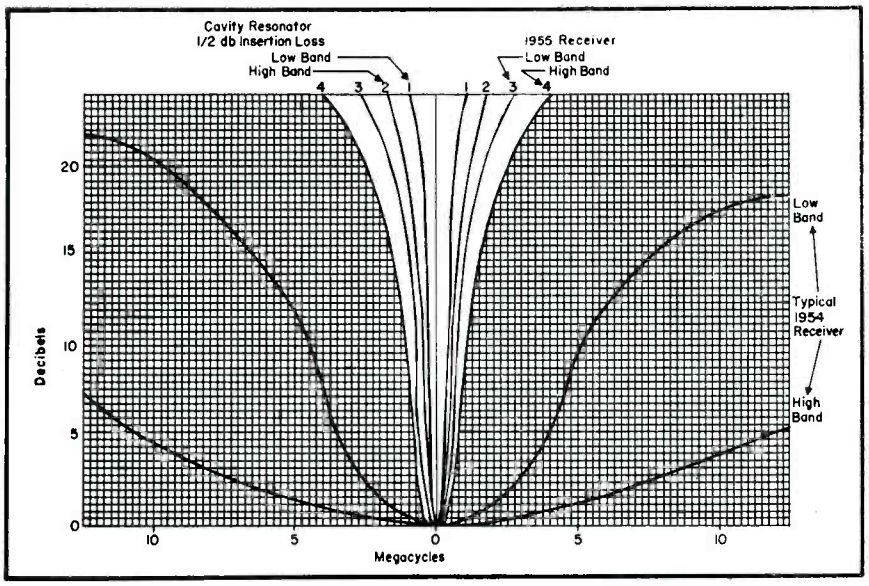


Fig. 2. Comparison of selectivity offered by 2-way system receivers designed in '54 and '55. Curve illustrates results achieved with antenna transformer and cavity resonator.

on the nose of the selectivity curve for full pass-band at threshold signal levels. At frequencies other than center frequency the circuits are reactive and present a low-impedance path, thus effectively bypassing them. This action provides a nearly perpendicular selectivity curve that is needed to operate on local-area adjacent channels. One might conclude that it is difficult to align a six-coil transformer; actually it is not. All that is needed is a stable generator and an *ac vtvm*. The procedure would be to place the voltmeter on the plate of the *if* amplifier and apply an on-frequency signal into the receiver.

In the alignment process (Fig. 2a), we short out coil 2 and peak *1* for maximum reading, remove the short on 2 and short 3, and tune 2 for a dip in the voltmeter. Next, we remove the short on 3 and short *4* and tune 3 for a peak in the voltmeter. In the following step 5 is shorted and the short on *4* is removed and we tune for a dip. This procedure is continued until all coils have been tuned. The voltmeter used in this alignment procedure must have a low input capacity or it will detune the first plate coil. The bandwidth of the amplifier is determined by the spacing between the tuned circuits. This coupling can be either set in the factory or in the field to give a narrow or a wide band type of operation. The coupling can be varied by the mounting holes in the transformer identified by *N* for narrow and *W* for wide.

The terminology *narrow* and *wide* band is derived from the move that will provide more spectrum space by splitting the width of the present channels. At present the high band (152-174 mc) channel is 60-kc wide; in the future it may either be 30, 20 or 15-kc. This high band model has been designed with this change in mind. The one six-coil transformer can be adjusted to give good adjacent channel performance on 30-kc channels, but should the split be to 20 or 15, or should one still desire more selectivity, then a second six-coil transformer can be added in the holes provided, following the second low *if* tube. The method of varying the selectivity by changing the coupling will mean less headaches for the service engineer. The 290-kc amplifier exhibits higher selectivity, as compared to a 455-kc amplifier of equal quality, using the same number of tuned circuits (12). In the six-coil *if* transformer each pair of coils is individually shielded from the others within the enclosing structure. This insures a minimum of mutual coupling, thereby increasing the *Q* of each circuit.

Other important features are precise temperature compensation and mechanical stability of the coils. Any coil will change its inductance when subjected to temperature variations, but it can be compensated by the use of temperature-compensated capacitors, provided the inductance retraces its temperature versus inductance curve *exactly*. The coils in this receiver will retrace accurately due to special treatment in manufacture. This feature permits the use of shields over the *if* transformers to prevent the temptation of unauthorized personnel from retuning these transformers. The tuning range of the *if* coils is sufficient to permit retuning for split-channel operation without having to replace either the first or the second oscillator crystal.

The squelch circuit in *vhf* receivers must be capable of allowing weak signals to be received without clipping them, or distorting the audio, yet it must be capable of good sharp cutoff after the carrier is removed. To accomplish this the voltages are balanced against one another in a see-saw fashion. The noise that is inherently present in all high gain stages is used; it is amplified and fed to a rectifier doubler circuit. Positive voltage from the rectifier is used to drive a *dc* amplifier. This amplifier cuts the first audio stage off, when the positive voltage is present. When a weak carrier (which is the worst condition for squelch circuits) is present, the first limiter grid conducts, developing a negative bias across its

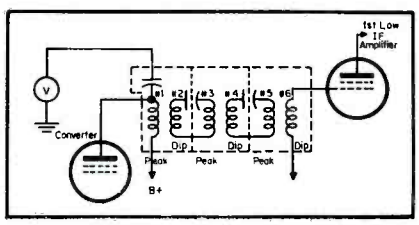
(*Continued on page* 52)

Table 1. Vhf **receiver troubleshooting chart, detailing symptoms and checks.**

Symptom	*Check*
Squelch will not open manually.	*1)* One should test to see if the second limiter current is normal; it should not be lower than minimum established value. If so, tubes should be replaced to bring up to normal. *2)* The 6AL5 rectifier should be removed. Noise should be present in speaker. If not, it will be necessary to replace the 12AX7 *dc* amplifier and audio.
Cannot squelch receiver.	*1)* The 6BH6 noise amplifier or 6AL5 rectifier, whichever is bad, should be replaced.

(Below)

Fig. 2a. Simplified schematic of 290-kc if amp, illustrating steps required to align six-coil transformers.



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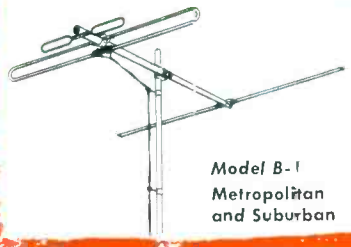
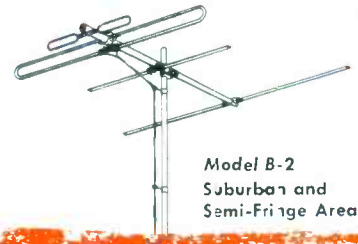
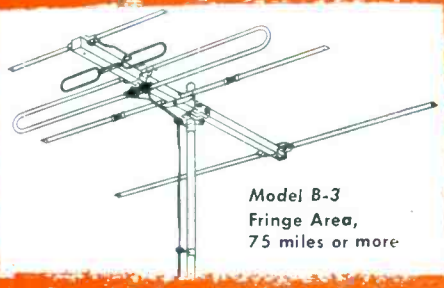


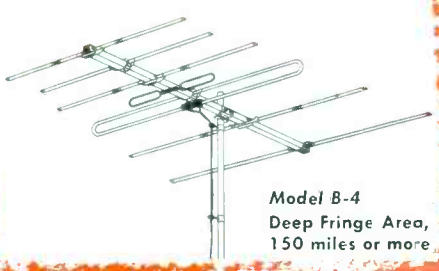
Model B-1
Metropolitan and Suburban



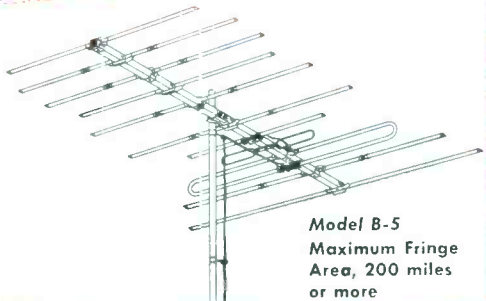
Model B-2
Suburban and Semi-Fringe Area



Model B-3
Fringe Area, 75 miles or more



Model B-4
Deep Fringe Area, 150 miles or more



Model B-5
Maximum Fringe Area, 200 miles or more

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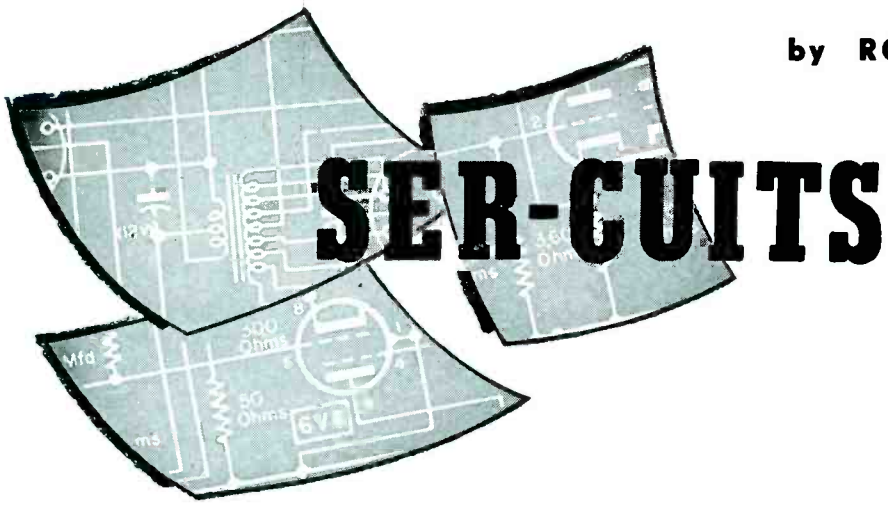
Dept. 8105

21-Inch ATR Wide-Band 41-Mc B-W TV Receiver

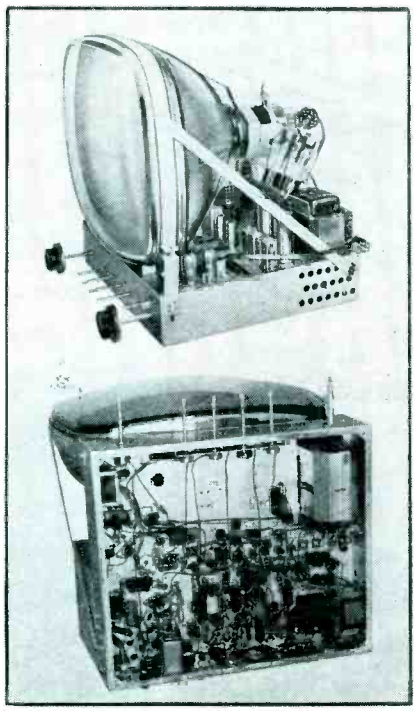


by ROBERT D. WENGENROTH

See Pages 40 and 41 for Complete Schematic of TV Chassis

THE TREND toward improved picture fidelity through the use of aluminized picture tubes has prompted the development of a new family of circuitry improvements, involving 41-mc wide-band *if*, cascode tuners, high-gain video amplifiers, and precision interlace. The schematic of a receiver‡ with such circuit features is shown in Fig. 1; pages 40 and 41.

In this chassis, we have a four-stage intermediate frequency amplifier with a design bandwidth of 3.9 mc, and a video carrier frequency of 45.75 mc. The first stage employs a 6AU6 (V_8); the next three are 6CB6s (V_9, V_{10}, and V_{11}). Improved bandwidth is attained through the use of six transformers with three traps. Four of the transformers utilize tube and wiring capacities for resonance; between the first and second stages the coupling is a complex network including two shunting traps and two series arms. All are slug tuned. Gain is maintained for the required bandwidth, and in addition, relative phase shifts for frequencies through the band are controlled to provide an overshoot-free picture.



4.5-Mc Trap Circuit

The output from the second detector, a IN60, includes the video signal with the sync negative, and the aural signal at 4.5 mc. The video load of the detector is a series-shunt-series peaked circuit providing the highest possible video load impedance to the detector. A series-resonant circuit serves as a 4.5-mc trap to the video signal, by transferring the sound energy to the sound *if* amplifier.

The Video Amp

The video amplifier, a 12BY7 (V_{12}) amplifies and inverts the video signal, and provides contrast control. (This tube has a transconductance of 12,000 micromhos, with a video load impedance of 3300 ohms, and gain of 40.) The circuit is a conventional series-peaked video amplifier with a 4.5-mc trap to eliminate the last traces of the sound carrier. The amplified video signal is applied to the cathode of an aluminized picture tube, 21AMP4A.

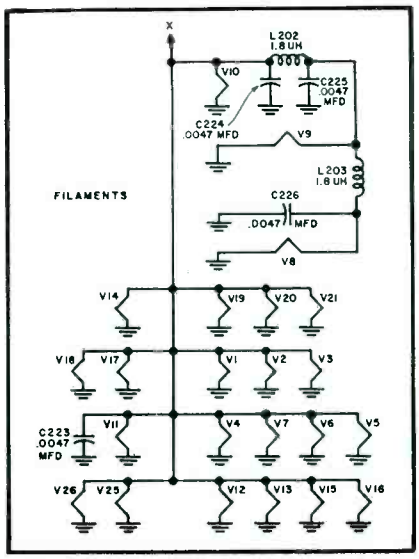
The picture tube operates at 18 *kv* and utilizes *pm* focus. The brightness control, in the grid circuit, includes a section of the power switch so that the spot on the screen is extinguished when the set is turned off.

A second amplifier parallels the video amplifier. Its purpose is to provide amplification of the *dc* component of the video signal and the synchronizing signal. In this way no *dc* restorer is required, while the main video amplifier is available for contrast control; thus improved picture quality results. Because of the larger plate-load resistor and the lack of peaking, this amplifier has high gain in the lower frequency range where the synchronizing information exists, while short noise pulses are given much less amplification. The tube used is a 6AU6 (V_{13}) biased by the output of the detector. An unby-

(*Continued on page* 40)

(Left)
Top and underside views of ATR chassis.

(Below)
Filament circuitry of ATR TV chassis 2600; see pages 40 and 41 for complete diagram of set.



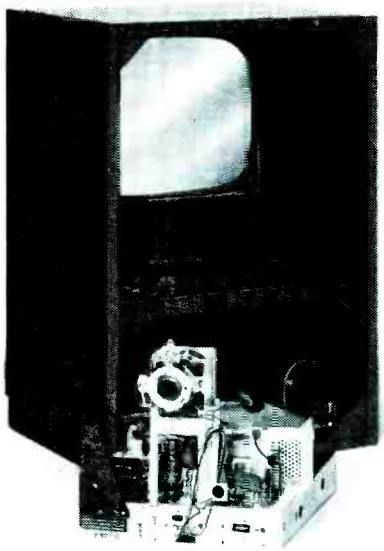
‡*American Television and Radio Co., model* 2600.

She: *But, how do I know this is a good tube?*

You: *Because, this is a CBS aluminized Mirror-Back picture tube. There aren't any better.*

She: *And I see it has the Good Housekeeping Guaranty Seal, too. That's proof enough for me.*

Customer confidence really counts when it comes to the big tube. That's when CBS tube advertising helps you most. For CBS tubes have the Good Housekeeping Guaranty Seal and are nationally advertised to 76.9% of your customers . . . the women of America. And 53% of these women are influenced in their purchases by that seal of approval. You protect yourself and gain your customer's good will when you install a new CBS aluminized Mirror-Back picture tube.



Show her the CBS carton with the Good Housekeeping Guaranty Seal.

CBS-HYTRON, Danvers, Massachusetts . . . A DIVISION OF COLUMBIA BROADCASTING SYSTEM, INC.

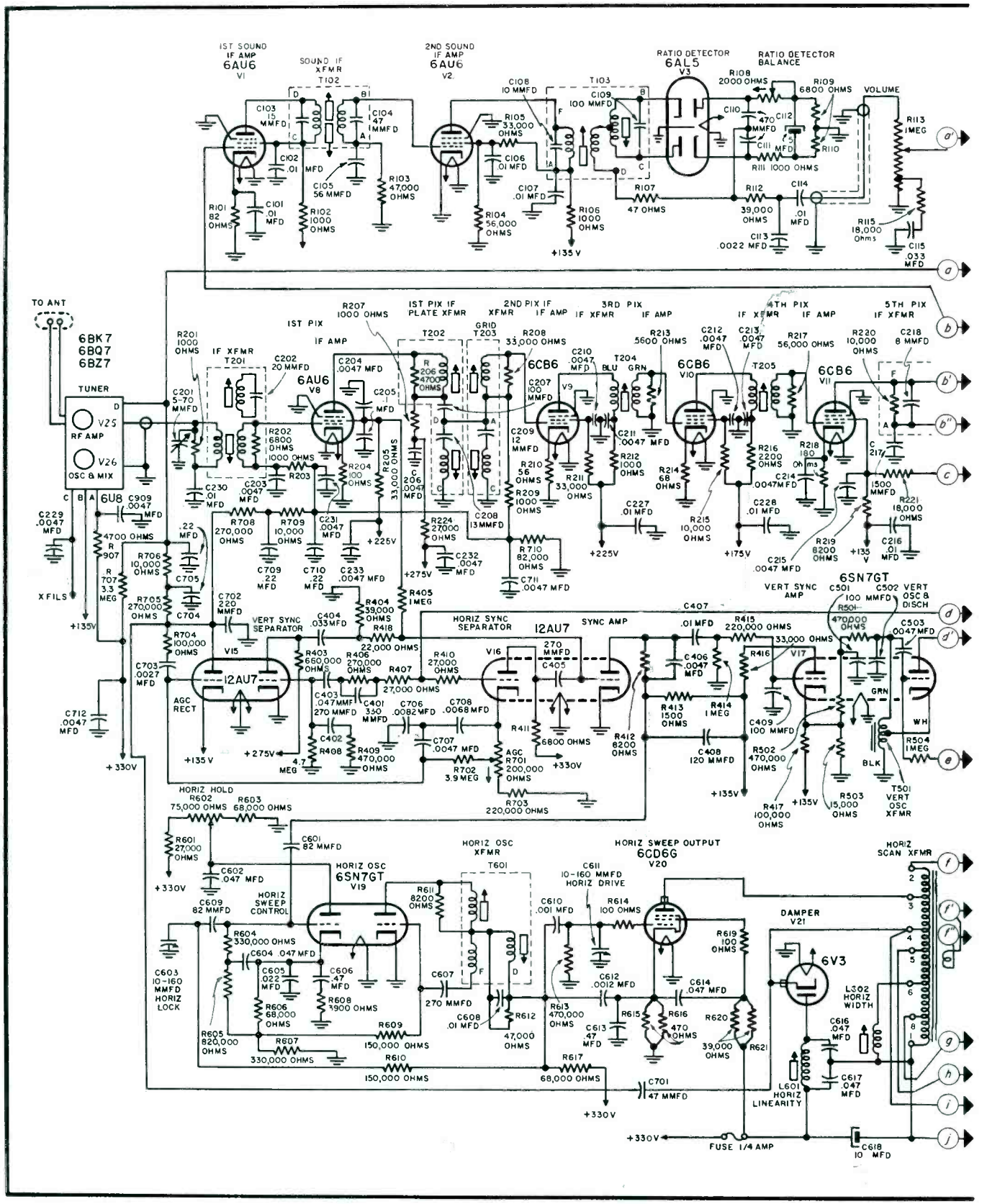
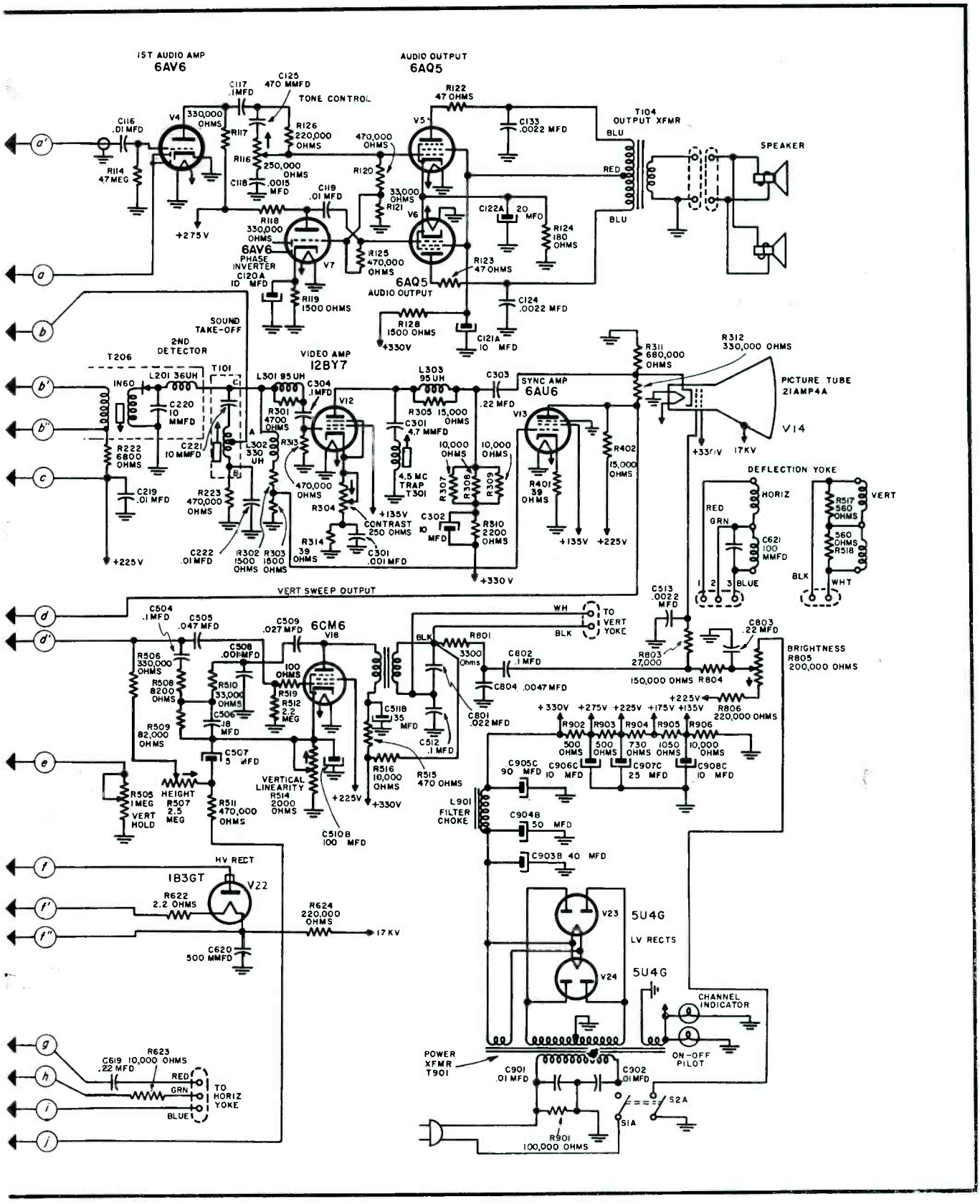


Fig. 1. Schematic of the ATR 41-mc wide-band chassis (model 2600) which features high-gain video amps. In chassis now being

passed cathode resistor provides both non-signal bias and gain stabilization.

The outputs from a pair of sync separators are recombined at the grid of the second half of a 12AU7 (V_{1b}). This tube section is a sync amplifier, and provides a high-level sync pulse to the vertical sync amplifier, to the horizontal sweep control tube, and to the *agc* circuit. Its grid is biased through a 1-megohm resistor from the screen of the first picture *if* amplifier. It should be noted that this is only a bias lead to the sync amplifier, not a signal lead back to the *if* amplifier. The positive-bias return holds the tube in a heavily-conducting condition, until a sync pulse occurs. This provides a maximum gain



made, the high voltage for the picture tube is 18 kv, and there is a 1-mfd capacitor in series with the voice coil of the hf speaker.

and amplitude range for sync pulses.

The sync pulses were recombined to attain a *fast* rise on the vertical sync pulse at the time of each horizontal sync pulse. In this way the vertical oscillator can actually be triggered by a horizontal pulse gated into the vertical oscillator circuit by the vertical sync pulse. The result is *precision interlace*.

The vertical sync amplifier and the vertical oscillator and discharge tube are the two halves of a 6SN7GT, V_{17}. The vertical sync amplifier is a cathode follower, with a two-stage integrating network, coupling it to the grid of the vertical oscillator. The vertical oscillator is a blocking osci

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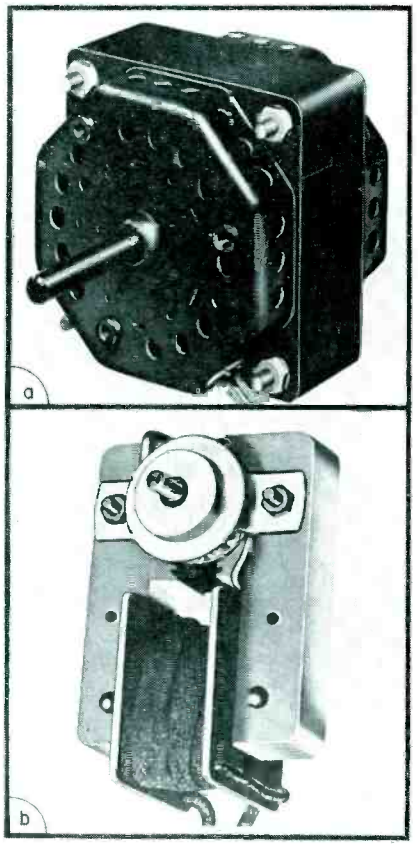
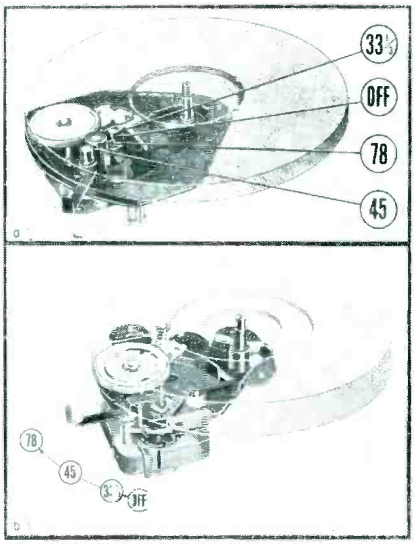


Fig. 1. **Typical shaded-pole induction motors. A two-pole induction type is shown in** (a); **a four-pole induction model in** (b). (Courtesy Alliance Mfg. Co.)

Figs. 2 and 3. A rim-drive three speed turntable is shown in Fig. 2. The proper pulley is positioned against the idler by the turret plate which is shifted by the lever protruding from under the turntable. Fig. 3 illustrates a rim-drive three-speed turntable utilizing a stepped-diameter motor shaft. The idler is moved vertically to engage the proper diameter step on the shaft. Note the wide rim on the turntable. (Courtesy General Industries Co.)



AUDIO Maintenance-Service Tips

by F. R. SAILES

Operational Characteristics of PHONO and TAPE MOTORS (Shaded-Pole Induction . . . Universal . . . Sync and Torque) and Their Maintenance and Repair

Motors play a vital role in phono and tape machines, and their installation or maintenance and repair require a thorough familiarity with the assorted types that are used, plus skilled handling of the units on the job.

Four basic types of motors are used for record players or tape recorders; shaded-pole induction, universal, synchronous and torque. The shaded-pole induction motors are the most common for record players, while sync and torque motors are often used on tape recorders.

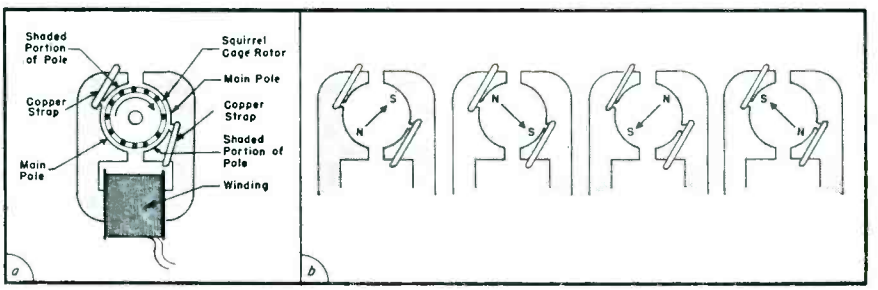
Operating Principles

The shaded-pole induction motor employs a copper strap around part of each pole to produce a field which rotates; the rotor is a squirrel-cage affair which has current induced in it by the moving field. This induced current supplies the magnetization which makes the rotor move. So that rotor current will be induced, torque must be supplied; this is accomplished by seeing to it that the rotor rotates at a speed slower than the rotating field. Therefore an induction motor runs at less than *synchronous* speed. Typically, the speed is near 1740 rpm (less than 1800 rpm) for 4-pole motors, and near 2900 rpm (less than 3600 rpm) for 2-pole motors. This type motor needs no brushes, its speed depending upon its load. In record players the load is light enough and nearly enough constant so that adequate performance is obtained.

The rotating field required in the shaded-pole induction motor is produced by the action of the shaded pole. As noted earlier, a shaded pole consists of a pole with its winding and an auxiliary one-turn copper strap around a portion of the pole. Because the copper strap is a shorted turn, the magnetic field cannot build up so rapidly in the portion of the pole which it surrounds as in the remainder of the pole. Similarly, as the magnetic field in the pole decreases, the field in the surrounded portion cannot decrease so rapidly. As a result, the surrounded portion acts as an independent pole lagging the main pole by nearly 90°. By placing the shaded portion between the normal poles, the electric field is made to move uniformly from unshaded to shaded, to next unshaded, to next shaded pole. Therefore, the magnetic field applied to the rotor appears to rotate. In a number of the higher-priced or higher-power shaded-pole motors, capacitors are utilized to shift the phase of the current supplied to the poles half way between the directly-connected poles in the

(*Continued on page* 44)

Fig. 4. Illustration of the construction of a two-pole shaded-pole induction motor (a) **and its rotating field** (b). **The rotating field is produced by induced current in the short-circuited one-turn copper strap.**



Audio Maintenance

(*Continued from page 42*)

motor. Such motors are known as split-phase type, which are not common in home-type reproducing equipment.

There are variations of the shaded-pole models. Where, for instance, a variety of frequencies and voltages are encountered, geared center-drive units are used. One such type has been designed for 50 or 60 cycle use, with voltages between 100 and 250 volts. A governor controls the speed by changing the load on the system. The motor operates at 1130 rpm, well below the synchronous speed of 1800 rpm, and changes speed considerably for a small change in torque. The governor is able to absorb changes in load torque and developed torque, while permitting only a small change in speed.

Universal motors are similar in appearance to the motors described, being typically geared center-drive units. The governor is essential in their use since their speed changes rapidly for changes in load. A major disadvantage of a universal motor is the need for brushes to supply current to the wound rotor. This type of motor is built, however, to operate on 100 to 250 volts, *dc* to 60 cycles, and only a tap change is required for the change from the 110 to the 220-volt range.

Synchronous motors are similar to induction types. However, the rotor is constructed of material which will retain its magnetism; the rotor becomes a permanent magnet and rotates in synchronism with the rotating field. Its speed is locked to line frequency, so long as the load does not exceed *pullout*, the maximum load the motor can handle.

Torque motors are induction motors designed to be operated *stalled*. They are used for takeup and rewind on tape recorders, where they serve to maintain tape tension by operating at low voltage, and to rewind by applying full line voltage; in rewind, the motor operates as an induction motor.

The available torque of typical phono motors is in the order of 1 to 5 ounce-inch; the power ratings run between 1/500 and 1/40 *hp*. Higher-torque motors are also in use, principally in high-priced equipment.

Record player drives fall into two broad classifications. The majority of American-produced units are rim-drive, utilizing a rubber-rim idler wheel between the motor or auxiliary shaft and the rim of the turntable. Many foreign units are center-drive, with gear speed-reduction.

Multiple-speed record players almost always utilize a change in the drive mechanism, rather than a change of motor speed to obtain the required speeds. The common means of changing speeds is to utilize three drive shafts, belt driven at different speeds, or driven at the same speed but having different diameters. One which produces the proper turntable speed is positioned to engage the idler by the speed-change lever. Another means of changing speeds is to utilize stepped diameters on the motor shaft, and shift the idler up or down the shaft so that it engages the proper diameter section. In gear-drive motors, the gearing is changed, while in governor-controlled motors moderate variations can be made by changing the governor setting to change the motor speed.

Maintenance

Some types of motors and many record changers need occasional oiling. The instruction manual for the particular instrument requiring atten-

tion should be consulted before it is oiled. Service men should note that improper oiling can do substantial harm. For example, one motor manufacturer[1] points out that the idler support plate should never be oiled. The load on this part is sufficiently light that even light oil will actually increase friction. In general, small phono-motors are built with bearings which will not run dry during the life of the motor.

The principle cause of slowing down or erratic operation are dirt and oil on critical parts. It has been found that carbon tet is very good for idler wheel cleaning.[2] Dust and lint must also be removed from the surface driven by the idler; the rim of the turntable. The motor and pulley shafts on multiple-speed drives must be free of oil. No oil should get on the surfaces driving the idler. If care is taken, so that oil is applied only on the bearings, one drop of number 10 or 20 oil on each motor bearing may quiet for a considerable time a noisy motor or free a motor which was running slow. However, the importance of avoiding oil on the drive shafts, idlers, and turntable rim cannot be overemphasized.

The idler wheel suffers from another possible trouble. On systems which do not relieve the pressure on the idler, flats can develop when the unit is not operated for a considerable time. In most cases, after 15 to 20 minutes of operation the flattened portion will return to normal. If the flat appears to be permanent, it will then be necessary to replace the idler. An attempt to remachine the idler tire will probably result in *wow*. In production, idler-wheel concentricity is held to extremely close tolerance, in the order of one ten-thousandth of an inch, by special techniques. It is unlikely that one can find a machine shop which can do as well.

More serious troubles, such as damaged windings or bent assemblies are items which the Service Man can best serve his customer by complete replacement. Rewinding the motor generally is not economical. It may be possible to solder a break in the top layer of a motor winding, but repairs of this sort are seldom satisfactory. It becomes necessary in the case of difficult repairs, to estimate whether the satisfactory repairs can be done for less than the price of a new part. Quite often replacement is not only more satisfactory in terms of performance, but also in cost to both the customer and the Service Man.

[1] *General Industries.*
[2] *From Alliance Manufacturing.*

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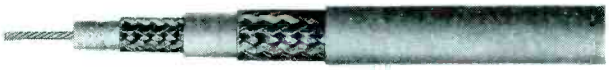

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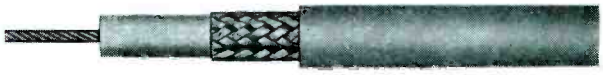

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Phono Needle Replacements: Types of Needles . . . Relation of Physical and Acoustical Characteristics to Needle Performance . . . Requirements of Cartridge Design to Match Needle Structures

by MAXWELL ALBERTS

OFTEN, SERVICE MEN ask why it is necessary to carry so wide a variety of needles to suit the various pickups now in use. The answer is not as involved as many argue. In audio we are faced with a very simple fact; audio is a perfectionist's hobby and thus any chance of achieving standardization, that would reduce the number of needle types, is a pretty hopeless task. Even the manufacturer who caters to audio must be a perfectionist who can never be trammeled by standardization.

We have the great variety of needles for phonograph pickups because pickup designers and manufacturers are constantly seeking to achieve an improvement in reproduction. Every pickup has been designed to provide its best performance with a particular type of stylus. For this reason, when the stylus is replaced, it is extremely important that one selects the *correct* shape and size as a replacement.

The variable reluctance pickup offers an excellent example of complementary stylus-cartridge design. In this cartridge we have an armature that moves between the poles of a magnetic circuit and is very close to the stylus itself; actually the armature moves with the needle instead of being driven by it through the arm.

The three most common forms of stylus (excluding the type used in the *v-r* pickup) are shown in Fig. 1.

The simplest shape, merely a modification of the old-fashioned needle, is illustrated in *a* of Fig. 1. This drawing reveals the important effect that the shape of the needle and the material of which it is made can have on performance. Even the old acoustic phono exhibited different tonal qualities, when assorted brands of needles were inserted, because of the change in needle length, rate of taper, and the quality of steel of which it was made. Now that the quality of reproduction has advanced a long way from that of the old acoustic phonograph, this principle is even more important.

In replacing even the simple type of needle, one must be careful to see that the correct dimensions and material are considered. If a needle with a precious stone tip, such as sapphire or diamond, is used to replace a shorter-lived metal-alloy type, its dimensions must follow the recommendation for the particular type of pickup to maintain a correct frequency-response characteristic.

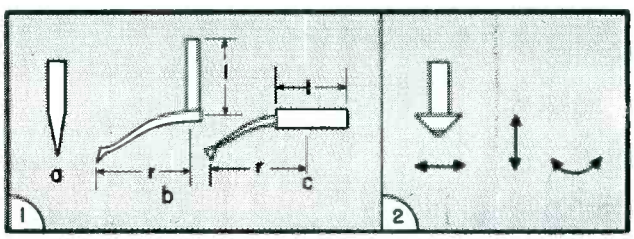
The other two types, shown in Fig. 1, merely differ in the manner that the shank holder moves in the pickup. In each case there are two important dimensions to take into consideration, besides giving attention to the fit of the shank in its holder, which should be a good push or snug fit, so that there is no room for vibration at this point; the radius of the stylus movement (shown as *r* in Fig. 1) must be correct, and also the length of the shank for inserting into its holder.

These factors are important to insure faithful movement of the stylus in the record's grooves at all frequencies. The stylus can depart from its correct movement in a variety of ways. One possibility of such deviation is shown in Fig. 2; the small double-ended arrows, underneath the end view of the stylus, represent possible directions of movement.

Desirable Needle Movement

The desirable one is shown at the extreme left, immediately underneath the stylus. Since the stylus is to some extent flexible in the vertical direction, it is also possible for the stylus to move, relative to the pickup, in a vertical direction as shown in the second position. These two forms of movement should be quite independent; the lateral direction should follow the waves in the groove, and the vertical direction, if it occurs at

Figs. 1 and 2 (below): Fig. 1 shows three common forms of needle, excluding the v-r type. In each, apart from the shank fitting snugly into its holder, the following dimensions are important: (a) the length and rate of taper; (b) and (c), radius of stylus movement, r, and the shank length, l. Fig. 2 illustrates end view of stylus arm of type (b) shown in Fig. 1, showing possible modes of stylus movement.



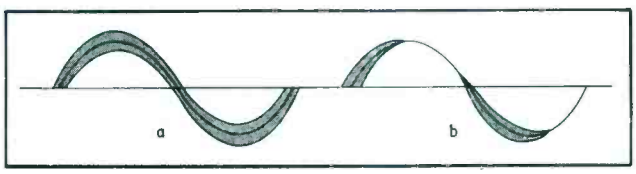


Fig. 3. The last mode of movement shown in Fig. 2 causes a combined wave, as at (a), to lose some of its high-frequency component, as at (b), which is a bad form of intermodulation.

Audio

(*Continued from page 47*)

all, should merely allow the stylus to follow any vertical undulations in the groove, due to record warpage. There should be no coupling between the two forms of movement.

Unbalance Problems

If the pickup is well designed, and the stylus fits it correctly, no such coupling will exist, but if an incorrect stylus is fitted into the cartridge, the movement may be thrown out of balance so that some kind of coupling will occur between the two forms of movement. The third arrow shows a rocking type of movement that can occur due to unbalance in a vertical direction. The stylus, instead of moving purely from side to side, introduces a rocking movement simultaneously. This can cause a serious deviation from the desired frequency response; but this is not the only defect possibility that can result from this poor combination.

Sometimes two resonances occur, and they are in a form of multiple relationship, so that a lateral movement at one frequency will excite a vertical movement, at some harmonically-related frequency. As a result, the stylus performs a figure of eight, or some other kind of Lissajous pattern. This kind of movement causes the stylus to bounce in and out of the groove, instead of following along the groove's base. Since program material contains a wide range of frequencies at the same time, such movement will not only cause distortion of the frequency that generates the trouble, but also produce intermodulation of any other frequency present, as shown in Fig. 3; page 47.

The wave at (*a*) represents the reproduction as it should appear, while the wave at (*b*) shows the result when the needle or stylus jumps out of the groove during segments of the lower frequency wave. The stylus cannot follow the high frequency undulations superimposed on the low-frequency wave, and hence they get lost for part of the latter, giving a choppy or dithery effect to high-frequency reproduction.

One should not assume, that if this effect does not show up when a single record is played as a test, that it will not occur on some other program material. If there is some unbalance in the pickup, due to use of a wrong stylus, this effect can occur at some frequency and will show up when the particular note that causes the Lissajous pattern is played on the disc; only when this particular note is played, will that dithery effect appear.

These effects are most likely to occur if a stylus using the wrong shank length is employed, because this will upset the leverage, transferred to the pickup, and also the balance of the movement.

Now let's consider the effects that occur when we use styli that have the wrong radius of tip movement. Two different stylus arm lengths at the end of a tone-arm are illustrated in Fig. 4. Assuming that the compliance, which is usually a piece of damping material somewhere in the cartridge itself, is the same in each case, a change in the stylus arm length will cause a change in the effective compliance to the movement of the tone arm at its resonant frequency; it will, incidentally, shift the resonant frequency. This change occurs because the longer stylus arm allows a larger movement, for the same degree of distortion in the compliance material.

This means that, if a short stylus happens to be the correct one, a long-

er stylus will result in a lower frequency of rolloff and a peak occuring before rolloff, as shown at Fig. 5 (curve *B*), causing undue emphasis of rumble and the lower frequencies in the record and creating unnatural reproduction, particularly on voice. If the longer stylus arm is the correct one for the particular pickup, use of a shorter stylus arm will result in restriction of the low-frequency response, as shown in curve *C* of Fig. 5.

Another possible result of incorrect stylus length or even incorrect construction of the stylus itself, high-frequency response, is illustrated at Fig. 6. The length of the stylus dictated by the designer of the cartridge always takes into account the compliance provided and various other characteristics of the pickup. The kind of movement that the stylus arm should follow, in tracing out a wave in the groove, is shown in *a* of Fig. 6. If the reaction produced by the pickup at the pivot point does not induce enough damping to the stylus, it may set up a different kind of vibration, at some frequency toward the high end, such as that shown at *b*. This is a natural resonant vibration of the stylus arm itself. If the pickup provides the correct damping, this natural resonant frequency will not occur, and the movement will be as shown at *a*, the same as at all other frequencies; but with insufficient damping to this particular resonance of the stylus, the movement changes to that shown at *b*.

The important thing to remember is the relationship between the angle of movement at the pivot, which is what determines the output in most cartridges. The resonance increases the angle of movement, provided by the same displacement of the stylus point at the lefthand end.

It should be remembered that the pickup cartridge, as well as its stylus, is an expendable item. This was the reason for introducing detachable cartridge elements, in place of the earlier units built right into the tone-arm.

Fig. 4. How the radius of stylus movement can affect tone-arm resonance effects. The relative lengths of the arrows show the relative movement at tone-arm resonance, other things being equal.

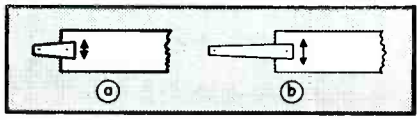
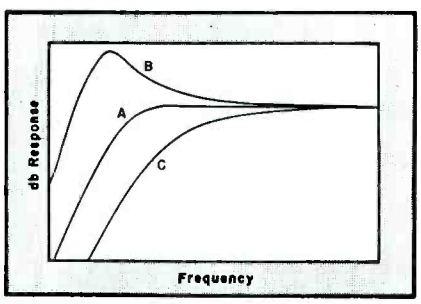
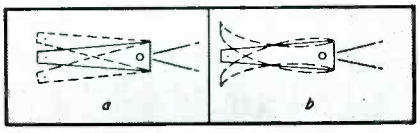


Fig. 5. Effect of incorrect stylus arm length (radius of movement) on If **response: A represents correct response; B is result of a stylus arm giving a longer radius of movement; and C is result of too short a stylus arm.**



(Below)

Fig. 6. The wrong combination can also result in spurious stylus arm resonance, as shown in (b). **By comparing the angle of movement for the same stylus displacement at its tip, it will be seen that the rotation at the pivot is accentuated at this frequency.**



Independent Service Man

(*Continued from page 21*)

still many battery sets in use, even in farm homes with electricity, and servicing them has been profitable for us. Using the auto-transformer, *battery* voltage may be lowered at will, to simulate the effect of the battery *running down*. At a voltage of 1.1, the oscillator tube may cut off. If this cutoff takes place appreciably above this value, the set will quit before the battery is fully discharged, with a resultant loss. It then becomes necessary to replace the oscillator tube; the oscillator should still work, even down as far as 1.05 volts. This demonstration, which is very rapid, can be used to convince one of the need for a new tube; the voltage is simply run down until the old tube stops oscillating, and a new tube can be installed to show that it will operate on the required voltage. This gadget is also used to test three-way portables; an *ac* voltmeter was recently added for quick checking. Here too, if the sets do not remain in operation down to an applied line voltage (around 105 volts) trouble will appear. Replacement of either the oscillator tube or the rectifier will usually remedy this complaint.

Other service aids we've installed include a picture tube, with yoke assembly, mounted on the bench to avoid removal of cabinet-mounted picture tubes. Special extension harnesses can be made up or purchased for the same purpose, to use the set's own tube.

Because of the variation in overhead expenses, an entirely new rate

structure prevails in the smaller towns. To arrive at this schedule in our town, all of the Service Men agreed on a nominal set of charges for various jobs, such as antenna installations, tube replacements, etc.

We have found that most customers object to *hour-charges;* Service Men in our communtiy have found far less *price-resistance* to prices quoted by the job, even though they work out to exactly the same amount.

This ties in with another facet of small-town life, not so prevalent in the cities. In the small town, everybody knows everybody else, and the most potent form of advertising known is merely *word-of-mouth.* It far exceeds in effectiveness any other form of advertising. One small word of either praise or condemnation from a neighbor will do more for you than all of the other advertising you could possibly use. It works both ways, too, so one must be careful and always do a top-notch job.

•

Transistor Radio

(*Continued from page* 23)

this lower bias and have a lower amplification factor, thus reducing the gain of the receiver and accomplishing the overall aim of *agc.*

Troubleshooting

At present there is only one way to check a transistor; by substitution. Unlike a vacuum-tube radio then, it is best to check the circuit thoroughly before attempting to check the transistors.

The cause of transistor failure is moisture getting through the seal. Since the transistors used in this set are hermetically sealed, failures should be few. This should govern you in a direction just the opposite of the vacuum-tube radio philosophy; suspect the transistor only as a *last resort.*

Normal service procedures can be followed in troubleshooting transistorized radios. With a voltmeter the battery supply should be checked first. If this is okay, any well-known troubleshooting procedure can be tried. The stage-by-stage interruption method, starting at the output stage, works well. The signal-tracing method works equally well and maybe a little better. It is up to individual preferences which method should be used.

The foregoing checks will only give you the stage in which the trouble is located; resistance and voltage tests must be employed to find the defective part. If this procedure fails to disclose a defective component, the transistor can be blamed as the cause of trouble and should be replaced.

While checking voltages you will note that they are exceptionally low; the total B— supply in this model is —13.5 *v.* The collectors on all of the *pnp* transistors are negative with respect to their emitters and bases, so don't be worried when the polarity is just the reverse of that in a tube radio.

At present, the five transistors are soldered into the circuit. If it becomes necessary to remove or replace a transistor, extreme caution should be used with your soldering iron, because excess heat will permanently damage the transistor.

If it is found necessary to replace the converter or first and second *if* amplifier transistors, it may be necessary to change the value of R_7 (100-470 ohms) in the second *if* amplifier for optimum receiver sensitivity, consistent with no regeneration.

One should always make sure that the battery is fresh and delivers the full 13.5 *v;* then start with R_7 at 470 ohms. If the set regenerates, the next lower value resistor should be tried and the procedure repeated until the resistance *just below* the lowest value where regeneration occurs is found.

Service Engineering

(*Continued from page* 36)

grid resistor. This voltage is fed to the rectifier's doubler circuit and cancels some of the positive noise voltage. The amplified noise drops to a lower magnitude, due to the quieting of the receiver. As a result of this carrier present, the *dc* amplifier conducts less and lets the first audio stage conduct and amplify any audio present.

One might think that control of the volume is an easy matter; one simply inserts a potentiometer in the grid of the first audio tube. However, one must remember that this receiver is in the mobile control head and is actually separated from the receiver by a 17′ or 20′ cable; with this in mind one can see it becomes difficult to run audio leads through a 20′ cable and not pick up hum and noises.

A fixed value of resistance could be inserted in the grid of the audio amplifier and the output attenuated with a constant-impedance network, which is commonly known as a pad. This pad would act as the volume control. But these pads are invariably noisy and require frequent cleaning or replacement. Another method that is commonly used is to vary the *dc* plate and screen voltage to the second limiter tube. This does eliminate hum and noise, but the volume cannot be adjusted to zero. The chief disadvantage in this method is that the position of this control affects the operation of the squelch circuit, which depends upon noise from the discriminator. There is also high voltage on the controls; thus servicing control head is a hazardous chore. These objectional features have been overcome by replacing the last resistor in the receiver deemphasis network by a variable resistor. This method utilizes a two-lead connection between the receiver and the control lead, which permits balancing out any hum or noise due to any other leads in the control cable.

The complete unit has been built with the operator and service engineer in mind. For example, in the receiver there are pin jacks to check the oscillator and multiplier-grid voltages, second low *if*-grid voltage, first and second limiter grid voltages, discriminator and plate-supply voltages, and primary source voltage. Any 20,000 ohm-per-volt meter having a three-volt scale can be used. Simple multipliers are used so that the service engineer can readily determine the actual voltages or currents. This design permits metering two or more circuits simultaneously.

Tube News

by A. M. KELWOOD

UNTIL ONLY a short while ago, transistors were used mainly in hearing aids. Recent advancements in their design and construction made it possible to include them in pocket radios, and achieve highly efficient results; as reported on page 22 of this issue.

To extend further the range of applications, transistor experts have now pushed the frequency utility of these pea-sized items way up into the megacycle range. As a result, it has become possible to develop many unusual devices, including transistorized test gear and even 2-way equipment.

The test unit is a portable voltmeter‡ covering frequencies from 20 cps to 1 mc.

The voltmeter, which has printed circuits, has a peak sensitivity of 0 to 1 millivolt and any of 12 decade (10 db) ranges may be switched on the front panel; 10-megohm input impedance on all ranges is included to prevent disturbances to circuits under test. Output terminals are provided so that the unit can be used for monitoring of the voltmeter's amplifier output with any device having 50,000-ohm or greater input impedance. Power is supplied by three standard batteries which provide over 35 hours continuous operation.

The 2-way item is a 40-50 mc walkie-talkie 12-transistor FM package, designed for the military, which can be carried in a shirt pocket. Field tests have indicated that two-way communication over a quarter mile is possible with this novel transistorized transceiver.

For radar and ultrahigh TV application, there has been developed a *junction tetrode* type of transistor* that will operate in the 1000-mc range. This has been accomplished by the addition of a fourth electrode to the basic junction transistor.

The junction tetrode transistor has been made to perform at high frequencies by reducing the width of the germanium bar and the central *p*-layer and by adding the fourth electrode. New techniques for producing the thin middle layer for all types of transistors have made possible an almost ten-fold reduction in its width; in the tetrode transistor, this layer is less than two ten-thousandths of an inch wide.

To fill the growing need for transistors with greater power, a *pnp* junction power transistor, which delivers 5 watts push-pull output with a 6-volt supply, has been developed.**

This transistor has a very high current rating with a low voltage drop across it; the relationship between its base and collector currents is extremely linear. The output impedance is low enough for a 5-ohm speaker voice coil to be used directly as the collector load in the *af* output stage.

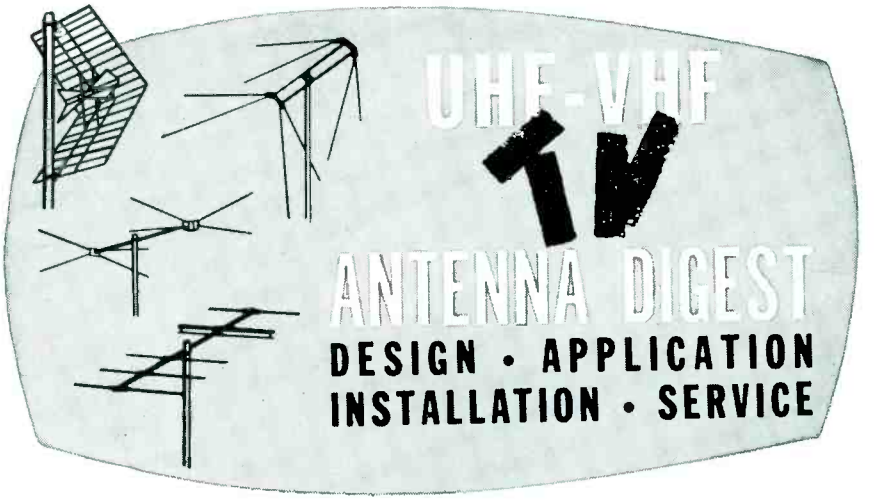
‡*Alto Scientific Co., Palo Alto, Calif.*

**Bell Laboratories.*

***Amperex Electronic Corp.; type 2N115.*

Transistorized portable voltmeter.

Troubleshooting Community-TV Systems‡



by RALPH G. PETERS

THERE ARE four vital tools required in the community-TV maintenance-repair kit; a lightweight TV chassis, *vtvm* or 20,000 ohm-per-volt meter, sweeper and field-strength meter.

The TV set serves to check the quality of reception at the antenna, amplifier locations, and distribution points. Any sudden marked changes in reception offer a positive indication of trouble and the type of pix trouble will reveal what's wrong with the system.

The *vtvm* or 20,000 ohms-per-volt meter is required to check the *agc* of single channel and broadband amplifiers and also to measure line voltage. A sweeper with good linearity will show response of single channel amplifiers and also permit spot checking of broadband equipment.

Field strength meters with continuous tuning are preferred. A 6-db pad should be used between meter and measuring point to minimize standing-wave ratio. Sometimes the meter detector will not completely rectify peak pulse signals on the picture carrier. This results in a reading lower than actual available signal.

After making field repairs such as tube replacement, replacement of power supply parts, gain controls, etc., one should inspect units for gain with a field-strength meter, a switch attenuator and an *rf* signal source. The *rf* signal can be conveniently obtained by tapping off the cable system. The attenuator switches should be set so that the db attenuation approximates the amplifier's db gain. Field-strength meter input readings should equal output readings.

Sometimes, gain of amplifiers will be found to be low as a result of low *ac* line voltage. To correct, a voltage-regulating transformer is recommended, with the wattage rating equal to or slightly less than the total wattage of the equipment to be regulated. Overloading the regulating transformer by 5% assures maximum regulation. Voltage regulating transformers should be ordered with *wave form correcting networks* to restore the peaks of the *ac* sine wave, providing the proper B+ voltage and amplifier gain.

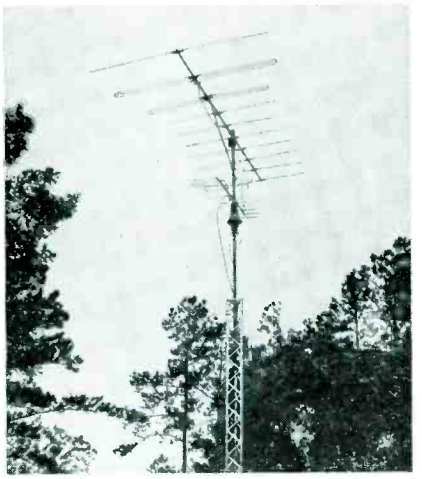
Typical troubles encountered in a community system include multiple ghosts or smears, due to an open circuit or short circuit in transmission line, improper line or equipment termination, incorrect terminal connection or jumper position on one of the units, or ghost in received signal.

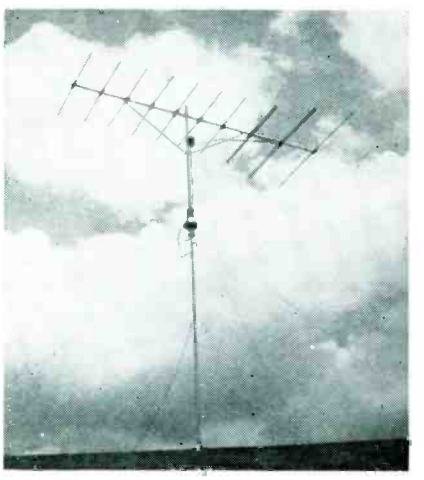
An overloaded line amplifier or distribution amplifier, or unbalanced signals in the line will cause complete picture breakup and often *ride-through* of one channel into several others. To correct overloading of amplifiers, gain must be reduced and attenuator pads should be used; amps should also be spaced further apart.

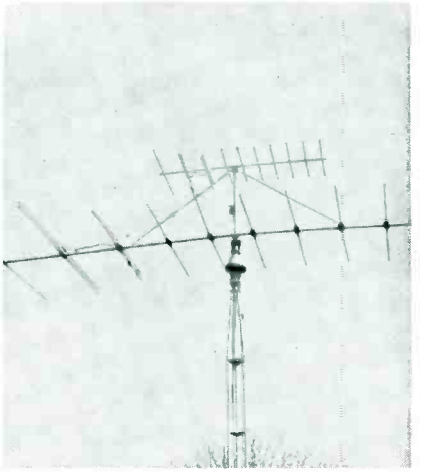
Often diagonal lines, or light herringbone, venetian blind and swirling patterns will appear. The causes are many: *Rf* interference due to FM stations or other radio services, local TV set oscillator radiation, line amplifier oscillation, co-channel or adjacent channel interference from another TV station. Local TV set oscillation can be cured only by checking individual sets and tapoffs for proper connections, and for at least 12-db isolation at the tapoff. Increasing the amount of isolation at the tapoff to the troublesome receiver will often eliminate the problem.

‡*Based on data prepared for the* ***Blonder-Tongue*** *Master TV Installation Manual.*

Three types of antenna systems installed in fringe and deep-fringe areas. At left is a rotor-controlled stacked tower-mounted antenna set up for co-channel problems. Center view shows roof-top mounted yagi with a rotator for fringe-zone use. And at right is another tower-mounted rotator-controlled stacked yagi for the super-fringe country involved in co-channel trouble. (Jack Darr)







BLACK AND WHITE TV
TRANSISTOR RADIOS
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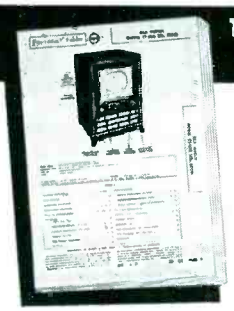

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4. Wave forms are shown right on the TV schematics for quick analysis by 'scope.
5. Voltages appear on the schematics for speedy voltage analysis.
6. Transformer lead color-coding is indicated on the schematic.
7. Transformer winding resistances appear on the schematic.
8. Schematics are keyed to photos and parts lists.

FULL PHOTOGRAPHIC COVERAGE

9. Exclusive photo coverage of all chassis views is provided for each receiver.
10. All parts are numbered and keyed to the schematic and parts lists.
11. Photo coverage provides quicker parts identifications and location.

ALIGNMENT INSTRUCTIONS

12. Complete, detailed alignment data is standard and uniformly presented in all Folders.
13. Alignment frequencies are shown on radio photos adjacent to adjustment number—adjustments are keyed to schematic and photos.

TUBE PLACEMENT CHARTS

14. Top and bottom views are shown. Top view is positioned as chassis would be viewed from back of cabinet.
15. Blank pin or locating key on each tube is shown on placement chart.
16. Tube charts include fuse location for quick service reference.

TUBE FAILURE CHECK CHARTS

17. Shows common trouble symptoms and indicates tubes generally responsible for such troubles.
18. Series filament strings are schematically presented for quick reference.

COMPLETE PARTS LISTS

19. A complete and detailed parts list is given for each receiver.
20. Proper replacement parts are listed, together with installation notes where required.
21. All parts are keyed to the photos and schematics for quick reference.

FIELD SERVICE NOTES

22. Each Folder includes time-saving tips for servicing in the customer's home.
23. Valuable hints are given for quick access to pertinent adjustments.
24. Tips on safety glass removal and cleaning.

TROUBLE-SHOOTING AIDS

25. Includes advice for localizing commonly recurring troubles.
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Wire-Wound Resistors

(*Continued from page 25*)

plus an ambient temperature of 25° *C*, produces a surface temperature of 325° *C*. Since ambient temperatures in most equipment are higher than 25° *C*, it is necessary to derate the resistor used. Thus, if 50° *C* is considered as the ambient temperature, which is typical of many TV receivers, then the resistor should be used only at approximately 87 per cent of its rated power.

Most equipment manufacturers consider this factor in their design and seldom operate a wire-wound resistor at its full power rating. For example, a manufacturer may call for a 10-watt resistor to do a job when, actually, only 5 to 7 watts are being dissipated.

Adjustable Wire-Wound Applications

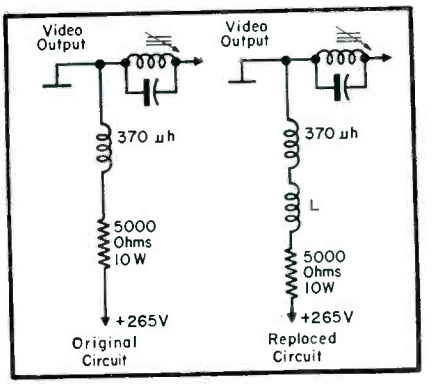
When using an adjustable-type wire-wound resistor, that portion which is used should be required to dissipate only a corresponding part of the full power rating. For example, let us suppose a 2,600-ohm, 10-watt resistor is required, but is not available. Instead, a 3,000-ohm adjustable wire-wound resistor is available. To use the 3,000-ohm resistor, it should have a higher rating than 10 watts. Specifically, the rating should be 3,000/2,600 x 10, or 11.5 watts. Inasmuch as the next highest power rating available is 25 watts, a 25-watt resistor must be used. Selecting a resistor whose actual power rating is approximately 50% greater than its calculated power rating, to compensate for ambient and excessive surface temperatures, is in accordance with standard practice.

The cost of a replacement part, as well as time, can be saved by replacing only the opened or burned out section of a multi-section, or tapped resistor, with a single fixed resistor of approximately the same resistance value and power requirement as the damaged section.

Exact Replacement Factors

One must always use the exact replacement, in resistance and inductance, (or one proven to be satisfactory) for a power wire-wound resistor, when it is used as part of the video output tube plate load. This practice must obtain because a variation in inductance can change the video response characteristic, thus impairing picture quality. Fig. 10 illustrates what happens when an incorrect 5,000-ohm 10-watt resistor is substituted for the original in the video amplifier circuit. If a round tubular type were used, its inductance would be approximately 100 *uh* or a large portion of the total inductance in the circuit including the 370 *uh* peaking coil. On the other hand, if a core-type 10-watt resistor were used as a replacement, the inductance would then be at least one-tenth that of the round tubular type, and improper as a replacement.

Fig. 10. Schematic of TV video output stage showing effect of using other than recommended replacement for 5,000-ohm, 10-watt resistor.



(*Continued from page* 41)

lator utilizing cathode feedback through a tapped transformer. It is similar to the well known Hartley oscillator except that the transformer is untuned.

The current pulse from the vertical oscillator discharges a 1-mfd vertical sweep capacitor (C_{504}), which recharges through the height control, toward the boosted B+ supplied from the horizontal damper circuit. The height control limits the rate of charging of this capacitor, and thus the magnitude of the sweep voltage when the next discharge pulse occurs. The networks connected to the vertical sweep capacitor shape the waveform supplied to the vertical output tube in order to obtain a linear sweep. The vertical-sweep output amplifier is a conventional circuit utilizing a 6CM6 (V_{18}), transformer-coupled to the vertical-deflection coils of the deflection yoke. A negative blanking pulse is derived from the retrace voltage across the vertical deflection coils of the yoke, and applied to the grid of the picture tube.

For the horizontal sweep, at the output of the second sync amplifier (the second half of V_{16}), the synchronizing signal is differentiated, to eliminate the vertical sync pulses, and applied to the grid of the horizontal sweep control tube, the first half of a 6SN7GT (V_{19}). The second half of V_{19} is a blocking oscillator with a partially resonant transformer in a grounded-cathode Hartley-oscillator circuit. The grid-blocking voltage, applied to the blocking oscillator, is controlled by the horizontal sweep control tube in response to the combined sweep and sync voltages applied to the grid. This is a typical *afc*-horizontal circuit. The current pulse from the blocking oscillator discharges an adjustable 10-160 mmfd capacitor, used as a horizontal drive control (C_{611}). When this capacitor recharges, the voltage across it drives the horizontal-sweep output tube.

The horizontal sweep output circuit is conventional; a 6CD6G (V_{20}) driving the deflection yoke through an output transformer, while a 6V3 (V_{21}) damps the ringing of the output circuit by converting the excess energy to boosted B+. The flyback high-voltage supply utilizes a 1B3GT (V_{22}) to supply 18 *kv* for the picture tube. The remainder of the circuit, such as the linearity and width controls, are also conventional.

The automatic-gain control circuit is keyed by a positive flyback pulse from the horizontal transformer. The positive pulse is applied to the plate of the *agc* rectifier, the first half of a 12AU7 (V_{15}). Sync pulses, which come from the horizontal sync separator, are applied to its grid. A 200,000-ohm potentiometer (R_{701}) in the cathode of the horizontal-sync separator serves both as a cathode load across which the sync voltage applied to the *agc* circuit is developed, and as a source of adjustable bias for the *agc* rectifier. (The sync amplitude supplied to the *agc* circuit is not affected by this control since a .0082 and .0068-mfd capacitive divider (C_{706} and C_{708}), with a .0047-mfd coupling capacitor (C_{707}) bypass the control.

The positive keying pulse from the horizontal deflection circuit is applied to the plate of the *agc* rectifier. The amount of current drawn depends upon the amplitude of the positive sync pulses applied to the grid. This current flowing through three resistors (R_{705}, R_{706} and R_{707}) with values of 270,000 and 10,000 ohms and 3.3 megohms, respectively, to B+ of 330

(*Continued on page* 58)

Coming Events

Northern California Audio Show
September 30, October 1 and 2
Sheraton-Palace Hotel, San Francisco

Institute of Hi-Fi Manufacturers Show
November 4, 5 and 6
Benjamin Franklin Hotel, Philadelphia

(Continued from page 57)

v determines the average voltage at which the circuit operates. Since R_{707} is a 3.3-megohm unit, a current of .1 milliampere is sufficient to place the average voltage at ground.

This .1 mil current is supplied by the *agc* rectifier when a small sync pulse on the grid drives the tube out of cutoff, when the keying pulse occurs. With a slightly larger pulse applied, more current is drawn, and the average voltage becomes negative, with respect to ground. A relatively small change in sync-pulse amplitude will produce a large change in average voltage; the resultant change in gain of the receiver provides a system with very close control of the amplitude of the video signal.

R_{705} and R_{706}, in conjunction with a pair of .22-mfd capacitors, C_{704} and C_{705}, filter out the positive pulse, leaving a *dc* bias to be applied to the tuner. To prevent the bias from going positive, this bias supply is clamped by the double diodes of a 6AV6 (V_4). Contact potential of these diodes actually maintains the *agc* bus always negative by at least ½ volt. Another filter consisting of two resistors and two capacitors (270,000 and 10,000 ohms, and .22 mfd (R_{708}, R_{709}, C_{709} and C_{710}) is in the *agc* bias line to the first and second picture *if* stages. An 82,000-ohm resistor (R_{710}) forms a voltage divider with R_{708} and R_{709}, which reduces the magnitude of the *agc* voltage to one-fourth that applied to the tuner. The different characteristics of the tubes used in the tuner and in the *if* amplifiers require this difference, so that the gain reduction for strong signals will be properly proportioned among the controlled stages to prevent overload.

The audio output of the ratio detector is deemphasized by R_{112} and C_{113}, (39,000 ohms and .0022 mfd), and fed to the audio amplifier through the tone-compensated volume control.

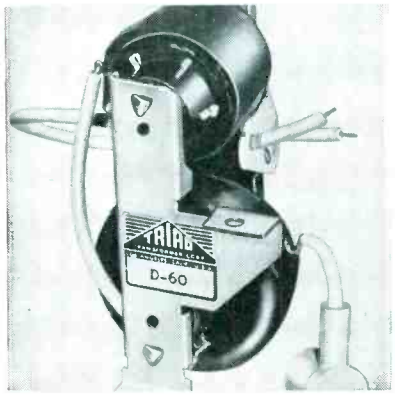
A *floating paraphase* inverter, another 6AV6, supplies the signal to a push-pull circuit. It should be noted that this circuit is inherently quite independent of tube characteristics, because of feedback from plate to grid through 470,000 and 33,000 ohm resistors, R_{125} and R_{121}. This feedback also makes the circuit self-balancing.

A transformer type supply, with high current capacity in dual 5U4G rectifiers, provides well-filtered B+ to all of the stages of the receiver. A bleeder provides the five different values of B+ for optimum set operation. Bypass capacitors are placed from the power leads to the chassis to help reject interference caused by razors, mixers, and the many other home noise sources.

TV Parts... Accessories

TRIAD REPLACEMENT FLYBACKS

Five replacement flyback transformers, for use in RCA, Travler and Zenith TV sets, have been announced by Triad Transformer Corp., 4055 Redwood Ave., Venice, Cal.



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MERIT HORIZONTAL-HVO TRANSFORMER REPLACEMENTS

Six horizontal and high-voltage output replacement transformers have been announced by Merit Coil and Transformer Corp., 4427 N. Clark St., Chicago, Ill.

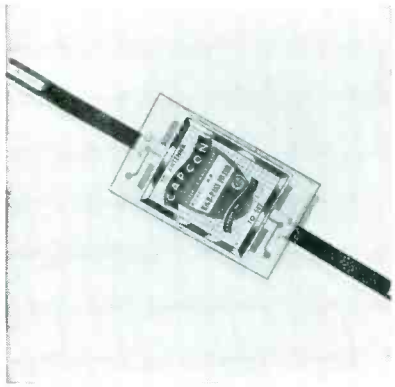
One unit, *HVO-41*, has been designed for Airline, Coronado, Truetone, Arlington, Firestone, Wells-Gardner, Silvertone and Warwick receivers; another, *HVO-42* for CBS-Columbia sets; *HVO-44* for Airline, Coronado, Firestone, Truetone and Wells-Gardner chassis; *HVO-45* for Westinghouse models; *HVO-47* for Andrea, Arvin, Du Mont, Hoffman, Kaye-Halbert, Pacific Mercury, Packard-Bell, Silvertone, Stromberg-Carlson and Tech-Master sets, and *HVO-48* for Magnavox receivers.

* * *

EICO TV ALIGNMENT CRYSTALS

A package of TV alignment crystals has been introduced by Electronic Instrument Co., Inc., 84 Withers St., Brooklyn 11, N. Y.

Holds five 4.5 and five 5-mc crystals applicable to TV sweep generators and marker oscillators.



(Left)
Printed-circuit three-section high-pass filter. Contains six coils and four capacitors. Designed to filter out interfering signals below 54 mc. Enclosed in transparent case. (Capcon, Inc., 25 Willett St., N. Y. 2, N. Y.)

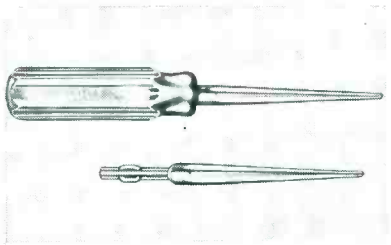
(Right)
Multi-set couplers available as two-way and three-way splitting devices. Housed in weatherproof cases, couplers are designed for installation on the exterior of building. Couplers are of voltage-splitting type. In high-signal strength areas, units may be used in tandem to serve as a TV distribution system. (Model 825; Technical Appliance Corp., Sherburne, N. Y.)

Bench-Field Tools . . .

XCELITE REAMERS

Chrome plated hand reamers, 38, with ½" to ⅜" capacity in wood, plastic and sheet metal, have been announced by Xcelite, Inc., Orchard Park, N. Y.

Available with handle or to fit detachable handle in model 99 multi-purpose tool kit.



* * *

R-COLUMBIA CLEANER-LUBRICATOR

A tool, *TrolMaster*, developed to clean and lubricate TV or radio controls, without removing chassis, has been announced by the R-Columbia Products Co., 305 Waukegan Ave., Highwood, Ill.

To operate, knob is removed at front of control, device is filled with solvents, tool is screwed onto the control, and plunger is pushed in. By the addition of an adapter which screws on, unit can also be used to clean and lubricate auto radio controls.

Nine inches long overall. Made of solid brass.

Recommended for use with device is Kleentrol solvent; a non-inflammable fluid. Further details in bulletin 21.

* * *

ARGOS PORTABLE BENCH

A portable work bench, the *Quickie Bench*, for in-the-home repairs has been introduced by Argos Products Co., Genoa, Illinois.

When folded for carrying, bench resembles suitcase; 26" x 11" x 6¼" thick. Set up it provides a work surface (masonite) 26" x 22" about 25" high. In addition there is an extension shelf 9" x 12" on one end.

Sides of bench are covered with tweed-gray fabric.

SERVICE PARTS RACK

A heavy duty parts rack, for storage and display of radio and TV parts, has been introduced by Service Parts Systems, Inc., 13380 E. Nine Mile Rd., East Detroit, Mich.

* * *

MASTRA TOOL-TUBE CARRIERS

Three radio and TV tube and tool carriers, *11*, 33 and 55, are now being produced by The Mastra Co., 2032 Euclid Ave., Cleveland, Ohio.

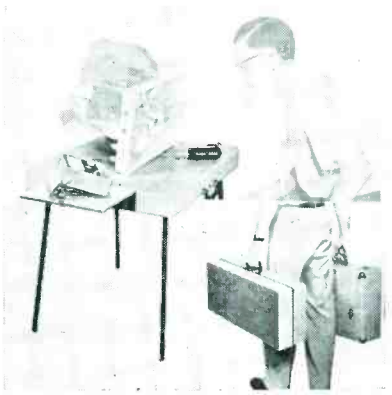
Model 11 has room for 45 small, 44 medium and 21 large tubes, plus assortment of tools. Model 33 has a removable tool tray and partition for tester; holds 100 small, 60 medium and 30 large tubes. Model 55 features side pockets and removable tray.

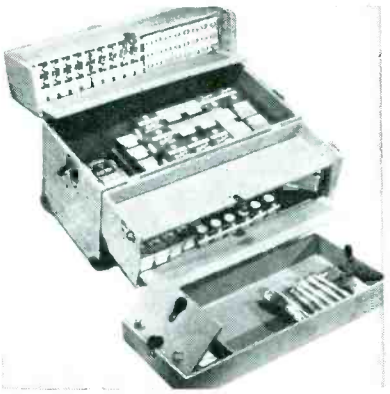
GUN-TYPE SOLDERING TIPS

An assortment of gun-type soldering tips is now being marketed by Electric Soldering Iron Co., Inc., Deep River, Conn. Included is a tip 1/16" thick for soldering tight spots and deep chassis connections.

Tips, it is said, will not bend, anneal or develop surface residue, even though left on circuit beyond operating cycle.

Included in the assortment are tips for soldering connections to small prongs and for thin channel-type lug connections.





Instruments

HICKOK VOM

A portable multimeter *(model 455)*, with a self-disconnect that operates a reset button when a dangerous overload is applied, has been developed by The Hickok Electrical Instrument Co., 10521 Dupont Ave., Cleveland 8, Ohio.

Meter sensitivity is 20,000 ohms/volt *ac* and *dc*. A single selector switch is used for function and range settings. Batteries are housed in a compartment which is accessible without removing case.

Audio model (456) with a sensitivity of 20,000 ohms/volt *dc* and 1,000 ohms/volt *ac* and including *db* ranges is also available.

* * *

PHILCO VTVM

An *ac/dc* voltmeter-ohmmeter *(model 6100)* has been announced by Philco Corp., Philadelphia, Pa.

Six voltage ranges afford *ac* and *dc* voltage measurements up to 1,000 *v;* six resistance ranges from .5 ohm to 1,000 megohms. *Ac* frequency range extends from 20 to 20,000 *cps.* An accessory *hv* probe permits *dc* voltage measurement to 30,000.

* * *

HEATH LINEARITY GENERATOR

A linearity pattern generator *(LP-1)*, covering TV channels 2-13, providing a free channel for adjustment, has been developed by Heath Co., 305 Territorial Rd., Benton Harbor, Mich. Produces vertical (6 to 12) or horizontal (4 to 7) bars, and cross hatch or white dot patterns. Horizontal and vertical frequency controls are provided for synchronizing and establishing aspect ratio. Attaches to receiver antenna terminals through a clip on shielded output cable. Uses 6X4, OA2, two 6J6s and a 12AT7. Can also be used to check sound.

* * *

G-C SERIES-FILAMENT TUBE CHECKER

Series-filament tube checkers for detecting burned-out tubes by plugging into proper tester socket *(model 9270)* are now available from General Cement Manufacturing Co., Rockford, Ill. Unit plugs into TV interlock or cheater cord.

Phaostron vtvm

PHAOSTRON VTVM

A *vtvm (777)* featuring illuminated scales and provision for peak-to-peak measurements, has been developed by The Phaostron Co., 151 Pasadena Ave., S. Pasadena, Cal.

Two jacks are used for measurements on 42 ranges. Accuracy is said to be 3% *dc* and 5% *ac*. Uses separate range and function switches. It has two zero-center scales for FM discriminator alignment.

Accessories include a high-frequency coax cable and *dc* probe. Unit and accessories are housed in a leather carrying case.

Schematics In This Issue

WHEN YOU CHANGE YOUR ADDRESS

Be sure to notify the Subscription Department of SERVICE at 52 Vanderbilt Avenue, New York 17, N. Y., giving the old as well as the new address, and do this at least four weeks in advance. The Post Office Department does not forward magazines unless you pay additional postage, and we cannot duplicate copies mailed to the old address. We ask your cooperation.

JFD WINS FCDA PUBLIC SERVICE CERTIFICATE

The Federal Civil Defense Administration has awarded a Public Service Certificate to JFD Manufacturing Co., Inc., for its recent role in the '55 Civil Defense atomic test program at the AEC Nevada test site.

* * *

GENERAL CEMENT CONSOLIDATES PLANTS

The General Cement Manufacturing Co., Rockford, Ill., and its five subsidiaries (G-C Electronics, Television Hardware Mfg. Co., Telco Electronics, Geelar Mfg. Co., and Wood Specialty Mfg. Co.) have moved into a five-story, 180,000 square foot building at 400 S. Wyman St., Rockford, Ill.

* * *

LINE OF ALUMINIZED PICTURE TUBES DEVELOPED BY RCA

A line of 25 types of aluminized *Silverama* television picture tubes, has been announced by the RCA Tube Division.

Included are 10, 12, 16, 17, 20, 21, 24, and 27-inch tube sizes, which it is said, will perform the functions of 114 types now on the market.

* * *

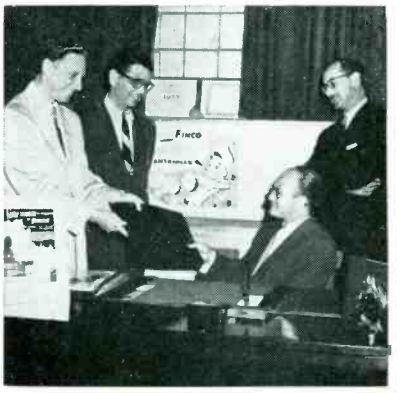
PRETELECAST CONFAB

Key figures in recent northwest speedboat race telecasts, sponsored by Channel Master. Left to right: Stan Sayres, owner of the boat Slo-mo-shun; **Lee Naylor, Channel Master western district sales manager, and Bill O'Mara, sports director of KING-TV who directed the telecast.**

10-MILLIONTH TV TUBE

Sylvania executives witnessing company's 10,000,000th TV picture tube wing its way to completion over a tube conveyor system in the Seneca Falls plant. Left to right; Willis C. Toner, plant manager; Matthew D. Burns, vice president-operations; Don G. Mitchell, chairman and president; W. H. Lamb, divisional general manager.

FINCO-LINE PROMOTION MEETING

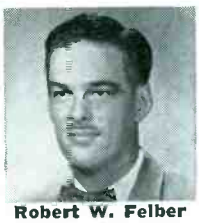


Aaron Fox, Finco ad-agency account executive, delivering personalized zipper case containing introductory promotional material on Finco Geomatic line to M. L. Finney, Jr., Finco general sales manager. Looking on, left to right, Howard Freed, agency production manager and Bill Zagar, agency art director.

PERSONNEL

JACK M. GUTZEIT is now national sales manager of Rogers Electronic Corp., New York, N. Y.

Jack M. Gutzeit



Robert W. Felber

ROBERT W. FELBER, former national service manager for Stewart-Warner, has joined the sales organization of American Phenolic Corp., Chicago Ill., as head of a new community-TV division.

* * *

RUSSELL D. GAWNE has been named sales manager of G-C Electronics Manufacturing Co., a division of General Cement Manufacturing Co., Rockford, Ill.

Russell D. Gawne

Douglas Vining

DOUGLAS VINING has become a field engineer at Technical Appliance Corp., Sherburne, N. Y.

* * *

PHILIP A. PORTNOY has been named vice president of Electronic Instrument Co., Inc., 84 Withers St., Brooklyn 11, N. Y.

* * *

BENJAMIN C. BOWKER has been appointed public relations manager of Allen B. Du Mont Laboratories, Inc., 750 Bloomfield Ave., Clifton, N. J. . . . JACOB H. RUITER is now director of advertising and sales promotion of the technical products division.

* * *

WEST COAST SHIPPING DEPOT

Astron Blue Point capacitors going to west coast distributors from Astron's new Los Angeles warehouse.

Components

C-D TUBULAR PAPER CAPACITORS

Polykane impregnated tubular paper dielectric capacitors, *Royal Cub*, designed for use under severe conditions of heat, cold, moisture and humidity, have been developed by Cornell-Dubilier Electric Corp., South Plainfield, N. J.

Units feature high insulation resistance, low power factor and a temperature range from $-55°\ C$ to $+100°\ C$. Available in .001 to 1-mfd capacitances and from 100 to 1000 *wvdc*.

* * *

G-C/STACKPOLE CARBON RESISTORS

Carbon resistors, in color-coded plastic boxes, have been announced by G-C Electronics Manufacturing Co., Rockford, Ill., and Stackpole Carbon Co., St. Marys, Pa.

The line, coded *G-C 60*, is available in assortments of six, four and three to a box in ½, 1 and 2 watt types, respectively; in 77 RETMA values, with tolerances of 20%, 10%, and 5%.

Richard G. Ellis, **vice president and general sales manager of General Cement and** Dick Bond, **distributor sales manager of Stackpole Carbon watching** Russ Gawne, **G-C electronics sales manager, demonstrate G-C/Stackpole carbon resistor jobber display. Looking on is** Stanley B. Valiulis, **G-C president.**

* * *

CAPCON MINIATURE AND SUBMINIATURE CAPACITORS

A line of miniature and subminiature capacitors, for use in transistor assemblies, printed circuits, hearing aids, miniature radios and transmitters, and portable and color TV sets, has been announced by Capcon, Inc., 25 Willett St., New York 2, N. Y.

Coming Event

Hi-Fi Audio Show
February 8-11, 1956
Los Angeles, Calif.

ADVERTISERS IN SERVICE
OCTOBER, 1955

Catalogs-Bulletins

VACO PRODUCTS CO., 317 E. Ontario St., Chicago 11, Ill., has released a 4-page illustrated brochure listing gift-packaged, personalized tool sets available for use as promotional good-will builders.

* * *

GENERAL ELECTRONIC EQUIPMENT CO., P.O. Box 347, Easton, Pa., has published a brochure, describing instruments and instrument kits that are available through distributors. Included are 'scopes, tube testers and multitesters.

* * *

EAGLE ELECTRIC MANUFACTURING CO., INC., 23-10 Bridge Plaza South, Long Island City 1, N.Y., has published a 68-page catalog listing electrical wiring devices, extension and cord sets, fuses, wall plates, push buttons, flashing devices, nichrome wire and elements and staples.

* * *

NEWARK ELECTRIC CO., 223 W. Madison St., Chicago, Ill., and 4736 W. Century Blvd., Inglewood, Cal., has issued a 260-page catalog covering electronic parts, tubes, equipment, tools and accessories. Included is a 64-page section devoted to high-fidelity systems and components.

* * *

MERIT COIL AND TRANSFORMER CORP., 4427 N. Clark St., Chicago 40, Ill., has released an 80-page TV transformer replacement guide (*No. 408*), listing replacements for 12,000 models and chassis, cross referenced with original manufacturer's part number.

* * *

CHICAGO STANDARD TRANSFORMER CORP., Addison and Elston Sts., Chicago 18, Ill., has published a 52-page TV transformer replacement guide listing replacements for more than 7,000 models and chassis. Units are arranged in alphabetical order by set manufacturer.

* * *

ERIE ELECTRONICS DISTRIBUTOR DIVISION, Erie Resistor Corp., Erie., Pa., has issued revised catalog sheets covering fixed glass capacitors, midget rotary trimmers, and 4-*w* glass resistors.

* * *

GENERAL ELECTRIC CO., 1 River Rd., Schenectady 5, N. Y., has published a 10-page booklet, *Capacitors for the Electronics Industry*, (*GED-2620*) describing basic characteristics of specialty capacitors for use in electronic systems.

•

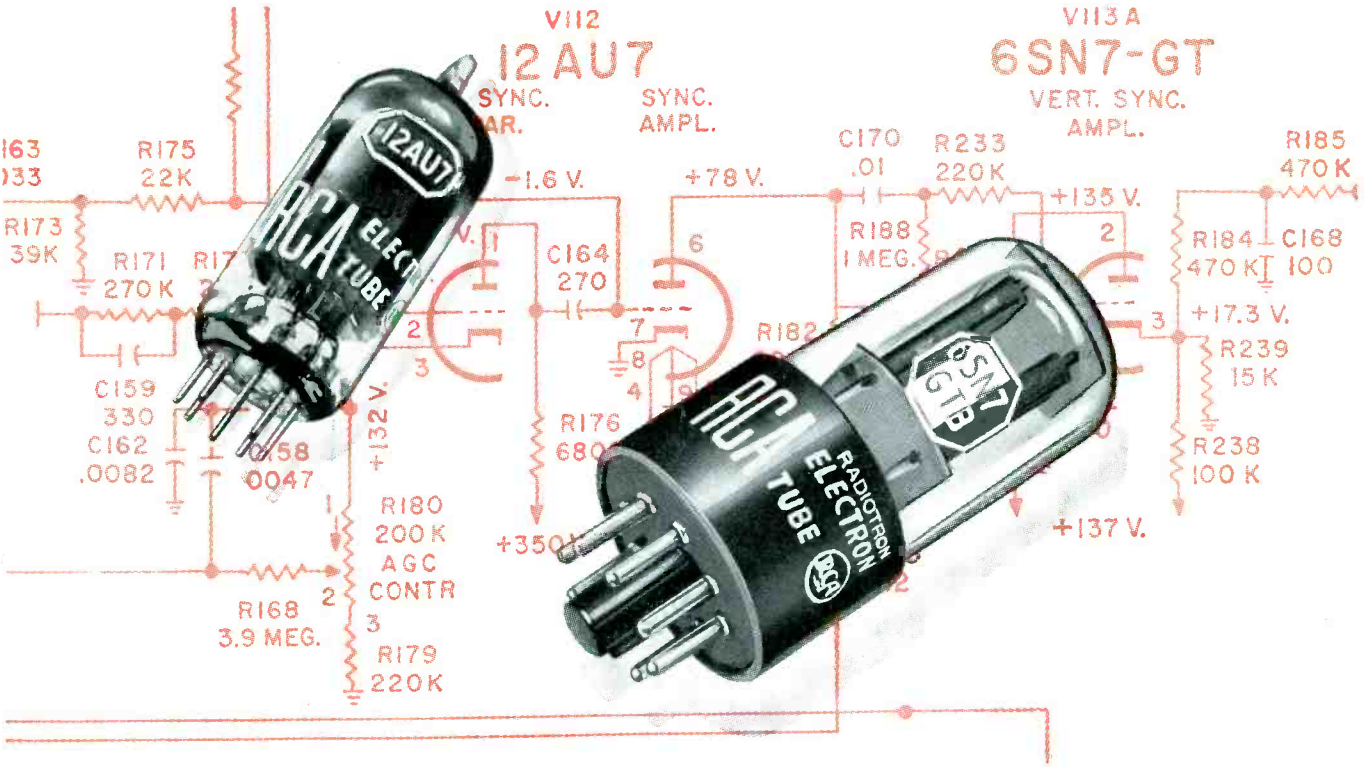
PRICE GUIDE

DAVE RICE'S OFFICIAL PRICING DIGEST (VOL. 1—No. 1): A resale pricing guide containing prices for over 60,000 replacement parts. Pocket-sized, with over 330 pages of consumer-price information. Will be revised every three months.—*3¾"x9¾", priced at $2.50; Electronic Publishing Co., Inc., 180 N. Wacker Dr., Chicago 6, Ill.*

JOTS AND FLASHES

DESIGN TECHNIQUES that will help curb interference from high-power fixed radio transmitters serving mobile units, which occasionally affects TV set performance in certain metropolitan areas throughout the country, are now under study by set manufacturers, employing test facilities of RCA. The tests are expected to reveal whether production models meet standards necessary to discriminate against the radiating signals, or what additional shielding may be required to provide adequate discrimination. Set performance data will be compiled and submitted to RETMA who will prepare a report for the FCC for its information and possible guidance on an interference ruling. . . . *Colonel Richard H. Ranger* has been elected president of the Audio Engineering Society, succeeding *Albert A. Pulley* of RCA. *Walter O. Stanton,* Pickering Co. prexy, has been named executive vice president. . . . Elgin National Watch Co., has established warehouse and distribution facilities at Elgin, Ill., for midwest and eastern distributors handling products of American Microphone Co., and Advance Relay Co., of Pasadena and Burbank, Calif. . . . As a part of a program for the accelerated production of color TV picture tubes, RCA has completed arrangements to purchase an additional 285,000 square feet of building space at Lancaster, Pa. . . . Service Instruments Co., has moved from 422 S. Dearborn St., Chicago, to 171 Official Road, Addison Industrial District, Addison, Ill. . . . Times Wire and Cable Co., Inc., has moved its offices and manufacturing facilities to Hall Ave., Wallingford, Conn. . . . The United Transformer Co., has opened a west coast plant at 4008 West Jefferson Boulevard, Los Angeles, Calif. . . . *Gramer Yarbrough,* sales manager of American Microphone Co., will head the committee for the '56 Los Angeles High Fidelity Music Show, which will be held February 8-11, and will be jointly sponsored by the Institute of High Fidelity Manufacturers and the West Coast Electronic Manufacturers Association. . . . *S. Prall Culviner* has joined the public relations department of Sylvania Electric Products, Inc., 1740 Broadway, New York 19, N. Y., as a project manager. . . . *G. Leonard Werner* has been appointed director of sales of Astatic Corp., Conneaut, Ohio. . . . *John P. Yohe* has been named director of purchases. . . . *John L. Bradley* has been appointed assistant manager of advertising and sales promotion of Ampex Corp., Redwood City, Calif. . . . *John F. Glump* has been elected sales and advertising vice president of Viking Instruments, Inc., East Haddam, Conn. . . . *Richard Johnson* has been promoted to manager of the Syracuse sales office of International Resistance Co. *Thomas E. Davis* is now on the office sales staff. They will cover the New York State area, excluding N. Y. City.

How to "tame" a TV Sync Circuit *FAST*



Use RCA Tubes with Built-In Quality!

For instance, RCA-12AU7's and 6SN7-GTB's are known for their close manufacturing tolerances. Microphonics are minimized. Plate current cutoff is closely controlled. Result: High tube stability—*even during variations in heater voltages!*

It's a fact--you can rely on RCA Tubes to give your customers stable TV pictures. That's because RCA Tubes are designed and manufactured specifically to meet the close tolerance requirements of TV circuitry.

So, insist on RCA Receiving Tubes for *all* your service work.

RADIO CORPORATION of AMERICA
ELECTRON TUBES **HARRISON, N.J.**

First Choice for TV Circuits . . . dependable RCA Tubes