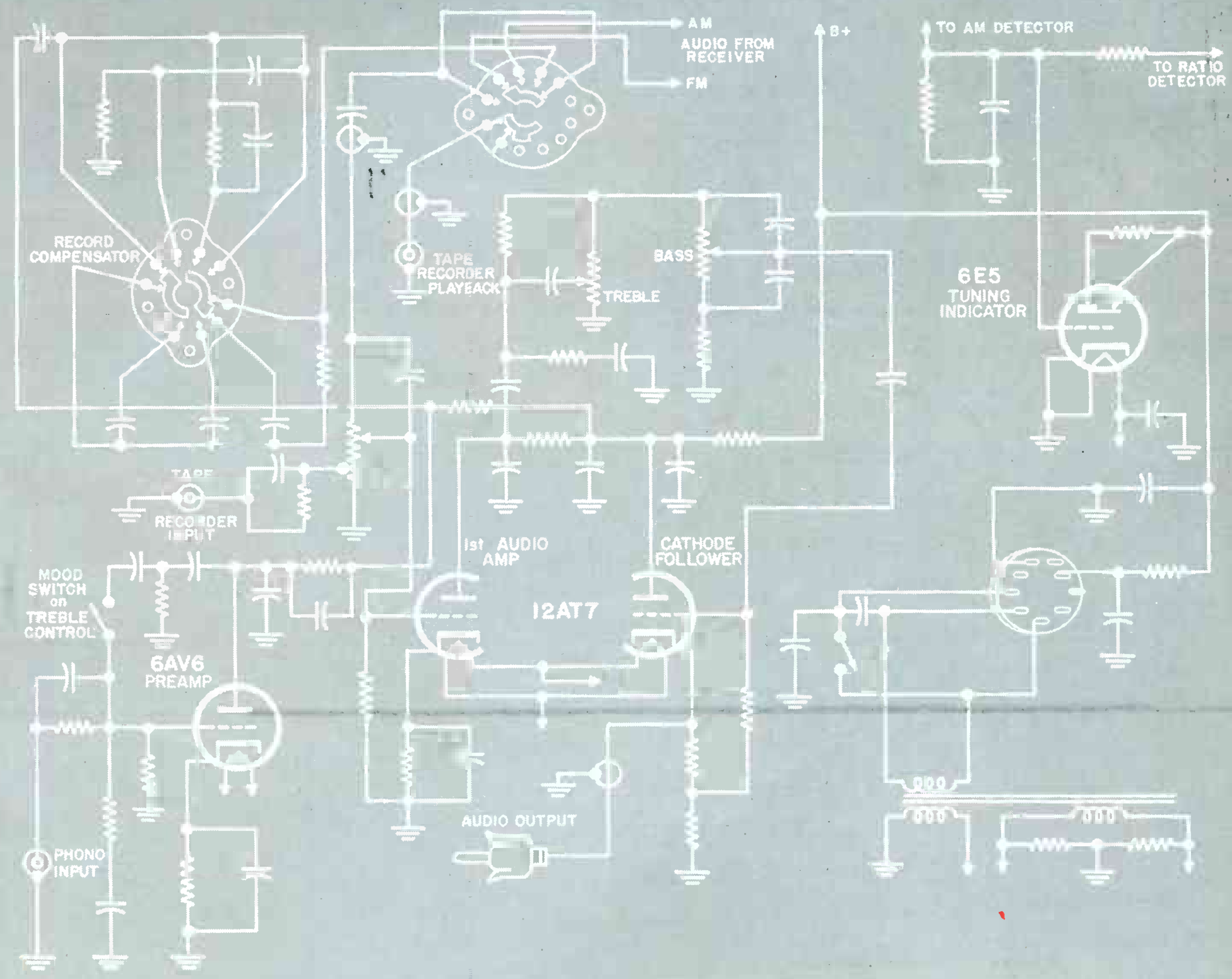
MAY, 1957

ELECTRONIC PARTS DISTRIBUTORS SHOW NUMBER

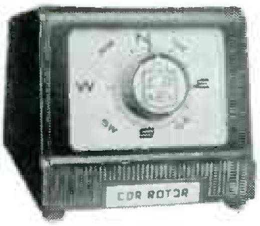
SERVICE

THE TECHNICAL JOURNAL OF THE TELEVISION-RADIO TRADE



Mood-music system on treble control of AM-FM receiver using 25-watt audio amplifier.

See circuit analysis, this issue



AR-22

TR-2

TR-4

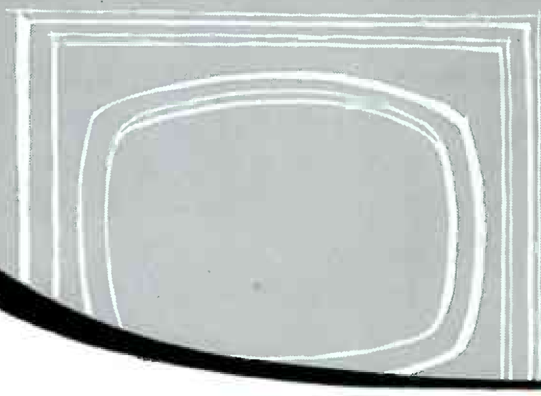
5-star feature...

1 the best color TV picture

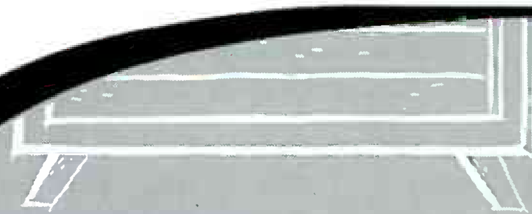
the growth of color TV means an even greater demand for CDR Rotors for pin-point accuracy of antenna direction.

2 a better picture on more stations

CDR Rotors add to the pleasure of TV viewing because they line up the antenna perfectly with the transmitted TV signal giving a BETTER picture . . . and making it possible to bring in MORE stations.



CDR ROTORS



TR 11 and 12

3 tested and proven dependable

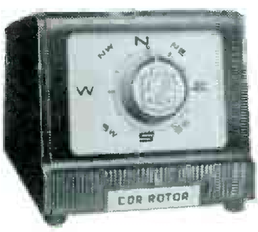
thousands and thousands of CDR Rotors have proven their dependability over years of unfailing performance in installations everywhere in the nation. Quality and engineering you know you can count on.

4 pre-sold to your customers

the greatest coverage and concentration of full minute spot announcements on leading TV stations is working for YOU . . . pre-selling your customers.

5 the complete line

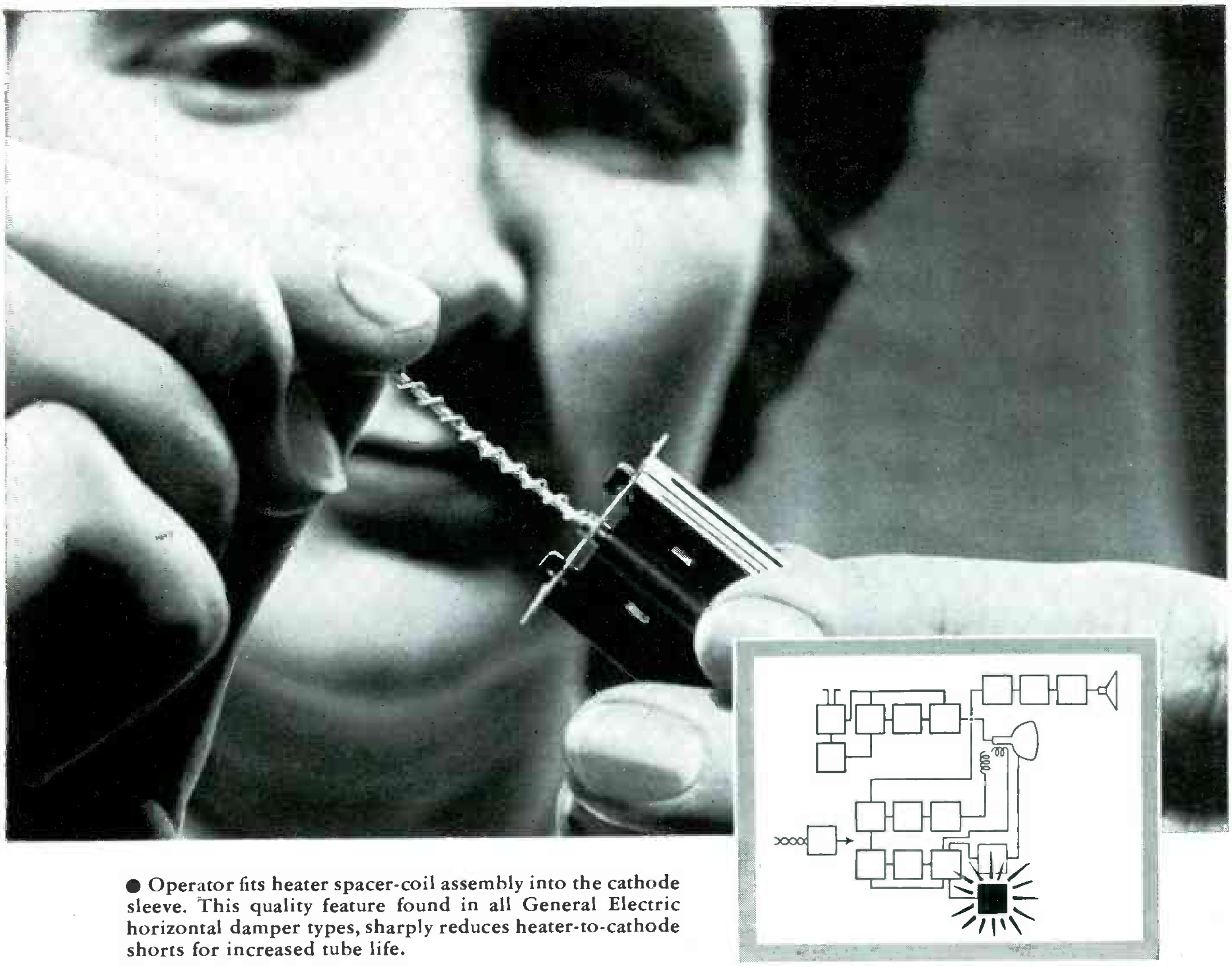
a model for every need . . . for every application. CDR Rotors make it possible for you to give your customer exactly what is needed . . . the right CDR Rotor for the right job.



AR 1 and 2

CORNELL-DUBILIER
SOUTH PLAINFIELD, N. J.

THE RADIART CORP
CLEVELAND 13, OHIO



● Operator fits heater spacer-coil assembly into the cathode sleeve. This quality feature found in all General Electric horizontal damper types, sharply reduces heater-to-cathode shorts for increased tube life.

High quality spacer-coil design cuts heater-cathode shorts, reduces G-E horizontal damper tube failures!

IN all General Electric horizontal damper tubes, a spacer coil permanently centers the heater in the cathode sleeve. This increases electrical insulation between heater and cathode and greatly lessens possibility of heater-to-cathode shorts, the largest single cause of horizontal-damper failure.

Other quality features of General Electric horizontal damper tubes further promote long-life, superior service. Micas are sprayed and slotted to reduce electrical leakage, and improved, highly adhesive cathode coating guards against plate-to-cathode arcs.

Testing is thorough. *All* General Electric horizontal dampers are flyback tested at maximum rated voltages. And, to protect full-life performance under extreme current loads, the tubes are life-tested in actual circuits reflecting severe usage.

Always replace with General Electric tubes! Their uniform high quality will build widespread customer goodwill . . . help bring you increased service business. *Distributor Sales, Electronic Components Division, General Electric Company, Schenectady 5, New York.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

161-1A5

Vol. 26
No. 5
MAY, 1957

SERVICE

THE TECHNICAL JOURNAL OF THE TELEVISION-RADIO TRADE

Including Radio Merchandising and Television Merchandising
Registered U. S. Patent Office

COVER CIRCUIT

FEATURES

CIRCUIT DIAGRAMS

DEPARTMENTS

Second-Class mail privileges authorized at New York, N. Y.; additional entry at the Post Office, Norwalk, Conn. . . . Subscription price: $2.00 per year ($5.00 for 3 years) in the U.S.A. and Canada; 25 cents per copy. $3.00 per year in foreign countries; 35 cents per copy.

AUDITED PAID CIRCULATION ABC

EDITOR and PUBLICATION DIRECTOR

Lewis Winner

Associate Editor: **David E. Pearsall II**
Assistant Editor: **Robert D. Wengenroth**
Editorial Assistant: **Arnold Gewirtz**
Editorial Assistant: **Howard Jennings**
Art Director: **Anthony R. Aliffi**
Supervisor, Circuit Diagrams: **Michael D. Bellezza**
Editorial Production: **Astrid Kelly**

•

CIRCULATION DEPARTMENT

Circulation Manager: **A. Goebel**
Ass't Circulation Mgr.: **A. Kiernan**

•

ADVERTISING DEPARTMENT

Advertising Mgr.: **Aaron L. Lefer**

Pacific Coast: **Leo Sands,** Dist. Mgr.
535 Ramona St.
Palo Alto, Calif.:
Tel.: DAvenport 5-3716

Published Monthly by
Bryan Davis Publishing Company, Inc.
52 Vanderbilt Ave., New York 17, N. Y.
Tel.: MUrray Hill 4-0170
B. S. Davis, Pres. Lewis Winner, Vice-Pres.

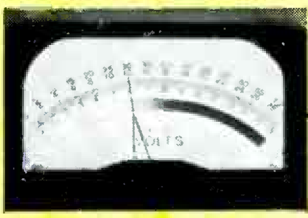
5

Sylvania IF Amplifier Tubes

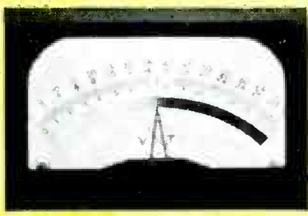
"fixed-bias" tested

In determining the plate current (I_b) and Transconductance curves, grid bias is fixed at three points. These points, representing conditions of weak, average, and strong signals establish the nature of the plate current characteristic curve. The "fixed bias" points selected vary according to tube type.

Low "fixed bias" point at −1 volt (bottom scale)



Mid-range "fixed bias" point at −3 volts (top scale)



High "fixed bias" point at −7.5 volts (bottom scale)

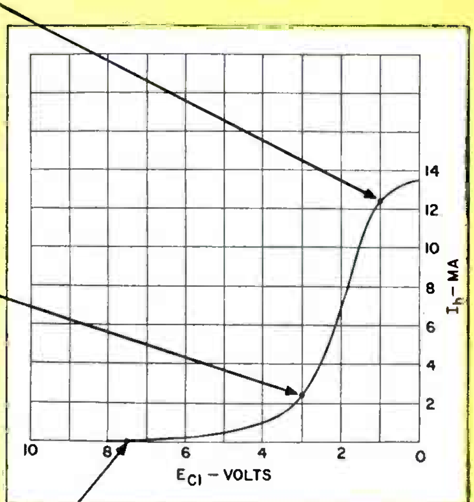


Plate current characteristics, shown on this typical test curve, are carefully controlled by the "fixed bias" test, assuring good performance and stable AGC functioning over a wide range of TV signal conditions.

Dynamic TV set conditions are set up in these test bridges making the "fixed bias" test a true measure of how the tube will perform in TV sets encountered by you in the field.

for stable performance and service dependability

IT HAS always been Sylvania's policy to search for new and better ways to test tubes under dynamic conditions for closer control over performance. The "fixed bias" test is typical of these techniques. It places a more stringent, realistic measure on the tube's ability to perform under varying circuit conditions.

By controlling the plate current characteristics and transconductance of IF amplifier tubes, the "fixed bias" test gives the serviceman an extra measure of dependability regardless of make, model, or age of the TV set serviced.

The range of stable operation is controlled, too, for smooth AGC action over wide variations in signal strength.

These are the same reasons that Sylvania IF types are the choice of leading TV set manufacturers, attested by the wide assortment of Sylvania original types listed among IF tubes now in popular use.

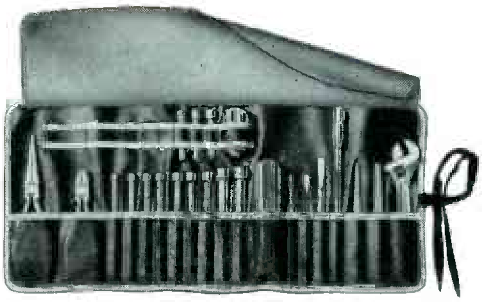
In addition to the "fixed bias" test many other electrical tests are performed on Sylvania IF amplifier types including stability during life. During life tests, close controls are placed on interelectrode leakage.

In every way, Sylvania IF amplifier types offer you maximum assurance of trouble-free service based on sound, newly developed testing methods. Specify Sylvania IF amplifier tubes in the new yellow and black carton.

SYLVANIA

SYLVANIA ELECTRIC PRODUCTS INC.
1740 Broadway, New York 17, N. Y.
In Canada: Sylvania Electric (Canada) Ltd.
University Tower Bldg., Montreal

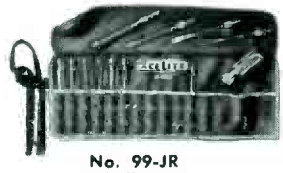
LIGHTING • RADIO • ELECTRONICS • TELEVISION • ATOMIC ENERGY



"99" TOOLS

cover the full range of electronic servicing — 3 popular "99" roll kits — the 26 individual "99" tools shown — plus distributor backup stock kits.

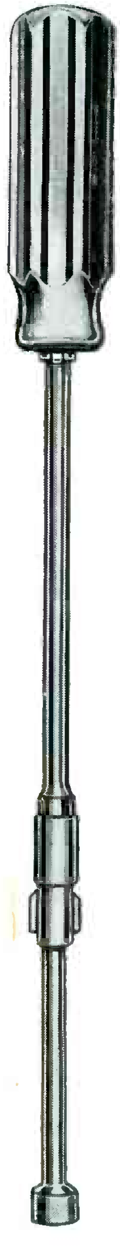
New! No. 99 S.M. Kit — 21 tools



No. 99-JR
Roll Kit
— 11 Tools

No. 99-PR
Roll Kit
— 13 Tools

XCELITE



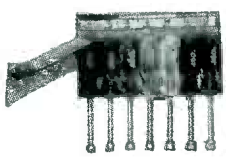
Toolmanship . . .
Preferred by All Hands!

From individual screwdrivers, nut drivers and pliers to the big new No. 99 SM Service Master Kit, there's a bonus of craftsmanship and imagination that makes every XCELITE hand tool "preferred by the experts."

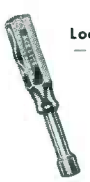
Besides its regular popular line, XCELITE brings you a continual supply of new and original tools — the new No. 99-X10 Snap-in Shaft Extension — reamers with the T-handle leverage feature — pocket clip nut drivers and screwdrivers — adjustable wrenches and "special-purpose" pliers.

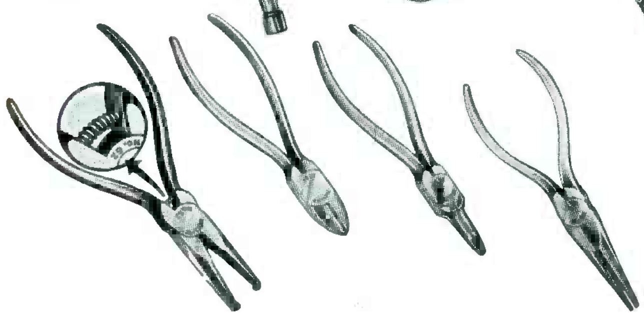
See the latest
— as well as the
"tried and true"
— at the

PARTS SHOW
BOOTH 592!



No. 127
Lockable Wall Kit
— 7 Color Coded
Nutdrivers





SERIES "99" TOOLS

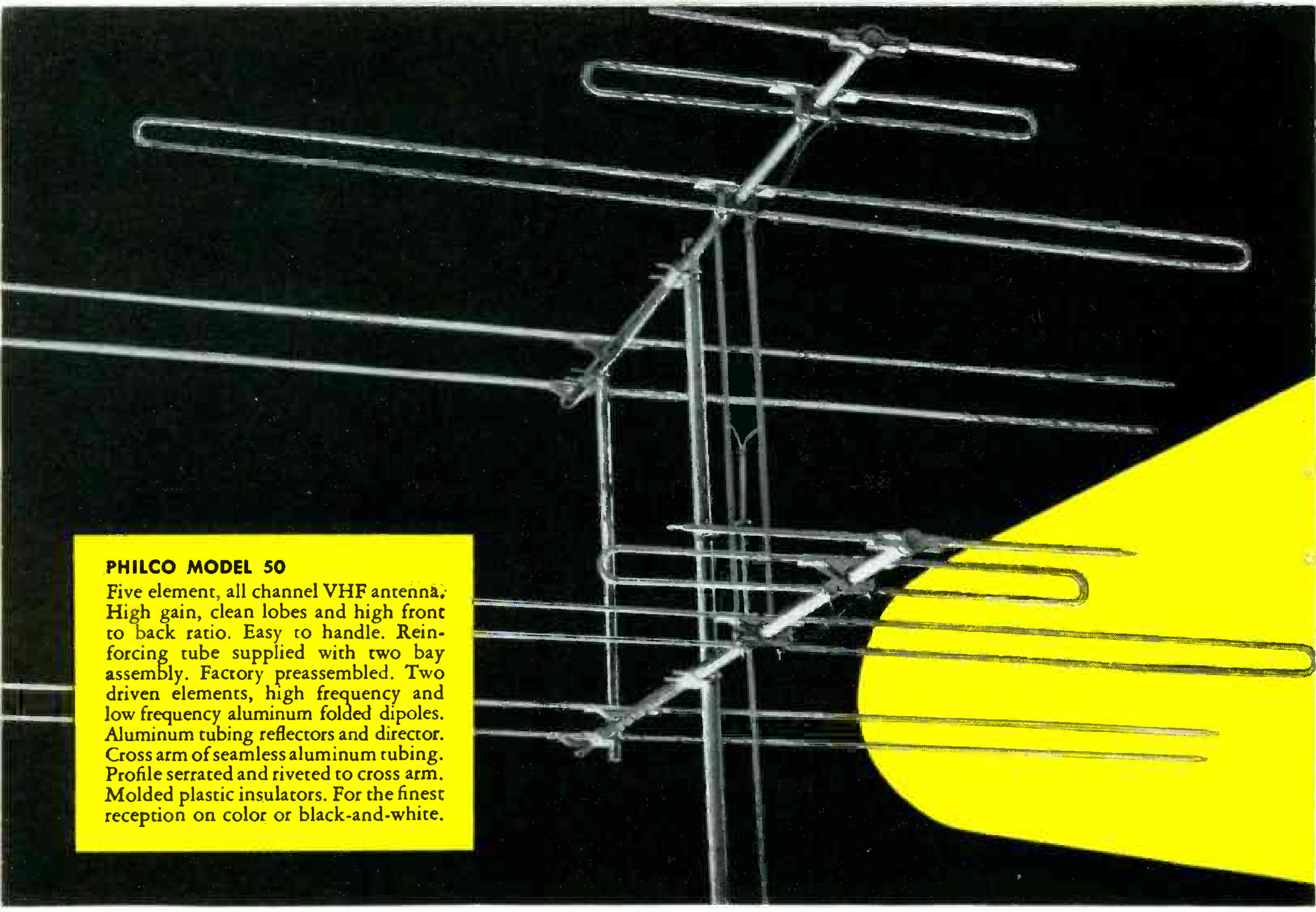
No. 99-1	Handle (Regular)
No. 99-2	Handle (Junior)
No. 99-3	Handle (Stubby)
No. 99-6	3/16" Nut Driver
No. 99-7	7/32" Nut Driver
No. 99-8	1/4" Nut Driver
No. 99-9	9/32" Nut Driver
No. 99-10	5/16" Nut Driver
No. 99-11	11/32" Nut Driver
No. 99-12	3/8" Nut Driver
No. 99-14	7/16" Nut Driver
No. 99-16	1/2" Nut Driver
No. 99-81	3/16" & 9/32" Slotted, Reversible
No. 99-82	#1 & #2 Phillips, Reversible
No. 99-83	3/16" & 9/32" Frearson, Reversible
No. 99-84	3/16" Clutch "G," Reversible
No. 99-811	3/16" Slotted
No. 99-812	9/32" Slotted
No. 99-821	#1 Phillips
No. 99-822	#2 Phillips
No. 99-38	Reamer (1/8"-3/8")
No. 99-39	Reamer (1/4"-1/2")
No. 99X10	Extension

Stubby Nut Drivers
No. 99-S8 No. 99-S10 No. 99-S12

XCELITE, INCORPORATED

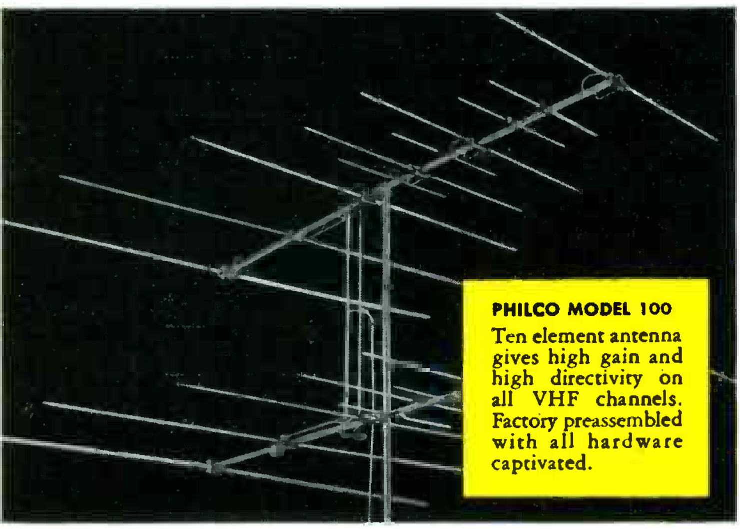
ORCHARD PARK, NEW YORK

In Canada — Charles W. Pointon Ltd., 6 Alcina Avenue, Toronto, Ontario



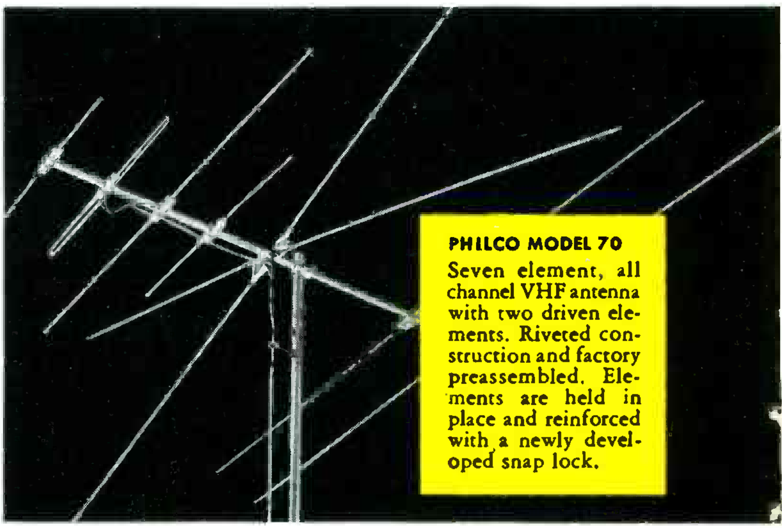
PHILCO MODEL 50

Five element, all channel VHF antenna. High gain, clean lobes and high front to back ratio. Easy to handle. Reinforcing tube supplied with two bay assembly. Factory preassembled. Two driven elements, high frequency and low frequency aluminum folded dipoles. Aluminum tubing reflectors and director. Cross arm of seamless aluminum tubing. Profile serrated and riveted to cross arm. Molded plastic insulators. For the finest reception on color or black-and-white.



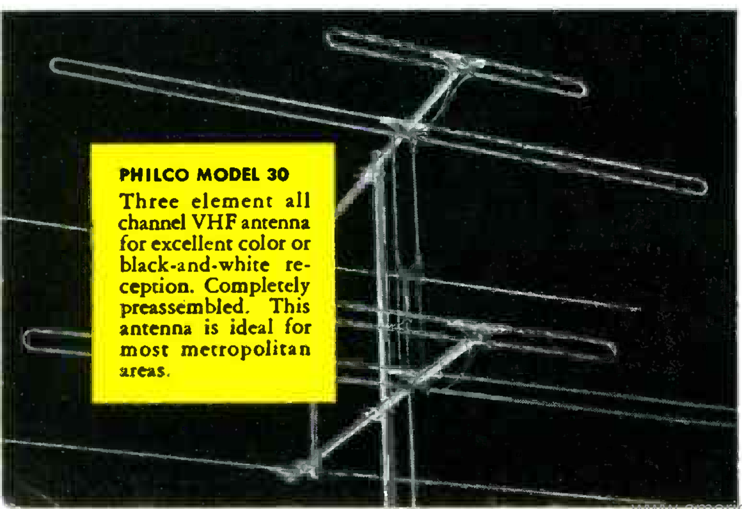
PHILCO MODEL 100

Ten element antenna gives high gain and high directivity on all VHF channels. Factory preassembled with all hardware captivated.



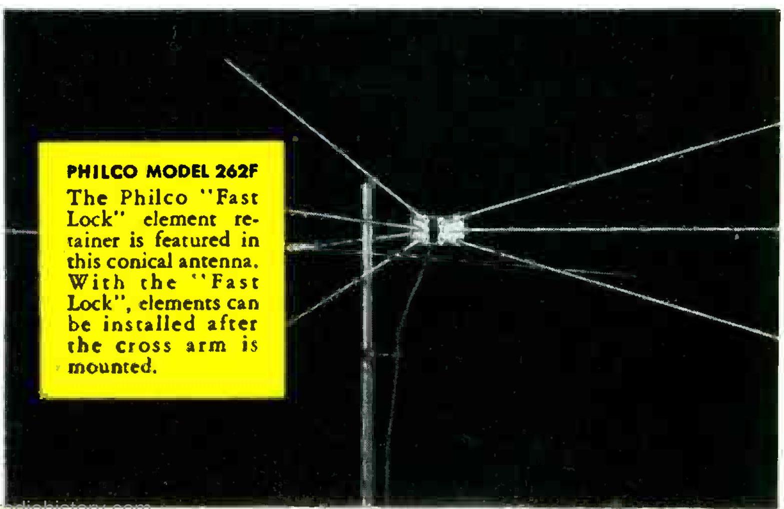
PHILCO MODEL 70

Seven element, all channel VHF antenna with two driven elements. Riveted construction and factory preassembled. Elements are held in place and reinforced with a newly developed snap lock.



PHILCO MODEL 30

Three element all channel VHF antenna for excellent color or black-and-white reception. Completely preassembled. This antenna is ideal for most metropolitan areas.

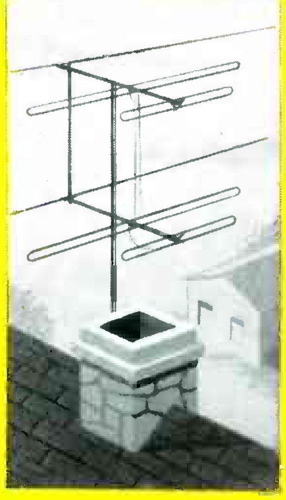


PHILCO MODEL 262F

The Philco "Fast Lock" element retainer is featured in this conical antenna. With the "Fast Lock", elements can be installed after the cross arm is mounted.

Mr. Service Dealer

BIG NEWS from PHILCO!



Fringe tested, color tested TV Antennas, now at volume prices!

Give picture power equal to antennas priced two to three times higher. Compare! Now, Philco brings you a complete line of quality antennas with a wide range of models to give outstanding performance over the entire VHF range. These antennas were designed and engineered to reproduce the best pictures whether in strong signal areas or far out into the fringe and whether receiving a picture in color or black and white. In many locations you can give your customers stations they never received before. Field and laboratory comparison tests conducted under the most exacting circumstances on actual on-the-air programs give you the complete insurance that you can always sell Philco antennas with complete confidence in any TV area.

Philco Super Power TV Antenna ROTORS

color or black-and-white at its best

P11 CONTROL
Manually operated antenna rotor that will easily handle two bays. Designed for years of dependable service. Fits masts up to 1⅜" diameter.

P4A CONTROL
A heavy duty rotor. Accurate direction control provided by manually operated motor switch and indicator meter. Plastic cabinet of modern design.

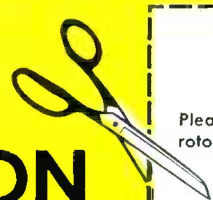
AP22 CONTROL
Heavy duty, long-life automatic rotor with new automatic control unit providing dependable and fool proof operation. Also available as AP1.

P11
AP1
Rotor

P4A
AP22
Rotor

a complete line, Mr. Service Dealer, for every installation need!

Get the full story on Philco antennas and rotors with more quality and performance for your dollar. See your local Philco distributor or mail this coupon now!



PHILCO® CORPORATION

ACCESSORY DIVISION • PHILA. 34, PA.

Philco Corporation Accessory Division
"A" Street and Allegheny Ave.
Philadelphia 34, Pa.

Please send me information on Philco antennas and rotors with more performance per dollar.

NAME ____________________

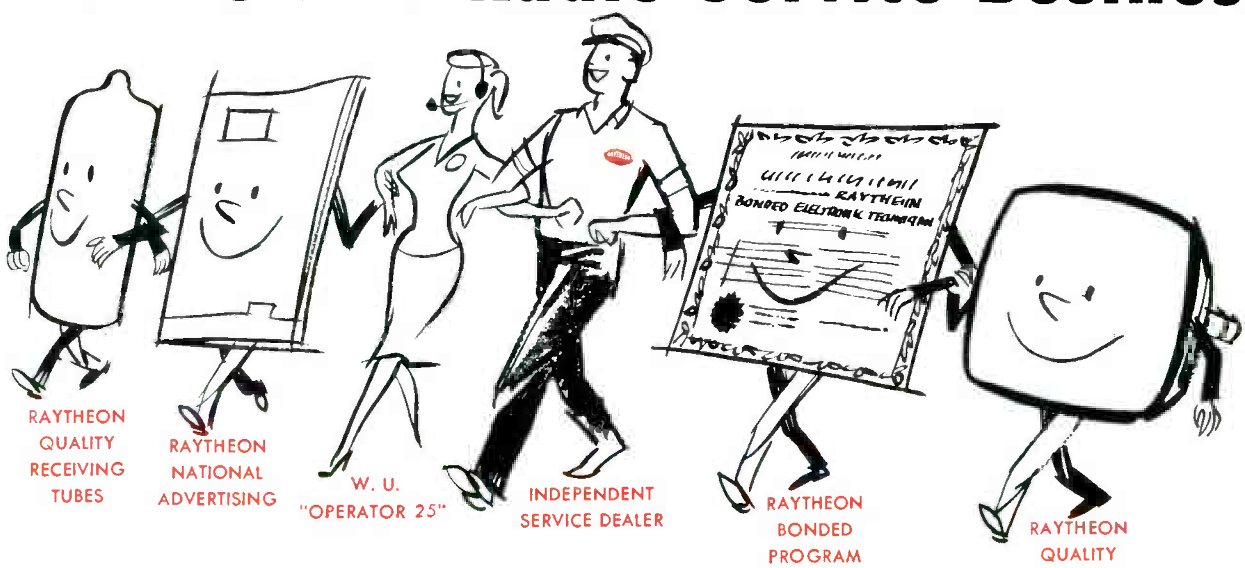
ADDRESS ____________________

CITY ____________ ZONE ______ STATE ______

S-557

How RAYTHEON Helps

Independent Service Dealers with their TV-Radio Service Business



Here are some of the many ways in which the makers of Raytheon TV and Radio Tubes help the Independent Service Dealer with his business.

1 For nearly *12 years* Raytheon has offered the Raytheon Bonded Electronic Technician program to Independent Service Dealers. Dealers who qualify have their service and parts guarantee backed by a bond issued through Continental Casualty Company, one of the country's largest insurance companies. It gives them real prestige in the eyes of the customer.

2 Raytheon provides "Western Union Operator 25" service for Bonded Dealers in 23,000 cities and towns. In answer to phoned requests for fast, dependable, *bonded* TV-Radio service, "Operator 25" sends customers to Bonded Dealers.

3 Raytheon consistently runs national advertising, presenting Independent Service Dealers as the best in the business.

4 Raytheon has a network of *independent* distributors with well trained personnel who are eager to help *independent* dealers.

5 Raytheon makes a complete line of TV and Radio Tubes that are tops for replacement work — Raytheon All-Set Tubes — designed to help the versatile service dealer who repairs all makes and models.

For the whole Raytheon story, get in touch with your nearest Raytheon Tube Distributor.

TV-Radio service is *your* business . . . serving *you* is ours

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 and Transistors, Nucleonic Tubes, Microwave Tubes.

RAYTHEON ®

Excellence in Electronics

26th Year of Continuous Publication

SERVICE

THE TECHNICAL JOURNAL OF THE TELEVISION-RADIO TRADE

Recognition For The Parts Distributor

In this rapidly expanding industry of ours, which has soared into the multi-billion-dollar class, one group merits special commendation for an outstanding job that is contributing much to this growth—the parts distributor.

To the Service Man, these achievements are particularly significant. They spell dynamic vision, so vital to the success of all service shops. It is not only this awareness of the problems of the day, but a willingness and ability to cooperate, that makes the distributor a valued associate and friend of the Service Man. Whether the situation is technical, or one involving merchandising, warehousing, delivery, accounting, credit or public relations, the distributor is usually well equipped to lend a hand.

In this complex technical age, prompt availability of the variety of advanced-designed products—be they components, test equipment or accessories—is extremely important. Distributors are the source of vast stocks of literally thousands of items—available not only in central depots, but in branches strategically located to expedite handling and delivery. Successful, proper and, in most cases, cordial credit arrangements are effected and maintained between the manufacturer upon the one hand and the service shop upon the other.

Knowing that service men are busy people, many distributors send sales crews out to visit shops—trained sales crews who are not only able to discuss new products and check inventory, but to resolve problems involving business trends, displays, advertising and sales promotions, and credit. Like those at the counter, in the stockroom or in the sales office, these field men have been schooled in modern technical and business practices, and are equipped to render sound counsel.

In order to supply professional technical advice on latest developments, a number of distributors maintain carefully supervised laboratories in which new test equipment, tools and components can be thoroughly investigated. Under critical study are the newest types of products, such as semiconductors, packaged electronic assemblies, printed-wiring boards, wide-angle picture tube parts; as well as equipment for color-TV, audio, commercial sound, closed-circuit and community-TV, transistor radios and two-way.

Headlined also by distributors is an all-out preference for standard-brand merchandise—a refusal to buy and sell unbranded and unknown products—and consistent compaigns to discourage the purchase of any merchandise of doubtful quality or origin. This progressive policy is vital to the Service Man; it not only makes it possible for him to do a better and faster job, because he has a dependable product on hand, but it is insurance against costly callbacks.

Another timely assist offered by distributors, highly prized by Service Men, are the numerous merchandising tips. Many distributors offer special bulletins describing field-tested promotional aids that can be used to develop more business. Covering the subject of advertising, one recent memo to Service Men pointed out that one doesn't necessarily have to advertise in newspapers, or on radio or TV—though depending upon one's market and scope of operation, these media have their place. But, the bulletin emphasized, one should resort to constantly changing displays to attract customers, to mail and to telephone follow-ups. And, the field memo added, the best advertising is word-of-mouth, passed along by satisfied customers who have enjoyed friendly and efficient service.

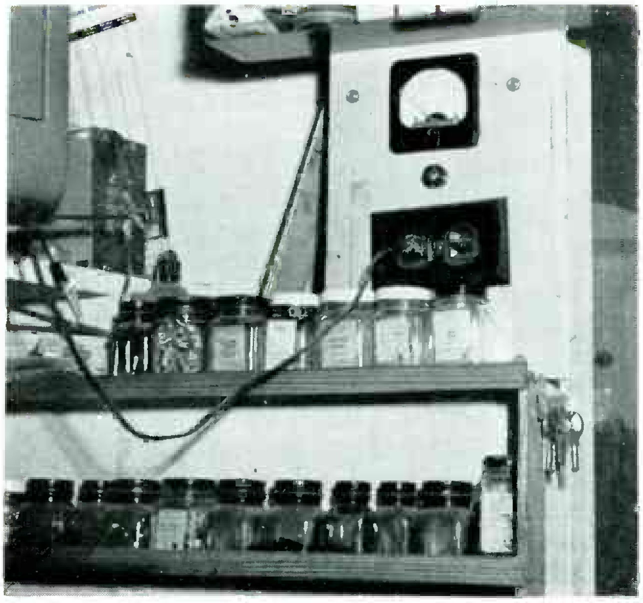
Also contributing to the progress parade is the active participation by distributors in cooperative educational and promotional drives designed to boost the independent service shop.

Ever alert to the changing scene, the distributors of the nation are constantly on the go, attending industry meetings, conferences and clinics. Once again, this year, they'll travel to the annual parts show in Chicago, the huge market place of ideas, where the latest components for installation, maintenance and repair will be on exhibit. And, as usual, they'll return armed with helpful front-line information for their most important customer—the Service Man.

The parts distributors certainly deserve recognition for their resourcefulness and their conscientious efforts to help all Service Men.—L. W.

Tracing Receiver Troubles

How To Use Wattmeter, Ammeter and Milliammeter To Locate Defects In



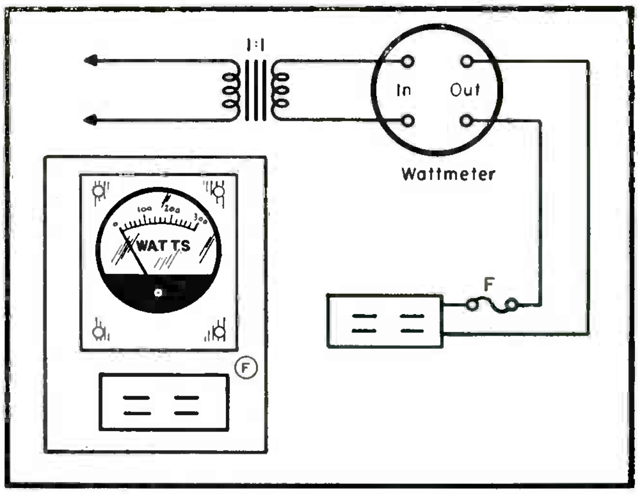


FIG. 1: WATTMETER with outlet mounted on wall of service shop close to TV end of bench; an extension from the outlet is wired to the bench proper, in parallel. Fusepost just below wattmeter holds 5-ampere fast blow fuse for meter protection against overloads.

by JACK DARR

One of the most useful measurements that can be made in a service shop is that of power input. If the power drawn from a source is excessive, there is trouble ahead, regardless of performance. Overloads, partial shorts and leakages might initially degrade performance only slightly, but eventually contribute to the cause of future troubles, leading to frequent callbacks.

The basic equipment needed for the power checks involves three items: A wattmeter reading up to 300 watts, that will take care of practically all requirements for any *ac*-powered apparatus from the smallest *ac/dc* radio to the largest TV set; an 0-30 *dc* ammeter to service auto radios, mobile amplifiers and even two-way radio sets, and a milliammeter in the bench *vom* to check battery-operated radios of any type.

The smallest, although not necessarily the simplest item that requires power checks, is the transistor portable that should always be tested for excessive battery drain. To perform this test the milliammeter should be connected in series with one of the battery leads and the current measured. In the Regency TR-1 transistor portable the correct battery drain is from 3.5 to 4.6 ma. Any reading above this should be investigated; a leaky filter is the most common cause of trouble here, as low-voltage filters used in transistor sets are subject to leakage problems. Other sets using the same number of transistors will have approximately the same drain.

Battery sets, such as those on farms, must also be checked carefully. Inserting a milliammeter in one of the B-battery leads will provide a quick check on the set's condition. This measurement should be taken often, especially when there are complaints about short battery life.

Many factors can affect current drain in a conventional battery set circuit; leakage in the filter capacitor, or in one of the few bypass capacitors. A more common cause is interelectrode leakage in the power tube, which uses over 80% of the total current drawn by the whole set. Leakage here upsets the bias, causing the tube to draw heavy currents. A change in the value of the bias resistor, or leakage in the coupling capacitor on the grid, can also upset the bias. Checks should be made with a *vtvm*, by measuring the grid voltage on the output tube; readings should always be negative, the actual value depending upon the type of tube used. The common 3Q5 or 3Q4, for instance, uses 4.5 *v* on the grid. A reading of only 2 volts would be reason for suspicion of leaky coupling. After servicing, the battery drain should be rechecked. For a four-tube set, readings run from 7-8 ma at normal volume; in a 5-tube set readings might go as high as 10 ma.

Auto-radios, being battery operated, can be easily checked, with an ammeter. Any troubles in the power supply circuits will show up on this test. If a portable ammeter is available many common troubles can be diagnosed, without even removing the set from the car. (A number of *vom's* provide a 10-ampere range which is just right for this test.) For instance, if a set refuses to operate, even though the vibrator is running, and the ammeter shows a reading of 15-20 amperes, the buffer is almost certain to be the culprit; it's either shorted or leaking badly.

This test will also spot open vibrators. If a reading of about 3-4 amperes is obtained and there is no vibrator sound, but the filaments are lit up, the vibrator is open. The new hybrid sets, using the low-voltage tube types, transistor output and no vibrator warrant careful attention. The 12-volt sets, for instance, draw much less current than the older 6-volt types. To illustrate, a 12-volt set with 8 tubes would draw about 3-5 amperes, as compared to the 6-10 amperes drawn by the same set

With Input Power Tests

Transistor-Tube Home-Auto Radios, TV Chassis, and Mobile Equipment

using 6-volt tubes. Actually, the total wattage is the same, but because the voltage has been doubled, the current drain is halved.

Even the common *ac/dc* radio may be checked quickly using an *ac* wattmeter. This instrument should be installed on the service bench, at an accessible location and connected to a convenient outlet. For quick confirmation of a suspected open fila- into the wattmeter outlet; no reading ment string, the set can be plugged means no continuity. Tubes should also be checked using one of the checkers made for TV tubes. (Incidentally, the order of failures, in almost all cases, seems to be: Rectifier, power tube, second detector, *if* amplifier and mixer-oscillator.)

Replacement of a dead tube should develop a meter reading, indicating immediately that the trouble has been spotted. This report can also be a timesaver in those cases where the filament string is not open. For instance, if a surge resistor has opened and cut off the *B* supply, the meter will reveal only the drain of the filament string. This will average 10 to 12 watts. The normal reading for the common 5-tube *ac/dc* radio without a clock, should be from 28-35 watts. Clock drains are small; 3-5 watts. The low reading assures one that the filament string is complete and that there is trouble elsewhere. The rectifier tube should be checked for an open cathode ribbon; if this shows up, the set should be checked for shorts. (This can be done from the top of the socket by measuring the resistance from the cathode to one side of the line plug.) If nothing shows up, the tube should be replaced. If there still is no sound and the same low drain obtains, checks should be made for open surge or open filter resistors.

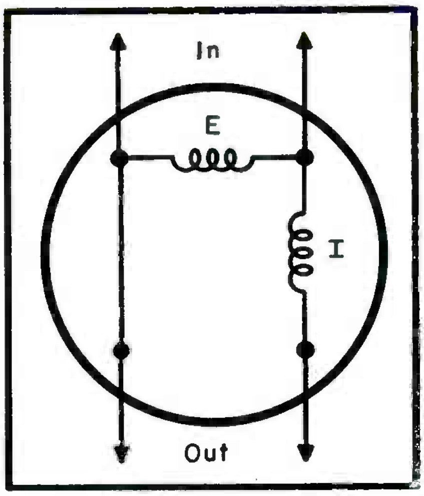


FIG. 2: BASIC CIRCUIT of ac-wattmeter setup. Instrument has four terminals; two input and two output, necessary because of internal circuitry. Wattmeter must combine functions of both a voltmeter and an ammeter. Therefore, a true wattmeter has voltage and current coils, effects of which are combined, so that, in effect, instrument multiplies the voltage across its terminals by the current flowing through them providing the product as a meter reading.

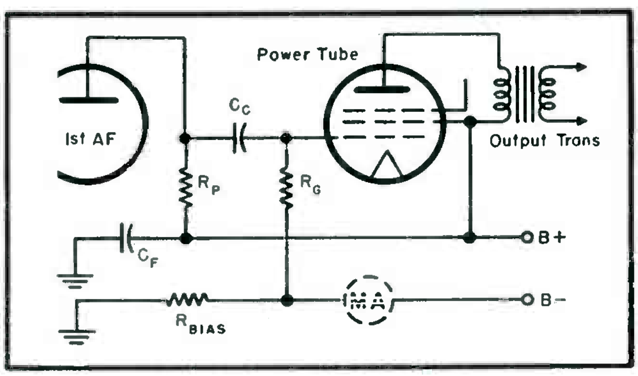
Other troubles also show characteristic drains. For instance, normal current with no sound might indicate an open voice coil on the speaker; no sound with a drain of 40-50 watts might be caused by a leaky power tube (50L6 or 50B5), a leaky coupling capacitor, or a shorted plate bypass capacitor on this tube. The resistance of the output-transformer primary winding would prevent the rectifier tube from being blown. Readings of only 3-5 watts below normal, with no sound, might indicate an open output-transformer primary winding.

The *ac*-operated sets may be analyzed in similar fashion. Wattage will be higher due to the added power. Although the rated wattage is or should be shown on the set label, a good approximation can be made by applying a base of 10 watts per tube and 10 for the transformer. Thus, in a 6-tube set, the wattage may be expected to run about 70 watts. Usually, it will run a little less; averaging around 65 watts. In these chassis, as in the *ac/dc* models, lower than normal readings indicate troubles in the power supply, with some stages being cut off completely. A reading of about 50% normal would probably indicate no voltage on the power output tube; a 20% low would indicate no screen voltage in the front end. What is more common and more dangerous, are the higher than normal readings; such readings always indicate trouble. If the reading is 10% to 15% too high, one should look for leaky coupling capacitors in power stages, heater-cathode leakage in power tubes, or filter or bypass capacitor leakage.

Wattage tests can also be used to locate internal shorts in the power transformer. If the transformer shows definite signs of overheating, with wax running out, but all voltages are close to normal, one must determine whether the fault has been caused by an external short circuit or by a breakdown in the transformer itself. With a wattmeter setup, one can

(*Continued on page* 46)

FIG. 3: TYPICAL BATTERY-set power supply, including output stage, where most power troubles occur. By inserting a milliammeter in the B— or B+ leads, one can check battery drain. If the bias resistor (R_{BIAS}) is off value, or if the coupling capacitor (C_C) is leaky, the power tube will be forced to draw excessive current. If the filter (C_F) is leaky, it will cause excessive drain. Normal drain for an average 4-tube set should never be over 8 ma at medium volume.



AM - FM Radio-Phono With

Analysis of Chassis That Features A 25-Watt Amplifier — 3-Speaker System, Remote Equipment And A Mood-Music Switch That Provides Wide-Range Reproduction At Low Levels

by C. C. KAYHART, Service Training Director, The Magnavox Company

THE RISING INTEREST in audio has prompted the design of complete radio-phono systems that include high-power amplifiers, multi-speaker setups, AM-FM tuners, plus remote control.

The circuit of a combination radio-phono[1] with the foregoing features and such innovations as a mood-music channel appears in Figs. 1, 2 and on the *cover* of this issue.

Remote Speakers

A hi-fi type of listener is often asked why he must use so much volume. The answer is that there is more realism in the music when heard at high levels. It cannot be denied that he is correct, but in the interest of harmony at home, such practice is advisedly limited to rare periods of solitude. One solution would be the use of remote speaker facilities which enable one to shut off the speakers in the cabinet and turn on the remote units installed elsewhere, perhaps in the bookshelf of the den, where one can listen in comfortable isolation.

In the chassis diagrammed, the remote speaker systems were designed to work in conjunction with single or dual-channel amplifiers. The systems consist of bass and treble speakers carefully integrated with acoustically designed enclosures. The speaker cabinet has been dimensioned for convenient placement in standard bookshelves, should this be desirable. A terminal strip on the power amplifier provides for a convenient connection to the remote speaker system.

The Mood Switch

There are other times when one would like soft background or *mood* music for dining, for reading or even conversation. This mode of listening must be done with low output if the music is not to intrude on any basic activity; but it is apparent to anyone who has tried this that something more than just a reduction in loudness is desirable, if the mood music is to add to the activity without being distracting.

To resolve this problem, engineering has devised a *mood-music* system.

The mood-music feature is placed into operation by a pull switch on the treble control and is performed electrically by a high-pass filter network (C_{177}, R_{168} and C_{176}) between the plate and grid circuit of the 6AV6 phono preamplifier. This filter provides feedback of the middle and high frequencies from the plate to the grid circuit. The phasing of the feedback circuit causes degeneration in the grid circuit and reduces the amplification at these frequencies. Since low frequencies are blocked by the high-pass filter circuit, they are not affected and the net result is an increase in low-frequency response below 800 cycles relative to the response at all higher frequencies. The relative change in response due to the *mood-music* switch is shown in the response curve; Fig. 1a.

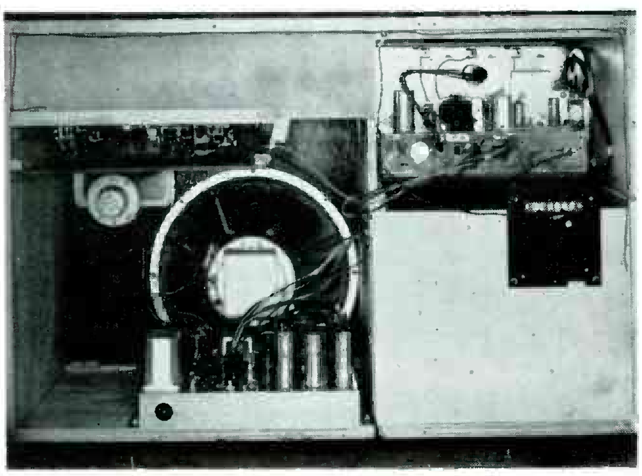
For serious high-fidelity listening at all levels the *mood-music* switch must be in the *open* position to restore the response to normal.

Phono

A 4-speed automatic record changer incorporated in this model was chosen for its low wow, flutter and rumble characteristics which are of essential importance when driving a high-powered, wide-range system. The physical mass of the changer has also been found to be sufficient to allow operation at full output without degrading effects of acoustical feedback from the speakers to the pickup.

The changer is equipped with a pickup having a diamond stylus for microgroove and a sapphire stylus for standard groove records. This pickup contains a ceramic type element. Compliance characteristics provide for excellent tracking throughout the frequency range with a stylus pressure of 7 grams.

The output of the pickup has been compensated to conform with the recording characteristics (*RIAA*) man-



REAR VIEW of radio-phono combination that features a mood-music system.

[1]*The Magnavox Continental model 295C*

The power output ratings described in this report refer to rms power outputs at approximately 2% total distortion. Some use peak power figures to rate their amplifiers. To illustrate, 20-watt amplifiers have been rated at 40 watts peak-power output. This figure is arrived at by multiplying the rms power by (1.414)².

Mood-Music Control

[See Front Cover and Page 16 for Complete Circuit]

ufactured into present day records. This compensation is provided by an *rc* network (C_{140}, R_{138}, C_{172} and R_{169}) located between the phono input receptacle and the 6AV6 phono preamp on the radio chassis. Additional compensation to take care of variations in recording characteristics between various makes of records, is provided by a four-position compensator switch and appropriate *rc* equalizing elements in the plate circuit of the preamp: *RIAA* for most records now made in this country; *LP* for early-type long-playing records; *EUR* for records made in Europe, *78* for most *78* recordings. The *78* position provides a considerable cut in high-frequency response, making it useful for reducing noise from any badly-worn record.

Radio Chassis

The radio chassis[2] contains the AM-FM tuner, phono preamp, first audio amp, cathode follower and all operating controls. Plate power for the radio chassis is provided from a main power supply contained on the power amplifier chassis. Filament power is obtained from a separate filament transformer mounted on the chassis, which contains two separate heater windings; one winding that supplies the 6AV6 phono preamp and the 12AT7 first audio, and cathode follower is balanced to ground in the interest of hum reduction.

Two separate mixer-oscillator circuits are used to provide stability and low noise level. The FM mixer-oscillator is a 6U8. Its triode section functions as an oscillator whose stability is further enhanced by carefully-controlled thermal compensation. The pentode section provides high gain as a mixer and minimum coupling of the oscillator signal between grid and plate, which minimizes undesirable oscillator radiation from the chassis. Total oscillator radiation is held well under FCC requirements by isolation of the oscillator signal from the antenna circuit.

The AM mixer-oscillator is a 6BE6. Radio-frequency amplification is provided for both FM and AM by a 6BZ6 pentode. A 3-section function switch, controlled from the front panel of the radio chassis, affords switching between AM and FM. All *rf* circuit switching is done at *dc* with the exception of the *rf* grid circuit. This feature permits the *rf* circuits to be carefully confined for minimum regeneration, allowing for higher circuit gain, while still maintaining good stability.

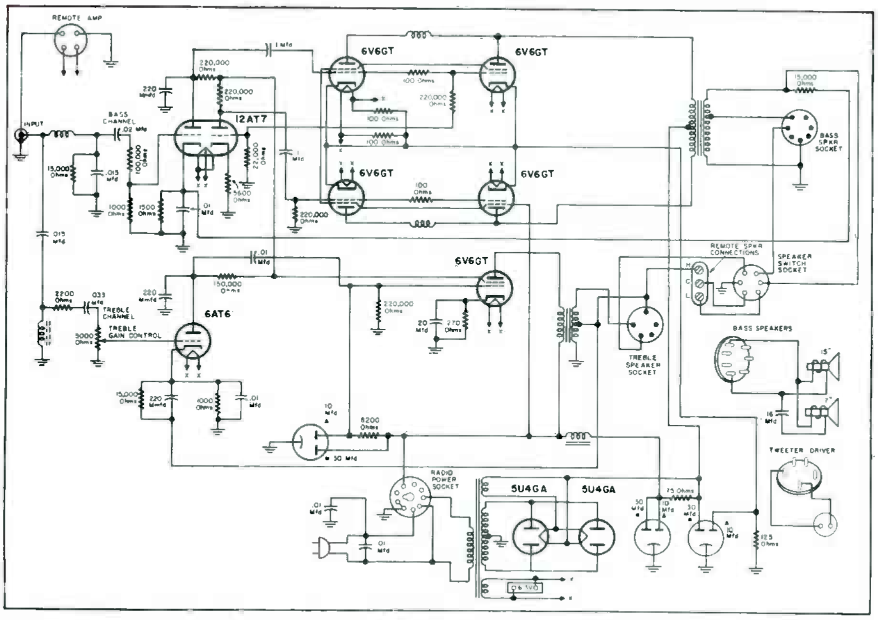


FIG. 1: POWER AMPLIFIER and speaker system for Magnavox mood-music chassis.

FM IF Amplifiers

Adequate gain and selectivity for FM are provided by a two stage 10.7-mc *if* amplifier driving a ratio detector. The first *if* and FM driver stages use 6BA6s. The ratio detector is a 6AL5 twin diode. Sufficient AM gain and selectivity are provided by a single 455-kc *if* stage driving a IN34A crystal detector. A sharply-tuned high-Q 10-kc filter, following the AM detector, prevents the beat between adjacent AM broadcast stations from appearing in the output.

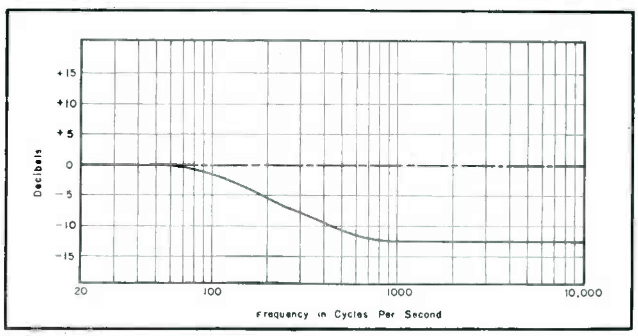
The quieting sensitivity of the FM tuner is better than 6 microvolts. The sensitivity of the AM tuner is 20 microvolts per meter for ½ watt output. Overall response of the instrument to FM is 30-20,000 cycles. Overall response to AM is limited, for all practical purposes, only by the nature of the broadcast signal itself.

A 6E5-type tuning indicator is mounted on the instrument control panel. Since the tuning characteristics of the AM and FM circuits are similar, the indicator serves for both. The indicator control voltage for AM tuning is a portion of the receiver *avc* voltage. The control voltage for FM tuning is taken from the negative side of the ratio-detector balanced load.

Section *1* of the function control switch serves to transfer the audio outputs of the AM or FM detectors across the 1-megohm loudness control (R_{147}). A third and fourth position of the function control places the loud-

(*Continued on page* 50)

FIG. 1a: MOOD-MUSIC response. The dashed line represents the normal instrument response; solid curve illustrates the relative change in response due to the mood-music switch.



[2]*Model CR-730BB*

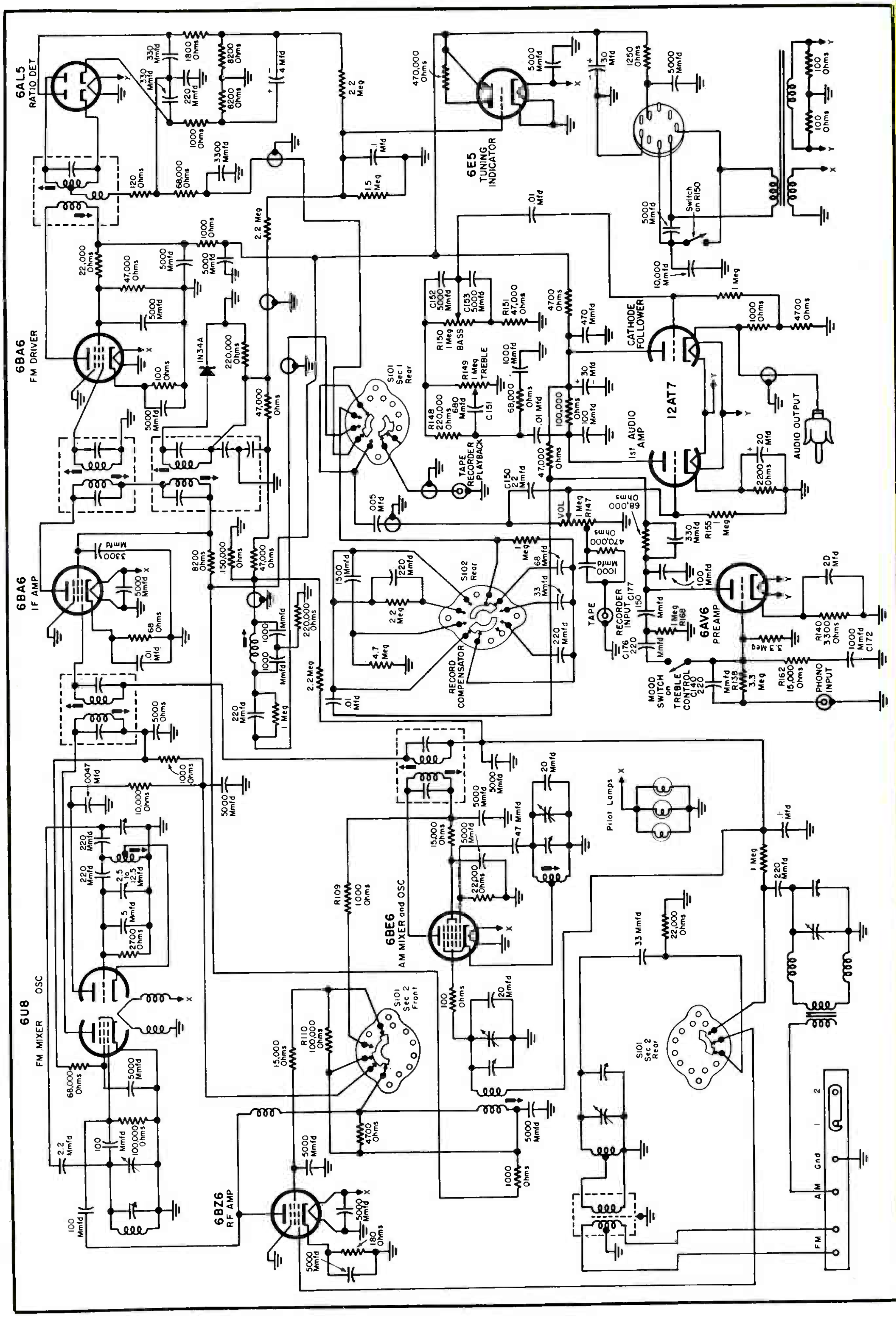
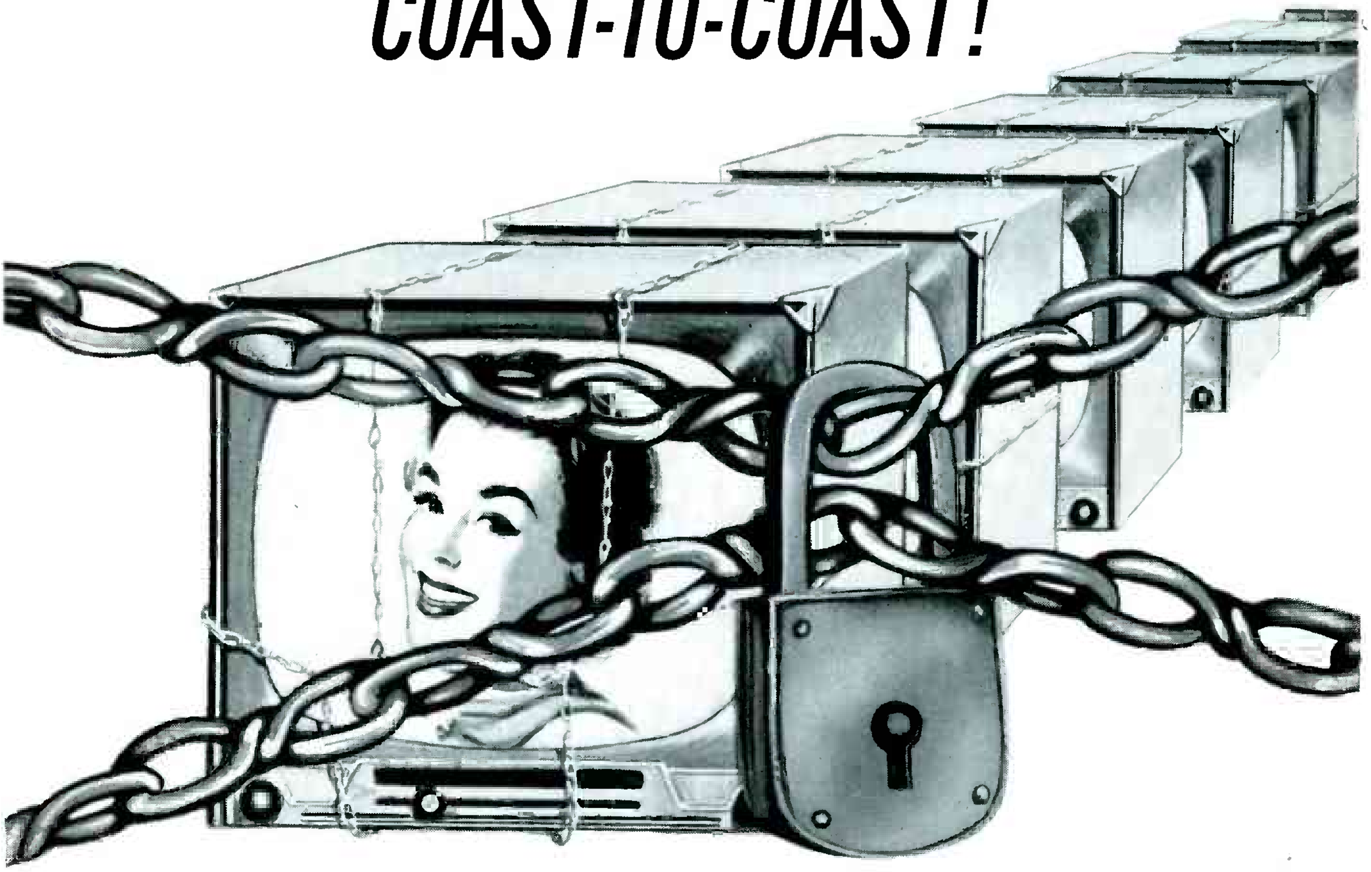


FIG. 2: COMPLETE DIAGRAM of Magnavox AM-FM radio-phono which features a 25-watt amplifier—three-speaker system and mood-music control.

103 TV TUBE "TORTURE TESTS"

COAST-TO-COAST!



"Locked TV" prove WESTINGHOUSE tubes work better, cut call-backs!

RIGHT NOW leading Electronic Parts Distributors across the nation are giving Westinghouse RELIATRON® Tubes the most grueling test in TV history!

RIGHT NOW 103 standard make TV sets—like those used by your customers—are performing continuously! Every set is locked tight. Every set is 100% equipped with Westinghouse RELIATRON Tubes taken right from regular Distributor stock to prove they outlast, outperform other tube brands—in any make TV!

RIGHT NOW these 103 sets are racking up fantastic performance records! For example, one "Locked TV" has run over 17,000 hours . . . more than 11 years' average viewing time!

SEE THE "LOCKED TV" TEST right now at *your* Westinghouse Tube Distributor. Find out how it can pay off in profits for *you!*

Electronic Tube Division • Elmira, New York

YOU CAN BE SURE...IF IT'S Westinghouse

13-Transistor Signal-Seeking Auto Radio

by W. C. CALDWELL

Service Engineer, Delco Radio Div., General Motors Corp.

W. C. CALDWELL checking all-transistor radio in the lab.

Complete Description of All-Transistor Chassis That Provides Up To 10-Watts Output

AN ALL TRANSISTOR radio featuring *wonder-bar* tuning and up to 10 watts of *af* output has been designed for the Cadillac Brougham car.

Relatively high-frequency *npn* transistors are employed in all stages except in the audio amplifiers and relay control stages, where *pnp* types are used. All transistors except the power output units plug into small transistor sockets; the power units (Delco 2N278) are insulated by mica and bolted tightly to the chassis for good heat transfer.

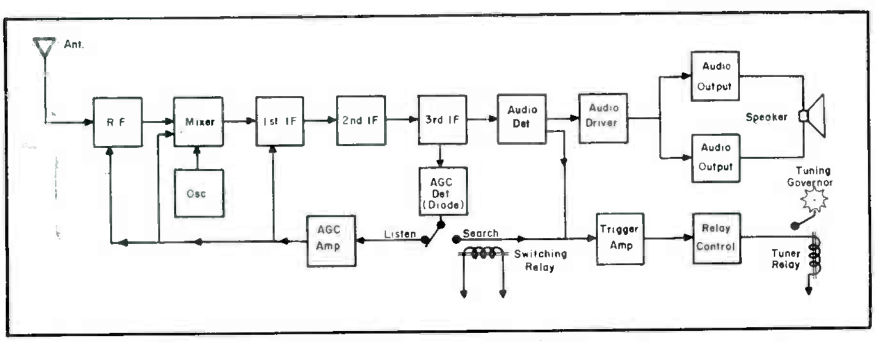
In the circuit, a signal is fed to the *rf* stage where it is amplified and then sent into a mixer stage. At this point, the station signal combines with the oscillator signal to form the intermediate frequency of 262 kc. This 262-kc output signal (from the mixer stage) is amplified by three *if* stages. At this point, the signal is sent out in two directions; down to the *agc* detector diode, and into the audio detector where the *if* carrier is removed and the intelligence passed on to the audio driver stage. Having obtained sufficient drive, considerable power is then developed by push-pull power output transistors and sent to the speaker for reproduction.

An *agc* detector diode changes the *if* signal to a *dc* voltage which is proportional to the station signal strength being received. A special switching relay then feeds this voltage into the *agc* amplifier during *listen* time, where it is amplified and used to control the gain of the *rf* mixer and first *if* stages. While searching, the *agc*-detector output voltage mixes with the voltage from the audio detector stage to form a uniform trigger voltage for various signals received. This composite voltage is then sent to the trigger amplifier, which turns off the relay control transistor and stops the tuner on stations.

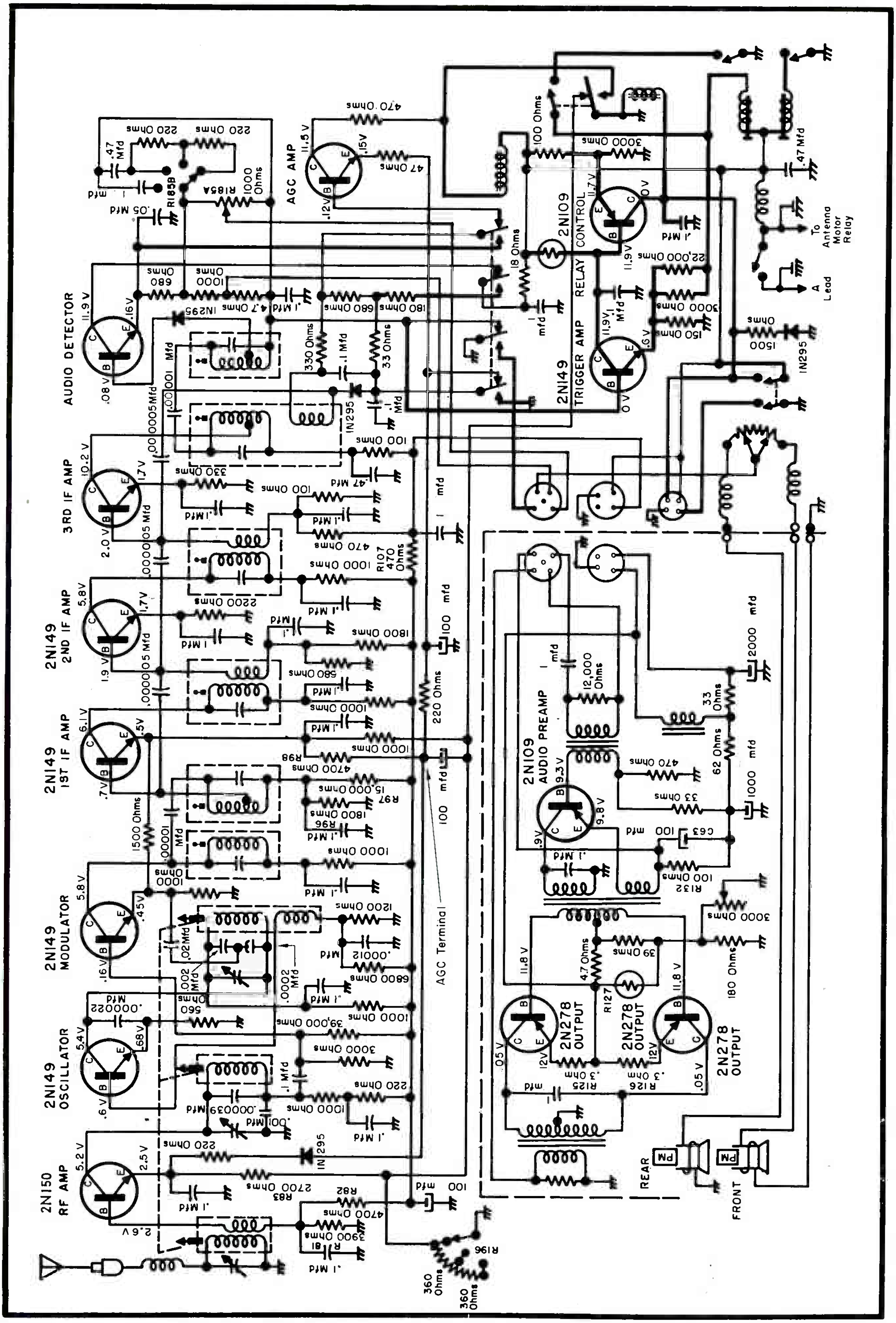
The antenna is tuned by an *lc* input circuit, of which the antenna is a part, and coupled by a step-down transformer into the base circuit of the *rf*-amplifier transistor. This is common practice in transistor circuits, since the input impedance of transistors is generally much lower than the input impedance of vacuum tubes. In this stage, and in all of the signal amplifier stages in this receiver, the popular common-emitter circuit arrangement is used; that is, the signal is applied between base and emitter and taken off between collector and emitter, so that the emitter becomes the common element for the input and output circuits. A *dc* bias voltage is applied to the base of the *rf* (2N150) amplifier. This is obtained from a voltage divider consisting of 3900 and 4700-ohm resistors; R_{81} and R_{82}. The bottom of R_{82} is connected to a 6.5-*v* line, supplied from the 12-*v* car battery and dropped by a 470-ohm series resistor (R_{107}) in that line. The emitter of the *rf* amplifier stage obtains its voltage by a voltage drop across a 2700-ohm emitter resistor (R_{83}) as transistor collector current flows thorugh it. This leaves a difference voltage of .1 between base and emitter for forward bias. Approximate static current drawn by this stage is 1 ma, with no signal applied. This is varied by *agc* voltage applied to the emitter and by a search sensitivity control (R_{196}) during the time that the tuner is seeking.

The oscillator (2N149) uses a tuned collector circuit, with an untuned base winding for positive feed-

(*Continued on page 49*)



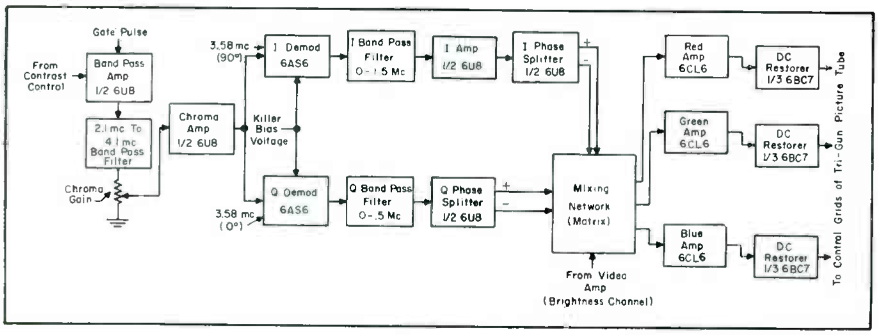
BLOCK DIAGRAM of all-transistor auto-radio which features signal-seeking tuning and employs thirteen transistors, two of which are power types in a push-pull audio circuit.



COMPLETE CIRCUIT of the Cadillac all-transistor radio with npn transistors in all stages except the audio and relay-control portion where pnp types are used.

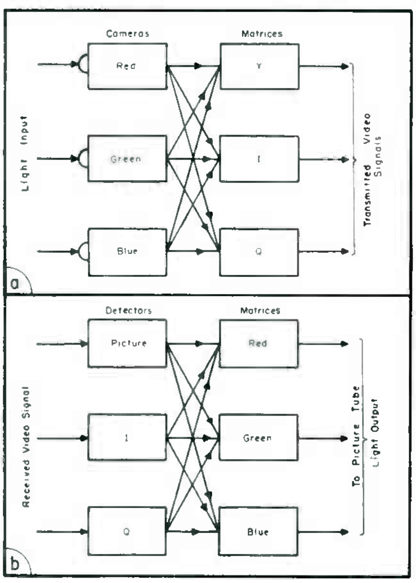
Trends In Circuitry For

A Report on the Circuits Developed For Early and Present 3-Gun



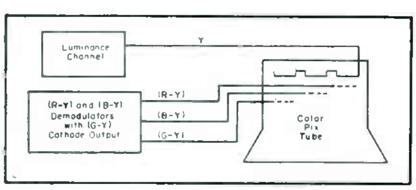
(Above)

FIG. 1: CHROMINANCE channel of an early ceiling-performance color-TV receiver. (Courtesy Admiral Corp.)



(Above)

FIG. 2: THE IQ color-TV receiver system which is the inverse of the color transmission system.



(Above)

FIG. 3: HOW HIGH-LEVEL color detectors drive the color picture tube directly.

(Right)

FIGS. 4a-b: BLOCK diagram in (a) illustrates (R-Y) (G-Y) color demodulation system which provides better utilization of the dynamic ranges of the tubes. Early color-detection system is diagrammed in (b); this circuit operated from the quadrature phases of the subcarrier voltage.

by ROBERT G. MIDDLETON

Chief Field Engineer, Simpson Electric Co.

THERE ARE two well-defined trends at present in the development of color-TV circuitry. One concerns simpler and more economical circuit arrangements for the utilization of the three-gun picture tube. The second trend is directed toward the commercialization of one-gun picture tubes such as the *Apple* and Lawrence types. The one-gun picture tubes utilize a modified color signal, which has been converted from a simultaneous to a sequential signal.

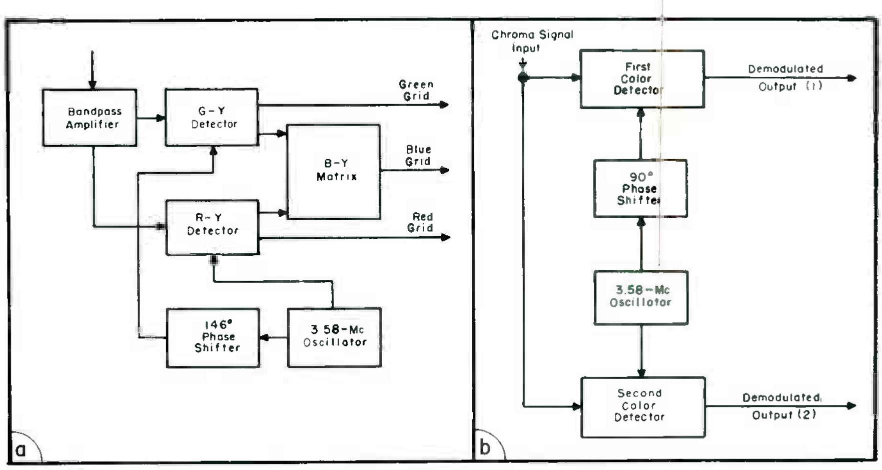
Early Model Wide-Band IQ Color-Demodulation

Early color receivers all processed the NTSC signal[1] in a very straightforward manner, as illustrated in Fig. 1. Such receivers can provide ceiling performance in color reproduction, but on the other hand require a relatively large number of tubes and components. The arrangement of an *IQ*-color receiver, one technique in the early designs, is basically the inverse of the circuitry of a color transmitter, as illustrated in Fig. 2.

The arrangement shown in Fig. 1 uses what is known as *low-level color demodulation*, since the color detectors are followed by amplifiers. Some more recent receivers utilize *high-level-color demodulation*, in which the detector outputs are applied directly to the grids in the color picture tube.

In a typical high-level demodulation system, two triodes are utilized as color detectors and *(G-Y)* matrix. The output from one triode plate is an *(R-Y)* signal which is applied to the red grid in the picture tube. The output from the second triode plate is a *(B-Y)* signal which is applied to

[1]*The standard NTSC color signal is remarkable from the standpoint of its compatibility, since the same transmission is utilized directly to energize either a black-and-white receiver, or a color receiver. The NTSC signal utilizes techniques of frequency interleaving and two-phase subcarrier modulation to achieve compatible picture reproduction.*



COLOR-TV Receivers

Tube Chassis and Systems Projected For 1-Gun Models

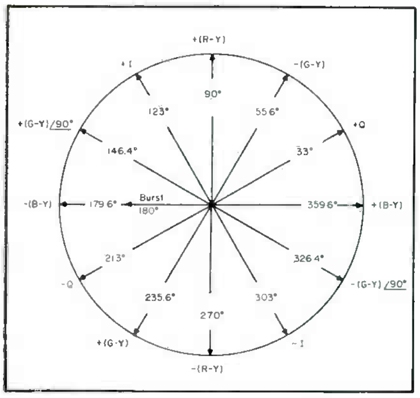


FIG. 5: A CHROMINANCE phase diagram which shows that I and Q are in quadrature.

the blue grid in the picture tube. A common cathode circuit is used; this develops (*G-Y*) output which is applied to the green grid in the picture tube. The Y (or luminance) signal is applied to all three cathodes in the color picture tube. Thus, the picture tube serves as the final matrix, as well as a transducer. The principle of this arrangement is shown in Fig. 3.

The earlier color-TV receivers, both of the *IQ* and (*R-Y*) (*B-Y*) types, made use of quadrature color detection. That is, the color-subcarrier voltage applied to one color detector was separated 90° in phase from the color-subcarrier voltage applied to the other color detector, as noted in Fig. 4*b*. Fig. 5 illustrates the point that the *I* axis is separated from the *Q* axis by a phase angle of 90° (123°-33°); likewise, the (*R-Y*) axis is separated from the (*B-Y*) axis by 90°.

Both *IQ* and (*R-Y*) (*B-Y*) detection system operate equally well when energized by the transmitted *IQ* color signal. Although transmission is made along the *IQ* axes, demodulation can be accomplished along *any* pair of axes; however, when demodulation is accomplished along the *IQ* axes, the *I* channel is operated at a bandwidth of 1.5 and the *Q* channel is operated at a bandwidth of .5 mc. This is in contrast to the chroma bandwidths utilized in the (*R-Y*) (*B-Y*) detection system, where the bandwidth of the (*R-Y*) and (*B-Y*) channels must both be restricted to .5 mc, to avoid color crosstalk. The *I* signal is transmitted in double-sideband form out to .5 mc, and in single-sideband form from .5 on out to 1.5 mc. The *Q* signal is transmitted in double-sideband form only out to .5 mc. It is the single-sideband region of the transmitted signal which restricts the bandwidth of (*R-Y*) (*B-Y*) demodulators to .5 mc, since the *I* signal has components along both (*R-Y*) and (*B-Y*) axes. Of course, very small areas of color cannot be reproduced in the (*R-Y*) (*B-Y*) type of receiver.

Tube Range in (R-Y) (G-Y) Detection

Since demodulation can be accomplished along any pair of axes, some of the later color-TV receivers operate along the (*R-Y*) and (*G-Y*) axes for detection; this approach affords better utilization made of the dynamic ranges of the tubes in the chrominance section. This possibility results from the readjustment of chrominance values made at the transmitter; to avoid overmodulation on highly saturated colors (*R-Y*) is reduced to 87.7% of its initial value, (*B-Y*) to

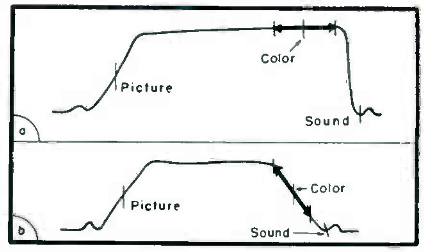


FIG. 6: COLOR-IF response curves. Curve in (a) shows result when the color signal is placed on top of the if curve as in the conventional system. The vestigial color-sideband system of reception result is shown in (b); the color signal falls on side of the if curve.

49.3% of its initial value, and (*G-Y*) is accordingly increased to 143.2% of its initial value.

These readjusted chrominance values must be restored to their initial (unadjusted) values in the receiver, by suitable proportioning of gains in the chrominance channels. It is obviously more economical to reduce (*G-Y*) than to amplify (*B-Y*). Hence, the (*R-Y*) (*G-Y*) detection system depicted in Fig. 4 has made considerable headway. It will be observed from Fig. 5 that (*R-Y*) and (*G-Y*) are separated by a phase angle of 146°, and the injected color subcarrier voltages to the detectors accordingly have this phase-angle difference.

Hence, the (*R-Y*) (*G-Y*) detection system is not a *quadrature* system. The circuits have the same bandwidth as the (*R-Y*) (*B-Y*) system, and for the same reason. An interesting point to note is that a (*G-Y*)/90° signal

(*Continued on page 52*)

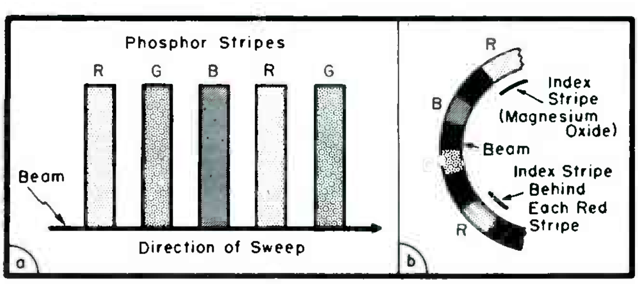


FIG. 7: APPLE-TUBE design. Illustration in (a) shows how the writing beam is modulated by the color signal as it traverses the phosphor stripes of the tube to reproduce the color picture. Thin index stripes that are behind each red phosphor stripe are detailed in (b); these produce secondary emission sync signals when the electron beams pass through the index stripe.

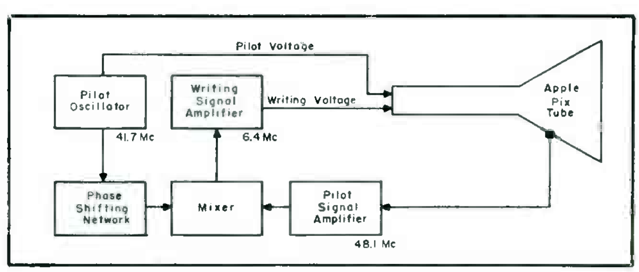


FIG. 8: BLOCK DIAGRAM of the circuit functions that produce individual fields on the screen of the apple tube. The writing signal frequency here is 48.1-41.7 mc, or 6.4 mc.

THIS MONTH IN SERVICE

SERVICE MEN TO PARTICIPATE IN NATIONAL PROBE OF UHF RECEPTION--For many months a number of plans to resolve the TV-channel situation, that might involve the more active use of the ultrahighs, have been under consideration. In reviewing the proposals, the FCC found that the suggestions were so varied, that it would be difficult to reduce the ideas offered to a concrete plan. It was suggested therefore that industry lend a hand and set up a special research program under the auspices of a study group. All segments of industry concurred and as a result a TV Allocations Study Organization, tagged TASO, was developed. Their job will be to investigate every phase of vhf and uhf reception and broadcasting. . . A highlight feature of the probe will be a critical analysis of uhf receiving conditions, based on experiences of Service Men throughout the country. . . Association members, independent Service Men and technical personnel of distributors who handle service sales will be asked to answer a detailed questionnaire and return to TASO in Washington for a review that will eventually become part of an official report to the Commission.

SERVICE MEN will be queried on such subjects as terrain in their areas: Whether it's flat, hilly, mountainous, heavily built up with high buildings, residential and light commercial not built up, urban or rural. They will also be asked to note the proportion of receiver installations that use indoor and outdoor antennas and the effectiveness of these pickups for uhf and vhf. Antenna location information will also be sought: Service Men will be asked if in fringe or marginal areas they explore the rooftop area for locations of maximum signal intensity, and if so, how such locations are correlated with optimum picture tube results at the receiver. . . TASO will also ask about centralized TV-receiving-system performance on the high and low bands. On tuners, Service Men will be questioned about tuning procedures as the set owners see it; also if there are difficulties in uhf tuning which have been found to prejudice owners against ultrahigh stations. Some of the specific technical questions on tuning that will be posed will revolve about: Oscillator drift, short tube life, self-oscillations, failure of the beating oscillator to cover the range, noise levels, spurious beat notes and oscillator range coverage. . . Other problems that will be listed in the quizz form will be: Man-made interference on uhf and vhf, effectiveness of uhf for color-TV and the types of antennas and accessories found to be best suited for such reception.

MEMBERS OF TASO believe that the field-experience information Service Men will supply in their replies will be extremely helpful to them in determining the steps that both industry and the FCC will have to take in setting up a new long-term allocation policy, in which the ultrahighs could play a vital role.

HEAVY PRODUCTION SLATED FOR FM AUTO SETS--FM auto sets, often described as the ideal car chassis, will soon be a featured item on many receiver lines, according to reports from leading auto-set makers. . . Now being made in small quantities, the early Fall is expected to see a real swing to the noise-free wide-band type of chassis. . . Tube lineup of one model, operating in the 30 to 50-mc range, now being produced on the Pacific coast, is: 6BJ6 rf, ½ of 6U8 as mixer and ½ of the tube as an oscillator which also uses a crystal in the circuit, 6BJ6s in two if stages, 6AL5 detector, and 12AX7 audio and squelch.

BROADCASTERS SPENDING MILLIONS FOR COLOR-TV FACILITIES--In preparation for the heavy schedules of color shows this Fall and Winter, huge studios costing millions, with elaborate monitoring, camera, lighting and air-conditioning systems, are now being built by telecasters not only on the West coast, but even in the East. . . In upstate New York, one broadcaster has set aside an entire wing of a building for color. The studios, management says, will be spacious enough to stage the largest type of spectacular presentations, the type they expect to offer within the next few months.

COMMUNITY-TV CONVENTION TO BE HELD IN JUNE--The sixth annual convention and trade show of the National Community TV Association will be held on June 4, 5 and 6 at the Penn-Sheraton Hotel, Pittsburgh, Pa.

Johnny Lucci of Lucci TV-Appliance Sales,
Staten Island, N. Y., reports:

"Our Servicemen Proved to be the Best Magic Genie Salesmen We've Got!"

Take it from Johnny Lucci, important Staten Island TV dealer—

"We expected our showroom salesmen to sell JFD Magic Genies but not our service department—but they did and how."

"Every time one of our servicemen makes a home call, he takes along a Magic Genie for demonstration. 75% of the time he makes the sale and earns the commission.

THE JFD MAGIC GENIE BELONGS IN YOUR PROFIT PICTURE!

More service-dealers are *making* more and *keeping* more with the JFD Magic Genie. Dynamic advertising in local and national media is creating thousands of Magic Genie ready-to-buy prospects in your trading area. Make it pay off at *your* store by stocking and showing the JFD Magic Genie. Now at your JFD distributor.

"We make sure no buyer or shopper leaves our store without being shown the Magic Genie. Many buy them with a new set or to replace their old antenna."

NATIONALLY ADVERTISED AT $17.95 promotionally priced at $14.95

JFD ELECTRONICS, INC.
PIONEERS IN ELECTRONICS SINCE 1929

Sound No-Raster Troubleshooting Chart ‡

Preliminary Circuit Checks: Horizontal oscillator, horizontal output, damper and *hv* rectifier tubes should be substituted. A visual check should be made for burned-out resistors, open fuses, bulging capacitors and broken leads.

Isolation-Transformer (See Fig. 1)

In the isolation-transformer circuit, B+ is applied directly to the horizontal output transformer, the damper plate is connected to the transformer, and the *spike* at the cathode is negative.

Autotransformer (See Fig. 2)

In the autotransformer circuit, B+ is applied to the damper tube cathode (sometimes through the linearity coil) which connects to the horizontal-output transformer and has a positive *spike*. The horizontal-yoke windings are connected across two taps of the horizontal output-transformer secondary.

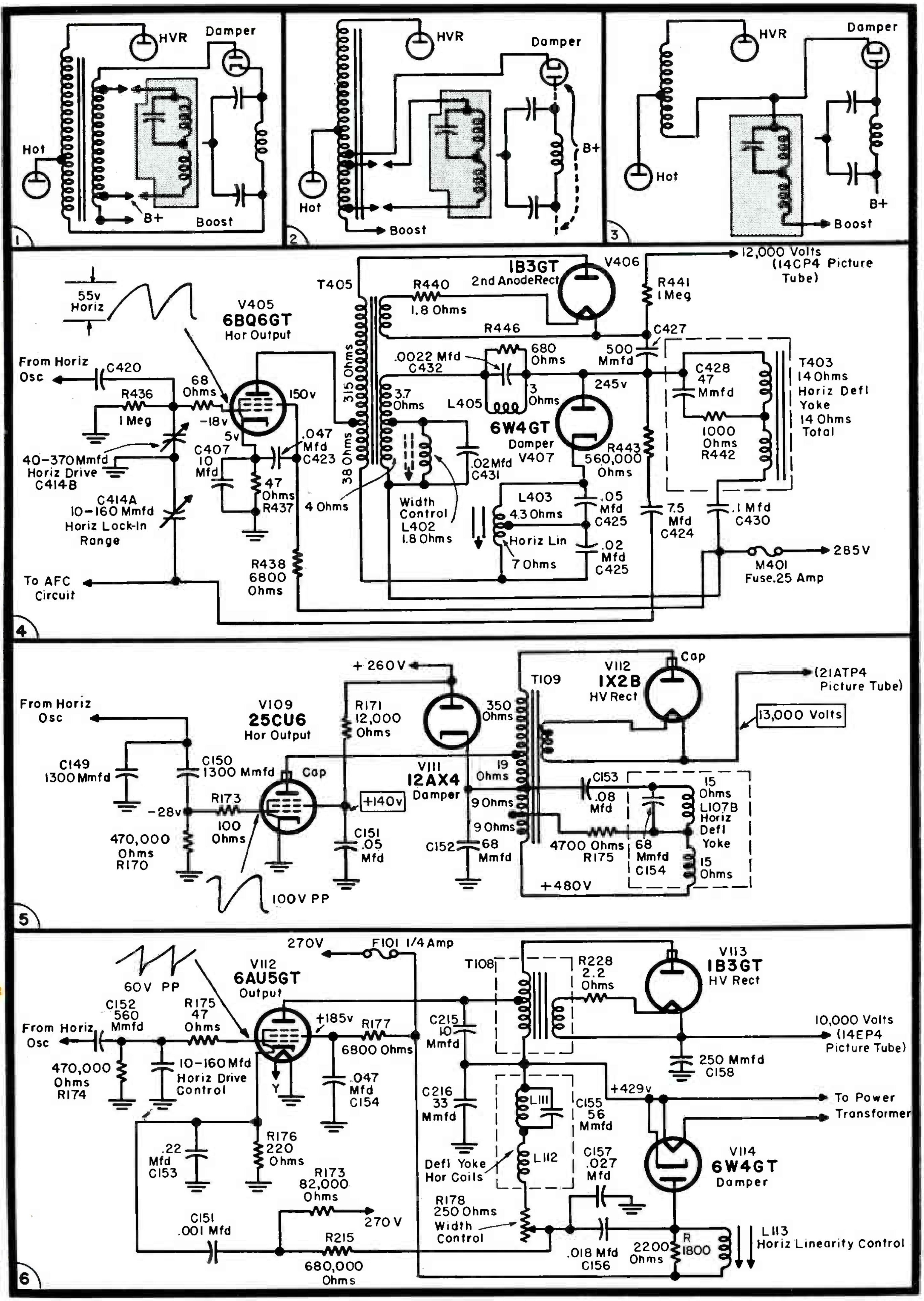
Direct-Drive (See Fig. 3)

B+ and cathode connections are the same as those of the autotransformer circuit. The horizontal yoke windings are connected in series with the horizontal-output transformer. The transformer core may be either metallic or air; in either case it is circular.

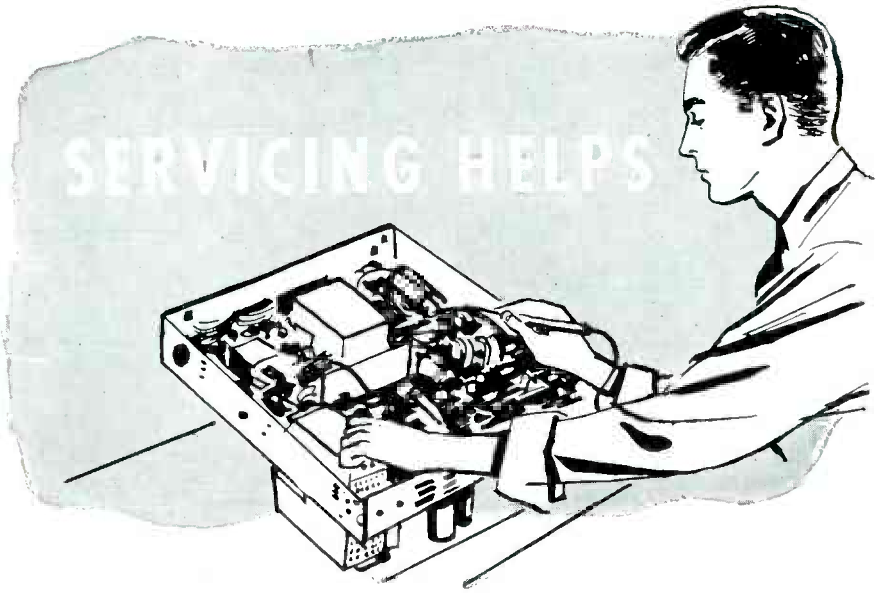
			Examples: Isolation-Transformer (See Fig. 4)		Autotransformer (See Fig. 5)		Direct-Drive (See Fig. 6)	
Check Using	**Check or Connection Point**	**Approximate Measurement**	**Actual Measurement**	**If Abnormal, Check**	**Actual Measurement**	**If Abnormal, Check**	**Actual Measurement**	**If Abnormal, Check**
Voltmeter	B+	10% of low voltage rectifier output	285 *v*	*Lv* rectifier and filter circuit, M_{401}	260 *v*	*Lv* rectifier and filter circuit	270 *v*	*Lv* rectifier and filter circuit, F_{101}
	Horizontal-output tube (*hot*) screen cathode	60 to 200 *v*	150 *v*	R_{438} (6800 ohms) and C_{423} (.047 mfd)	140 *v*	C_{151} (.05 mfd) and R_{171} (12,000 ohms)	185 *v*	R_{177} (6800 ohms) and C_{154} (.047 mfd)
	Hot cathode voltage	10 *v* per 100 ohms of cathode resistance	5 *v*	C_{407C} (10 mfd) and R_{437} (47 ohms)	None	....	18.6 *v*	C_{151} (.001 mfd), C_{153} (.22 mfd), R_{176} (220 ohms), R_{173} (82,000 ohms), and R_{215} (680,000 ohms)
	Boost voltage (at damper plate for isolation-transformer and damper cathode for other types)	1½ times greater than B+	400 *v*	T_{405}, L_{402} (width control), C_{431} (.02 mfd), C_{425} (.05 mfd), C_{426} (.02 mfd) and L_{403} (horizontal linearity)	480 *v*	T_{109}, C_{152} (68 mmfd) and L_{107B} (horizontal-deflection yoke)	429 *v*	T_{108}, C_{215} (10 mmfd), C_{216} (33 mmfd), L_{111} and L_{112} (horizontal-deflection coils), L_{113} (horizontal-linearity control), C_{156} (.018 mfd), C_{157} (.027 mfd) and R_{178} (250-ohm width control)
	Hot grid voltage	−10 to −80 *v*	−18 *v*	C_{420}, C_{414A} (10-60 mmfd), R_{435} (68 ohms) and R_{436} (1 megohm)	−28 *v*	Horizontal-oscillator circuit; C_{149} and C_{150} (1300 mmfd), R_{170} (470,000 ohms) and R_{173} (100 ohms)	−7.9 *v*	Horizontal oscillator circuit; C_{152} (560 mmfd), C_{143B} (10-60 mmfd), R_{174} (470,000 ohms) and R_{175} (47 ohms)
'Scope	*Hot* grid	50 *v p-p* (50° yoke) 65 *v p-p* (70° yoke) 75 *v p-p* (90° yoke)	55*v p-p* (70°)	C_{420}, C_{414A}, R_{435} and R_{436}	100 *v p-p* (90°)	100 *v p-p* (90°)	60 *v p-p* (70°)	60 *v p-p* (70°)
Ohmmeter	Plate cathode of damper tube	Greater than 30,000 ohms (disconnect damper tube resistor if used)	Greater than 50,000 ohms	L_{403} (horizontal linearity), C_{425} (.05 mfd) and C_{426} (.02 mfd)	Greater than 50,000 ohms	C_{151} (.05 mfd) and C_{152} (68 mmfd)	Greater than 50,000 ohms	C_{156} (.018 mfd)
Substitute Yoke	An 8-20 *mh* yoke should be substituted for original yoke; a 20-20 mh yoke can be used for direct drive	If *hv* returns, original yoke is defective	10 *mh* (10 ohms)	C_{428} (47 mmfd) and R_{442} (1000 ohms)	19 *mh* (21 ohms)	C_{151} (68 mmfd) and R_{175} (4700 ohms)	30 *mh* (35 ohms)	C_{155} (56 mmfd)

RIGHT—FIGS. 1, 2, 3: THREE TYPES of hy-drive systems; transformer (Fig. 1), autotransformer (Fig. 2) and direct drive (Fig. 3). FIGS. 4, 5 and 6: ISOLATION-TRANSFORMER circuit used in Admiral chassis 20T1 and 20V1 is illustrated in Fig. 4. The autotransformer circuit in Crosley 431 TV sets is shown in Fig. 5. A direct-drive system in RCA KCS-61 chassis appears in Fig. 6.

‡Based on PTM-bulletin service-aid data prepared by Irv Tjomsland, service engineer, Triad Transformer Corp.



HVR
Damper
Hot
B+
Boost
1
HVR
Damper
B+
Hot
Boost
2
HVR
Damper
Hot
B+
Boost
3
55v Horiz
From Horiz Osc
C420
R436 1 Meg
68 Ohms
V405 6BQ6GT Hor Output
150v
-18v
5v
40-370Mmfd Horiz Drive C414B
C407 10 Mfd
.047 Mfd C423
47 Ohms R437
C414A 10-160 Mmfd Horiz Lock-In Range
4 Ohms
R438 6800 Ohms
To AFC Circuit
T405
315 Ohms
38 Ohms
R440 1.8 Ohms
1B3GT 2nd AnodeRect
V406
R446
.0022 Mfd C432
680 Ohms
3 Ohms
3.7 Ohms
L405
6W4GT Damper V407
.02Mfd C431
Width Control L402 1.8 Ohms
L403 4.3 Ohms
Horiz Lin 7 Ohms
.05 Mfd C425
.02 Mfd C425
12,000 Volts (14CP4 Picture Tube)
R441 1 Meg
C427
500 Mmfd
245v
R443 560,000 Ohms
7.5 Mfd C424
C428 47 Mmfd
1000 Ohms R442
T403 14 Ohms Horiz Defl Yoke 14 Ohms Total
.1 Mfd C430
285V
M401 Fuse .25 Amp
4
+ 260V
From Horiz Osc
V109 25CU6 Hor Output
R171 12,000 Ohms
C149 1300 Mmfd
C150 1300 Mmfd
Cap
R173 100 Ohms
-28v
470,000 Ohms R170
+140v
C151 .05 Mfd
100V PP
V111 12AX4 Damper
350 Ohms
19 Ohms
9 Ohms
9 Ohms
C152 68 Mmfd
T109
V112 1X2B HV Rect
Cap
(21ATP4 Picture Tube)
13,000 Volts
C153 .08 Mfd
4700 Ohms R175
68 Mmfd C154
15 Ohms L107B Horiz Defl Yoke 15 Ohms
+480V
5
270V
F101 1/4 Amp
60V PP
V112 6AU5GT Output
C152 560 Mmfd
R175 47 Ohms
From Horiz Osc
470,000 Ohms R174
10-160 Mfd Horiz Drive Control
+185v
R177 6800 Ohms
.047 Mfd C154
Y
.22 Mfd C153
R176 220 Ohms
R173 82,000 Ohms
270 V
C151 .001 Mfd
R215 680,000 Ohms
T108
C215 10 Mmfd
C216 33 Mmfd
L111
L112
Defl Yoke Hor Coils
R178 250 Ohms Width Control
R228 2.2 Ohms
V113 1B3GT HV Rect
10,000 Volts (14EP4 Picture Tube)
250 Mmfd C158
+429v
C155 56 Mmfd
To Power Transformer
C157 .027 Mfd
V114 6W4GT Damper
.018 Mfd C156
2200 Ohms
R 1800
L113 Horiz Linearity Control
6



Transistor-Radio Test-Equipment Application Tips . . . Servicing Modulized Chassis . . . Radio-TV Set Service Notes: Hum Reduction . . . Curbing Regenerative Squeal

IN SERVICING transistor radios, voltage and continuity checks can be particularly revealing. The voltage tests can disclose current-drain problems that could be sources of key troubles.

Since transistors are relatively low-resistance devices and extremely non-linear, the continuity checks must be done carefully. An ohmmeter can give misleading results in continuity checks and can readily burn out a transistor if an excessive or wrong polarity voltage is applied to an element.

If signal-injection checking is used, care must also be taken to avoid damaging of the transistors. Shorting a transistor base to ground on many sets will cause excessive current drain and transistor failure. A blocking capacitor must be inserted in the signal-generator output lead to prevent loading of biasing circuits.

In many transistor models the same elements in the converter function both as oscillator and mixer. If the signal generator is connected to the converter-transistor terminal base, the local oscillator will be loaded out of oscillation. An *if* signal injected here is amplified properly; but an *rf* signal cannot be heard because the transistor no longer acts as a converter.

To check the converter, the *rf* signal must be injected through a very small capacitor; it is usually more satisfactory to employ a signal tracer to check the input circuit performance and then inject the *rf* signal through loose coupling to the antenna. To check the local oscillator operation, an *rf* voltmeter is required. A typical value of local-oscillator injection to the base is .15 *v rms* at 1400 kc. One must not use the vacuum-tube technique of measuring the *dc* drop across the oscillator grid resistor, because there is no comparable resistor.

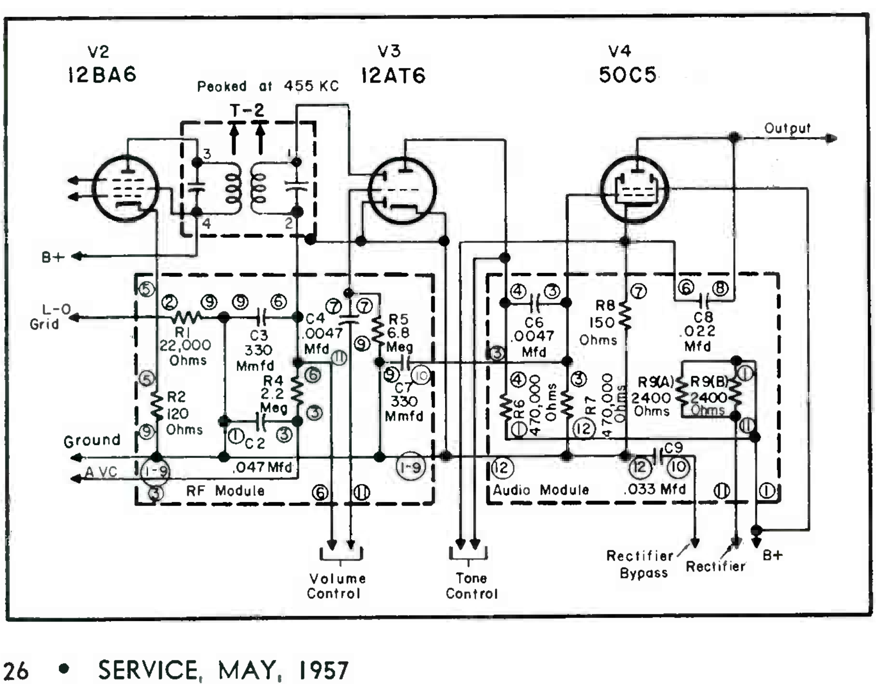
Servicing Modulized Chassis

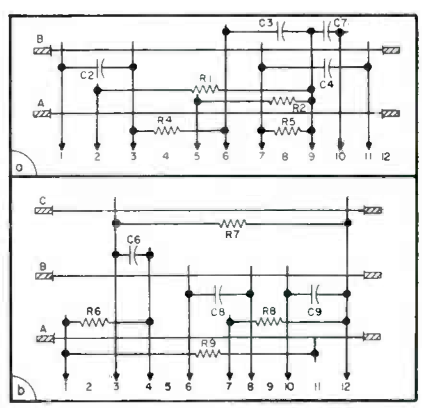
SERVICING CHASSIS which include components mounted on modules require the use of special techniques. In one chassis, Emerson 120349B, one module includes the *r* and *c* components of the *rf* and *if* section; another mounts the audio resistors and capacitors. When a component failure occurs in one of these modules, the module may be replaced or, often, repaired.

In most modules, as in the two in this receiver, all component terminals are available on the *risers* (wires running from top to bottom of the module); therefore it is possible to reach all terminals of each component. While it may not be possible to eliminate parallel paths to isolate a single component, measurements will usually clearly indicate the particular component at fault.

Repair or replacement is determined by the location of the defective component, and the nature of the defect. If a component can be isolated

(*Continued on page 47*)





(Left)

FIG. 1: RF-AUDIO MODULE circuitry in Emerson 867B.

(Above)

FIG. 2: DETAILED SCHEMATIC of RF-AF modules.

New High Quality Precision Instruments For SERVICE CALLS or SHOP WORK

...From KAY ELECTRIC

KAY

Utilator

Portable, Compact Utility Oscillator

FEATURES

- AGC'd for Flatness
- Metered Output 0.7 V rms into 75 ohms
- Broad-Band 4.5 to 220 mc
- Direct Reading Dial
- High Quality

A small, compact utility oscillator designed for bench or field service, the new Kay *Utilator* covers the 4.5 to 220 megacycle range. The unit is completely self-contained with attenuators, power supply and output meter. The *Utilator* provides a high level RF output AGC'd for flatness over the range, and a direct-reading frequency dial accurate to ±1%.

SPECIFICATIONS

Frequency Range: 4.5 to 220 mc, in six switched bands, fundamental frequency.

RF Output: 0.7 volts rms into nominal 75 ohms, metered; AGC'd.

Flatness: ±0.5 db over the range.

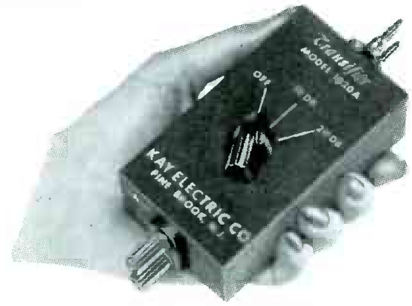
Frequency Calibration: Direct reading frequency dial calibrated to within ±1%.

Attenuators: Switched steps of 20 db, 20 db, 10 db and 6 db, plus continuously variable 6 db.

Dimensions: Width 11", Depth 6½", Height 8½"

Weight: 19 lbs.

Price: $295.00 F.O.B. Pine Brook, New Jersey



KAY

Transifier

All-Transistorized, Plug-In Wide-Band Video Amplifier

FEATURES

- Broad-Band Response to 15 mc
- Completely Transistorized — Small, Self-Contained, Compact Portable Unit
- Signal Gain Controlled by Overall Feedback—Built-In Stabilization
- No Hum
- Long Stable Life—Powered by Two Penlight or Mercury Cells
- Units May Be Cascaded to Provide Additional Gain

The Kay *Transifier* is a *true* modular unit, completely transistorized, with built-in feedback circuit for stabilized signal gain. The unit is self-contained in a cast-aluminum housing with standard banana plug input and output.
The *Transifier* may also be used as a low level pulse amplifier or as a pre-amplifier for video and audio instruments, vacuum tube voltmeters, cathode ray oscilloscopes, tape recorders and microphones. Other uses include, use as a humless audio amplifier and as a modular in control circuitry, and all types of audio-video electronic devices.

SPECIFICATIONS

Frequency Response: 10 db Position: 3 db down at 20 cycles and 15 mc
20 db Position: 3 db down at 20 cycles and 10 mc

Gain: 10 db and 20 db switchable

Input Impedance: Capacitance 15 mmf—Resistive Component—20,000 ohms at 1 mc to 15,000 ohms at 10 mc

Output Impedance: 500 ohms, approximately

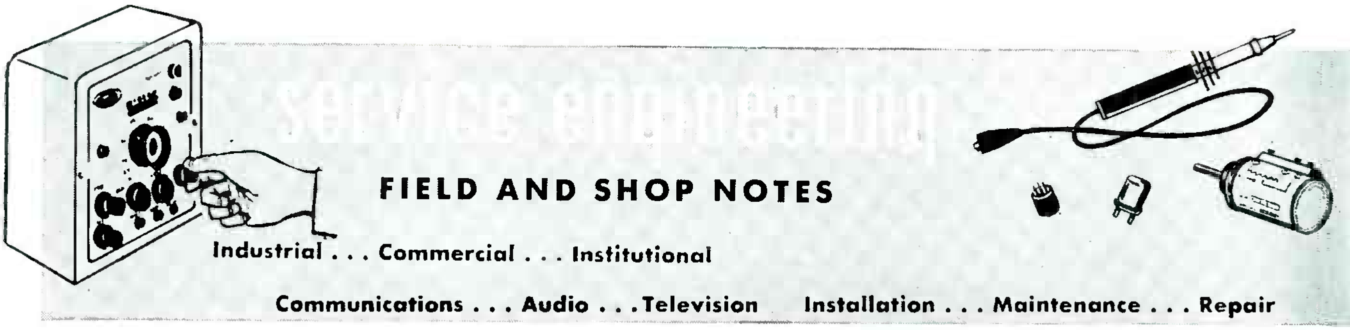
Maximum Output Voltage: 0.15 volts 10 db position
0.30 volts 20 db position

Price: $85.00 F.O.B. Pine Brook, New Jersey

For Literature on The Complete Line of Kay Transistorized Instruments, Write:

KAY ELECTRIC COMPANY

Dept. S-5, 14 Maple Avenue, Pine Brook, N. J. CAldwell 6-4000



Field-Bench Facilities of a Resort-Area Service Shop Specializing in Commercial-Sound Installation and Repair

by KENNETH SONNENBERG, BDM Electronic Labs, Inc.

We have been in the service business for twenty years and now specialize in the installation and repair of commercial sound equipment. We also handle TV and radio repairs.

Our shop, with approximately 1000 square feet of space, is located in Far Rockaway, N. Y., a resort town which with the adjacent area has a population of 60,000. In the summer months, the population swells to 250,000.

The main servicing area in our shop consists of a 20-foot work bench, that is 37 inches high, found to be a good height when standing or when seated on a stool.

The bench has been covered with tempered masonite and edged with aluminum. Along the front of the bench we installed *wiremold*, a continuous line of *ac* sockets each 6″ apart. The equipment shelf, which has a depth of 20″, enough for the deepest piece of equipment and a library of manuals, runs the full length of the bench. Ladders are kept beneath the work bench and against the wall which is in direct line with the outside door.

On the wall opposite the work bench is our stock of TV antennas, components, tubes and accessories on a unit of steel shelves 17′ long. The receiving tubes are stocked on 5′ long shelves spaced 6″ high. This space is enough for 1000 receiving tubes. The remaining 12′ of shelf space is for larger parts such as transformers, coils, batteries and mikes. Here the shelves are spaced to the height of 12″. Small parts are kept in steel cabinets which have 4 drawers with 12 partitions to a drawer. Here such small parts as capacitors, resistors, sockets, plugs and connectors are kept. Hardware is housed in a steel cabinet having 24 plastic drawers each of which has 3 partitions.

Tools are kept on a specially-built two-sided rack, made of masonite with an inside supporting frame of wood, mounted on a wooden dolly with rubber wheels. The tools are held in place by means of friction clips. Empty clips, indicate missing tools.

Antenna masts are stored on cradles beneath the large work bench. This space is in line with the door and is accessible for loading and stocking.

Test cables, wires, and equipment connectors are kept on a rack to prevent tangling.

For the repair of radios, both home and auto, a smaller version of the main work bench is used. This is 8′ long and is enclosed on the bottom by 4 doors. This enclosed area has been found to be ideal for the storage of stationery, bill books, statements, and anything that must be kept dust-free.

Along the back wall of the shop is a finished wooden shelf unit, on which sound equipment is displayed. Since sound equipment sales, service, and rentals represent a large part of our business this display plays an important role in our operation.

Service Call Procedure

Service call requests are detailed on a special form which notes customer's name, address, phone, brand of set, model, size of picture and complaint. The form is turned over to the Service Man assigned to the call. An itemized bill is supplied to all of our customers. Duplicates of the paid bills are entered in a daily book which details the work performed and parts sold. The service information is then noted on a card and filed alphabetically in a steel file.

Two days after a service call is completed a special postcard with a prepaid return postcard attached is

(*Continued on page 31*)

ASSORTMENT of commercial sound-system equipment involved in typical outdoor sound installations made by BDM.

TV REPAIR bench at BDM. Tool rack, at left, is mounted on a dolly for mobility. All tools are held in place by friction clips.

CATALOGS—BOOKS

Tru-Ohm Products, Division of Model Engineering and Manufacturing, Inc., 2800 N. Milwaukee Ave., Chicago 18, Ill. has released a 24-page resistor-rheostat catalog listing information on fixed enameled, adjustable enameled, oval, vitreous axial and printed circular resistors, as well as data on dustproof, caged and 360° rheostats.

* * *

The Hickok Electrical Instrument Co., 10535 Dupont Ave., Cleveland 8, O., has published an 8-page composite test-equipment catalog listing 25 pieces of test gear, color generators and the *Cardmatic* automatic tube tester.

* * *

Howard W. Sams & Co., Inc., 2201 East 46th Street, Indianapolis, Ind., has announced publication of the first volume of a series of manuals covering instructions for the removal of radios, power supply units and speakers from autos. This initial volume covers 1955 models of American cars. . . . For every auto covered, there is a list of the tools required, a phantom view of the dash panel with the radio in place, and a photo of the radio being removed. . . . Also listed with each model are rear-seat speaker data. This information indicates if there is a cutout provided, the size speaker required, and if control of the speaker must be added or if it is provided on the radio. . . . Priced at $2.95.

* * *

Kingston Electronic Corp., 17 Tudor St., Cambridge 39, Mass., has prepared a four-page brochure detailing the operation of the Kingston absorption analyzer designed to locate and isolate TV troubles through a waveform analysis.

* * *

Sylvania Electric Products, Inc., 1740 Broadway, N. Y. 19, has published a 48-page handbook of baseball facts and figures containing complete major and minor league schedules for 1957. Booklet includes a section on basic baseball strategy and plays by the game's top experts. Lists also outstanding major league records for 1956 together with a 1957 outlook for both the American and National leagues.

* * *

Skottie Electronics, Inc., subsidiary of Astron Corp., Peckville, Pa., has issued a six-page catalog describing their complete line of ceramic capacitors. Disk, tubular, and plate types are illustrated with charts and diagrams. Applications for temperature compensation, high voltage, and printed circuitry are discussed.

* * *

The James Vibrapowr Company, 4050 N. Rockwell Street, Chicago 18, Ill., has announced the availablity of a four-page technical paper on the measurement of residual noise in chopper circuitry. Article covers the theoretical as well as the practical evaluation of residual noise in a wide variety of chopper circuitry.

* * *

Heath Co., Benton Harbor, Mich., has released a 16-page booklet describing audio and test instrument kits. . . . Among the test units detailed are audio wattmeters, harmonic distortion meters, audio signal generators and audio analyzers.

* * *

General Electric Co., Syracuse, N. Y., has published two booklets on germanium TV rectifiers. One contains general information on the semiconductors; the other is a replacement guide listing a number of TV chassis in which the germanium rectifiers can serve as substitutes for the selenium types originally installed.

* * *

Warren Radio Co., 1002 Adams, Toledo, O., has announced release of a 224-page catalog listing components, equipment and other electronic products for industrial and service use.

(*Continued from page 28*)

SECTION OF SHOP devoted to commercial sound system work. Shown is portion of inventory of equipment and accessories.

mailed out. Information sought covers operation of set, satisfaction with service and general comments. Through this simple medium we have an accurate appraisal of our service. This technique has been found to be a great goodwill builder.

Field Problems . . . Solutions

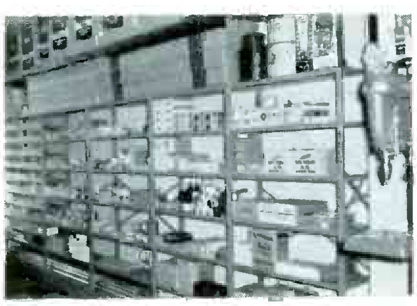
In the summer time, we are quite busy with outdoor sound-system installation and repair work. Because of the salt and sea-spray problems in our area, we often encounter odd problems.

Called on to check up on a paging-system installation we found that the speakers serving the beach front were not developing sufficient output.

On inspection of the equipment it was found that paper-cone speakers had been installed and though they were enclosed in baffles designed to protect them, time and moisture had taken its toll.

This problem was resolved by installing, in an overlapping pattern, 15-watt wide-angle speakers that are made of fiberglass-resin material and use hermetically-sealed driver units. These speakers enabled us to cover every part of the beach with maximum intelligibility.

All of our crew wear uniforms, which we supply. We've found that the uniform serves to advertise our shop, positively identifies our personnel and particularly affords a neat and business-like appearance reflecting our professional standards of operation.



ANTENNA, COMPONENTS, TUBE and wire racks. Component-area shelves are 12' long and spaced 6'3"; tube shelves are 5' long and with 6" of space between to accommodate 1000 tubes.

Traffic Appliance Servicing

How Automatic Electric Coffee Percolators Operate and How To Repair Them

by SOL WALLACH, Electra-Craft Appliance Company

WITHIN THE LAST FEW YEARS the electric automatic coffee percolator has become the third most popular traffic appliance and as a result an expanding need for service has developed.

Basically, all percolators operate in the following way: Cold water must be used in all instances; if not the operation of the entire timing mechanism is affected. Perking action should take place almost immediately and the surrounding liquids should heat up while this perking action continues. This action should stop when the fluid of the vessel is below the boiling point of water. In most makes this condition is indicated by a pilot light that flashes on when the main heating element cuts out. At this point a low-wattage heating element serves to keep the coffee hot (approximately 170°), if, of course, the percolator is connected to the power line.

Design Variables

In the *Universal* automatic percolator there are two separate heating units; the main heating and the warming units. Used, too, is a bi-metal strip, which upon reaching a maximum temperature point will bend towards switch contacts; on the position known as *strong*, the contacts are forced to open at approximately 204°. At this moment the indicator light will go on and the warming unit will remain in the circuit.

Calrod-Rod Types

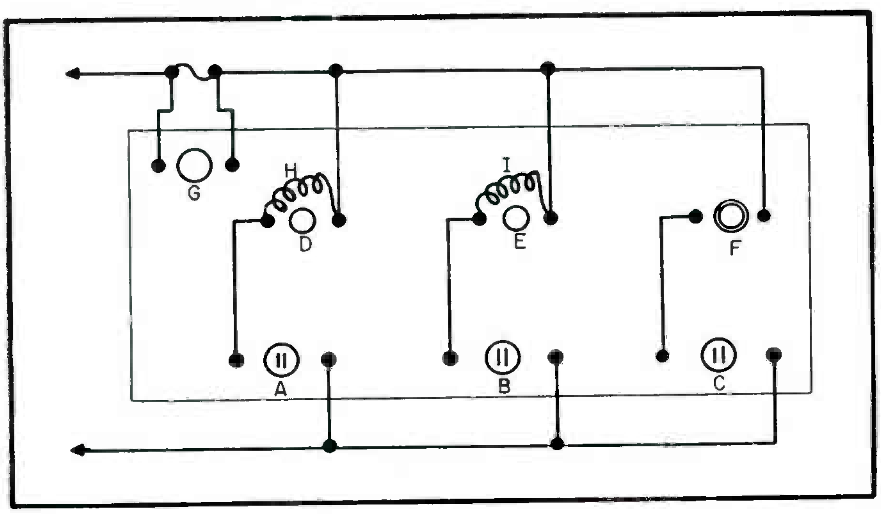
The Westinghouse percolator (model *PE*-541) has a calrod unit welded to the base of the body to heat the liquid at the same time that another element heats the well where perking action takes place. There are two thermostats on this model; the first one cuts off the calrod unit at 160°-180° and perking action continues until the temperature of 190°-200° is reached in the *strong* position.

In another Westinghouse model (*PE*-552) there's a preset thermostat that cuts out the main perking unit at 180°-190° and keeps a warming unit on to keep the liquid hot.

Indicator-Light Models

A fourth type, the *Presto* percolator, has an indicator light that goes *on* when the appliance is plugged in. It also has a calrod element welded to the bottom of the body. On the *strong* position, the calrod element should cut out at 190°-194°; perking action will continue for 3 to 5 minutes and then the indicator light will go out.

ELECTRIC PERCOLATOR testing board. A=receptacle for testing 400 to 600-watt percolators; B=receptacle for 1000-watt unit tests; C=receptacle for continuity checks; D—E=receptacle for a 6 to 8-v bulb (such as pilot bulb No. 43); F=outlet for 7-watt 117-v bulb; G=standard fuse receptacle (15 amperes); H=9 turns of a .660-watt coil element and I=9 turns of a 1000-watt coil element.



Preset Thermostats

Still another percolator, the *Mirro*, has a factory-preset thermostat that will cut out the main combination heating and perking element at approximately 195° and a 30-watt warming element will continue to warm the liquid. This type of preset thermostat is used by many manufacturers and can be easily recognized.

A preset thermostat with only one heating unit is used in the *West-Bend* models; here the thermostat cuts in and out to keep the coffee hot.

Booster-Perking Elements

A pair of 400-watt elements are used in G.E.'s percolator (model *13P30*). One is a booster element for heating the liquid, the other for perking. A low-wattage element is used to keep the coffee hot.

Another G.E. model (*P*-31) uses a bi-metal blade which opens the control switch at 181° to 195° and throws a *keep-warm* unit in series with the perking element to develop about 50 to 70 watts to keep the coffee hot.

Service Tools

The tools required for servicing are mostly standard nut drivers, screwdrivers, long-nosed pliers, diagonals and crimping pliers. A suitable thermometer is a must. It must have a range of 60° to 300° *F* and should be long enough to reach almost the bottom, yet extend up through the top so that it can be easily read.

Special attention should be given to the inset or stem. The valve washer

(*Continued on page 61*)

ASSOCIATIONS

IRTSA, Wisconsin

At the annual election of officers of the Indianhead Radio-TV Servicemen's Association, Wisconsin, *Everett Siemond* was elected president; *Clyde Struve* was named vice president; *Richard Presnell*, secretary, and *Vernon Meindel*, treasurer.

Kenneth Wheeler was appointed chairman of the program committee, and *C. W. Stiemke* will continue in his post as corresponding secretary.

° ° °

TSA, Albany, N. Y.

The Television Service Association, Albany, N. Y., has elected *Warren Baker* president.

Other new officers include *Henry T. Sepulski*, vice president; *William Noah*, treasurer, and *William Skilling*, secretary.

° ° °

CSEA, California

The Board of Directors of the California State Electronics Association, headquartered in Fresno, California, now consists of the following members: *H. Lawrence Schmitt*, president; *Jim Wakefield*, secretary; *Lee Johnson*, vice president; *John Blackwood*, treasurer; and *Art Blumenthal*, *Herb Sulkin*, *George Martin*, *Arnold Meyer*, *Ray Warthen*, *Jack Halloway* and *Ed Mitchell*.

On the board of delegates are: *Ed Mitchell* (TSDA, San Mateo County); *Andy King* (RTA, Vallejo); *Jack Brown* (RTA, San Gabriel Valley); *Morris Bloombaum* (SRTT, San Fernando); *Del Davis* (SRTT, Glendale); *Dick Kelso* (RTA, Santa Clara Valley);*Fred Abrams* (Long Beach RTA); *Lloyd Brown* (RTA, South Bay); *E. E. Harris* and *Jerry Strouse* (San Francisco Technical Guild); *Howard Bogue* (Citrus Belt RTA); *Mel Dumolt* (RTA, Alemda County); *Vernon Steinhauer* (CEA, Fresno); *Vic Bangle* (RTA, San Antonio); *Ben Leff* (RTA, Pasadena); *Walt Rundquist* (RTA, Los Cerritos); *James Brewer* (ARTDA, Sacramento); *Clinton Matthews* (RTA, San Diego County); *Harry Bernstein* (RTA, Santa Monica); *Tom Lawson* (Tri County RTA); *Bob Martin* (San Joaquin RTA); *J. Blackwood* (TV Service Association of Bakersfield); and *G. McGeorge* (RTA, Salinas).

The state association has been set up on a five-section basis covering the following areas; *A*, northern end of the state south to Santa Clara County; *B*, the Fresno region; *C*, the Bakersfield region; *D*, the Los Angeles area; and *E*, the San Diego territory.

Twenty-two local associations are now members of CSEA.

° ° °

TSA, Seattle, Wash.

Harold Hart has been elected president of the Television Service Association of King County, Seattle, Washington.

Others named were *Clayton Fuller*, vice-president; and *Ray Murphy*, secretary-treasurer.

NEW OFFICERS OF ESFETA (left to right): P. P. Pratt, treasurer; Gordon Vrooman, president; Robert A. Larsen, vice president; and Thomas Salsibury, sergeant-at-arms. George Carlson, secretary, was absent when photo was taken.

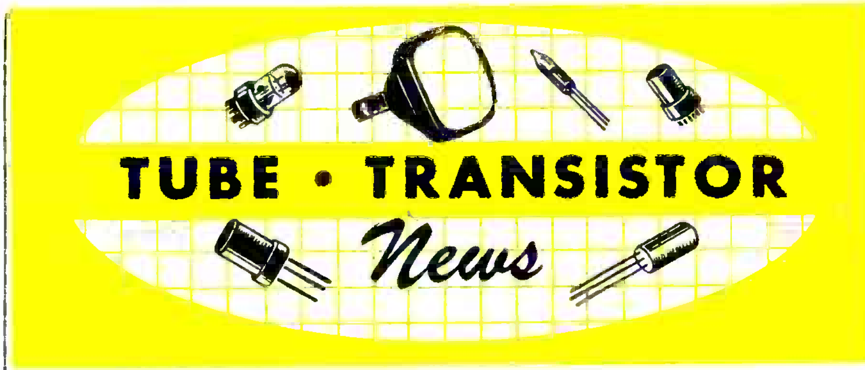
ESFETA, New York

GORDON VROOMAN, of the Syracuse TV Technicians Association, has been re-elected president of the Empire State Federation of Electronic Technicians Associations. *Robert Larsen*, of the Radio Television Guild of L. I., has been elected vice president; *George Carlson*, of the Electronic Technicians Association of Jamestown, secretary, and *P. P. Pratt*, of the Television Electronic Service Association of Western, N. Y., has been renamed treasurer. *Thomas Salisbury*, of the Mohawk Valley TV Technicians Guild, is now ESFETA sergeant-at-arms.

Four associations have been accepted by ESFETA as member associations: Tri-County Electronic Technicians Association, Olean; Rockland Association of Electronic TV Services, Pearl River; Mohawk Valley TV Technicians Guild, Utica; and Tompkins County TV Dealers Association, Ithaca. There are now eleven associations active in ESFETA. The state body is now said to represent 80% of the organized service associations in New York.

TEN YEARS AGO IN SERVICE

COMPONENT, ACCESSORY and test-equipment manufacturers disclosed plans for nationwide clinics, co-sponsored by local distributors and in some instances associations, featuring technical sessions on tube testers, alignment, troubleshooting, emergency repair and antenna installations, with emphasis on TV and FM chassis. . . . A number of associations indicated keen interest in a national service association, patterned like the Institute of Radio Engineers, that would be known as the Society of Service Engineers. . . . The first analyses of mixer-oscillators used in Philco, G.E., RCA, and DuMont TV chassis were published in SERVICE. . . . An exclusive report on the testing and troubleshooting of shaded-pole motors used in small fans, blowers and phono players also appeared. . . . A code-of-ethics program for Service Men was outlined by *Herb Clough*, chairman of an industry parts cordinating committee, at a meeting attended by *Jack Berman*, representing EPEM; *Harry Kalker*, RMA; *Bob Baggs*, Sales Managers Club, and *Bill Schoning*, NEDA.



Design-Application Notes on New Beam-Power AF Tubes . . . Transistors for High-Power AF and TV, and Two-Way-Radio

The accelerated interest in audio has prompted the development of new types of tubes and transistors to provide improved performance. Recently, one manufacturer[1] announced a beam power tube of the 7-pin miniature type for use as a class A amplifier in the audio output stage of TV and radio receivers.

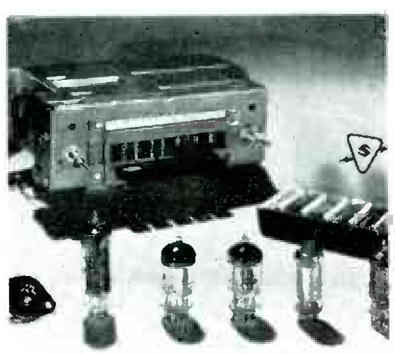
The tube (6DS5), when used in cathode-bias circuits, can deliver a maximum-signal power output of approximately 3.6 watts with a peak *af* grid-1 voltage of 9.2. Cool operation of grid 1 is claimed because of the tube's structural design which minimizes grid emission. In view of this feature, the 6DS5 can be used with cathode bias and a relatively large value of grid-1-circuit resistance. This is a significant feature in TV receivers where the audio output tube is driven directly by the FM detector tube.

Transistor Developments

In the transistor field, one company[2] has developed a pair of high-power types, with it is said a significant potential in audio amplifiers.

Designated the *MN*-24 and *MN*-25, the transistors can provide 30-35 db gain at less than 5% total harmonic distortion when delivering 4 watts.

These new types were noted as embodying a number of advantages over earlier models: More power, more reliable high-temperature performance, gain maintained at high power, and less distortion.



RECEIVING TUBES and transistor (foreground), manufactured by Sylvania, presently being used in 12-volt hybrid auto radios.

Three new high-frequency transistors (germanium tetrodes)[3] have also been announced. Among some of the possible applications of these new semiconductors are TV sets, and two-way radio transmitters and receivers.

One of the transistors has been designed to amplify at 120 mc.

The new tetrodes are produced by the meltback process. In this process layers of *p*- type germanium are produced; these are said to be so thin that twenty such layers would be required to equal the thickness of a single magazine page.

The tetrode transistors are hermetically sealed in an all-metal case of welded construction. The transistor package is designed for use on printed-wiring boards.

The new transistors have been designated 3N29, 3N30, and 3N31. With a common base connection and a bandwidth of 2 mc, they are rated for a minimum of 10 db gain, respectively, at 30 mc, 120 mc and 15 mc.

Maximum collector dissipation for all three units is 50 milliwatts at 25°C. They are rated for operation at a maximum junction temperature of 85°C.

The allowable collector voltage for the three devices is 7.

For receiver local oscillator use, the 3N29 has an oscillating frequency of 50-60 mc; the 3N30 will oscillate at over 200 mc, and the 3N31 at 30 to 40 mc.

[1]RCA [2]Motorola [3]G. E.

You Have More TO SELL WITH A *Winegard*

The more sound selling facts you can put before a customer, the more chance you have of closing a sale! And the Winegard Color'Ceptor gives you selling points no other antenna can offer . . . exclusive buying appeals that clinch 9 out of 10 sales!

They See the Gold and They're Sold

The gold-anodized finish of the Color'Ceptor gives it a rich, quality appearance not found in any other antenna. When you show the Color'Ceptor alongside competitive models, the Color'Ceptor is so distinctive, so *finished-looking* that it is invariably selected by your customers. Gold-anodizing has a practical sales advantage, too. It provides immunity to corrosion—prevents deterioration in performance.

If the Winegard Color'Ceptor Won't Bring in a Station You Want to See . . . Nothing Will!

Proof of performance was dramatically illustrated when Robert Seybold of Dunkirk, New York—using a Winegard Antenna—broke all long-distance reception records in 1956 (see Radio-Electronics Magazine, Jan., '57). Equipped with optional signal-boosting Power Pack and patented "Electro-Lens"* focusing, the Color'Ceptor is second to none for long-distance reception and clear, watchable pictures in both black-and-white and color!

factory-authorized
ANTENNA SPECIALISTS
Installation • Service • Sales
Winegard
TELEVISION ANTENNAS

The Sign of Better Business

The Winegard Authorized-Dealer decal (pictured above) is proving a real business-builder for every dealer who displays it. Heavily promoted in Winegard's national advertising, the decal tells the world that "here's the place to buy the gold-anodized Color'Ceptor."

Want More Details?

Mail coupon below for all the facts on Color'Ceptor's spectacular success story! Winegard gives you everything you need to make antenna sales boom—the product, free display, national advertising, proven sales techniques. Join the swing to Winegard—it's the best move you can make!

Winegard company

Dept. B5, 3000 Scotten Blvd., Burlington, Iowa

Name ____________________

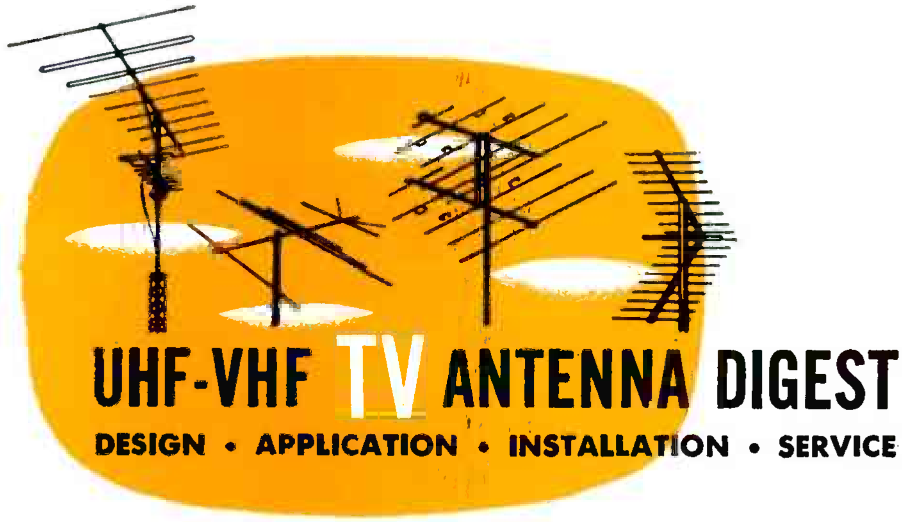
☐ Please rush me free 4-color descriptive literature on your gold-anodized Color'Ceptor and information on display material.

☐ I'm interested in the complete line of new 1957 Winegard antennas.

Company ____________________

Address ____________________

City ______________ State ______________



Analysis Of An Indoor TV Antenna Using A Single Vertical-Element Rod For Pickup

by MATTHEW MANDL

MULTIPLE REFLECTIONS developed by metallic objects in a room represent one of the major problems in indoor TV reception. Such multiple reflections due to bouncing of horizontally-polarized waves at all angles, make it difficult to orient an indoor antenna properly.

Initially, the picture and sound signal energy is transmitted with horizontal polarization; that is, a horizontal antenna is used and the transmitted wavefront of energy is as indicated in Fig. 2, where the electrostatic lines of force are in a horizontal plane. When high frequency signals travel through space, part of the horizontally polarized waves invert (about 10 to 20 per cent) and actually arrive at the TV antenna vertically polarized; Fig. 3. Thus, since the receiving antenna is horizontal in its position, all the energy is not picked up because horizontal antennas are not sensitive to vertically-polarized waves. Tilting an antenna upward, as is sometimes done with rabbit-ear types, helps; but at an angle between true vertical and true horizontal portions of the vertical and the horizontal signals are lost.

If the rabbit-ear type of indoor antenna is adjusted so that both of the elements are in a vertical plane, the lines of force of each interact and tend to cancel each other, because the two vertical rods act as a transmission line section instead of an antenna.

Field Investigation

In an investigation of these problems, it was discovered that at low levels in built-up areas, or indoors, over fifty per cent of the signal often was vertically polarized.

Thus, it was felt that the answer to the problem lay in a technique that would permit pickup of the vertical waves, or those near vertical, and this could be accomplished with a single-rod vertical member which could be angled or tilted slightly to take advantage of the waves that are slightly off the true vertical plane.

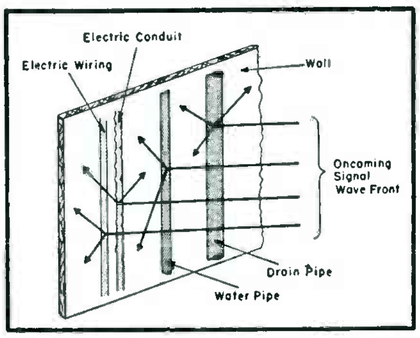


FIG. 1: HOW METAL in walls can cause reflection of TV waves. Metallic objects in ceilings and floors would add to multiple reflections and re-reflections. Tests have indicated that an almost unmeasurable amount of reflections occur in a typical room, causing points of high gain where in-phase conditions exist, and low gain and interference where out-of-phase points occur.

Vertical Member Design

Experiments with various straight-rod element systems resulted in the design of a model[1] with a single member whose length could be extended substantially to meet receiving conditions in a room. Since the use of a single rod left one side of the transmission line open and unbalanced, it was found necessary to incorporate a bent-rod load (within the housing) to provide system balance.

Phasing Section

A phasing section, harmonically related to the channels, was also included; in addition, a 12-point position selector switch was circuited in the system so that the normally low

(Continued on page 48)

[1]Snyder 10-D.

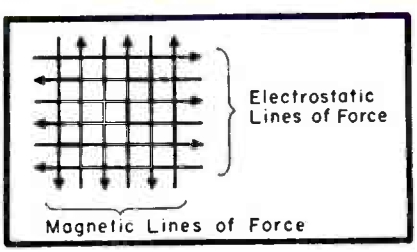


FIG. 2: SINCE THE transmitted signal from a TV station is horizontally polarized, the type of wavefront transmitted shown above results; here the electrostatic lines of force are horizontal.

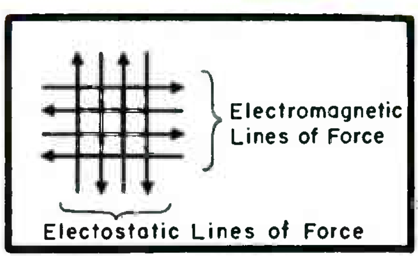


FIG. 3: AFTER THE TRANSMITTED energy leaves a TV antenna and travels through space, some of the vhf horizontally polarized energy (about 20%) inverts and becomes vertically polarized, as illustrated here.

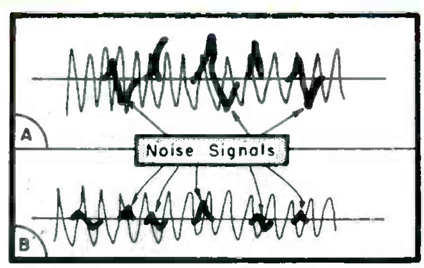
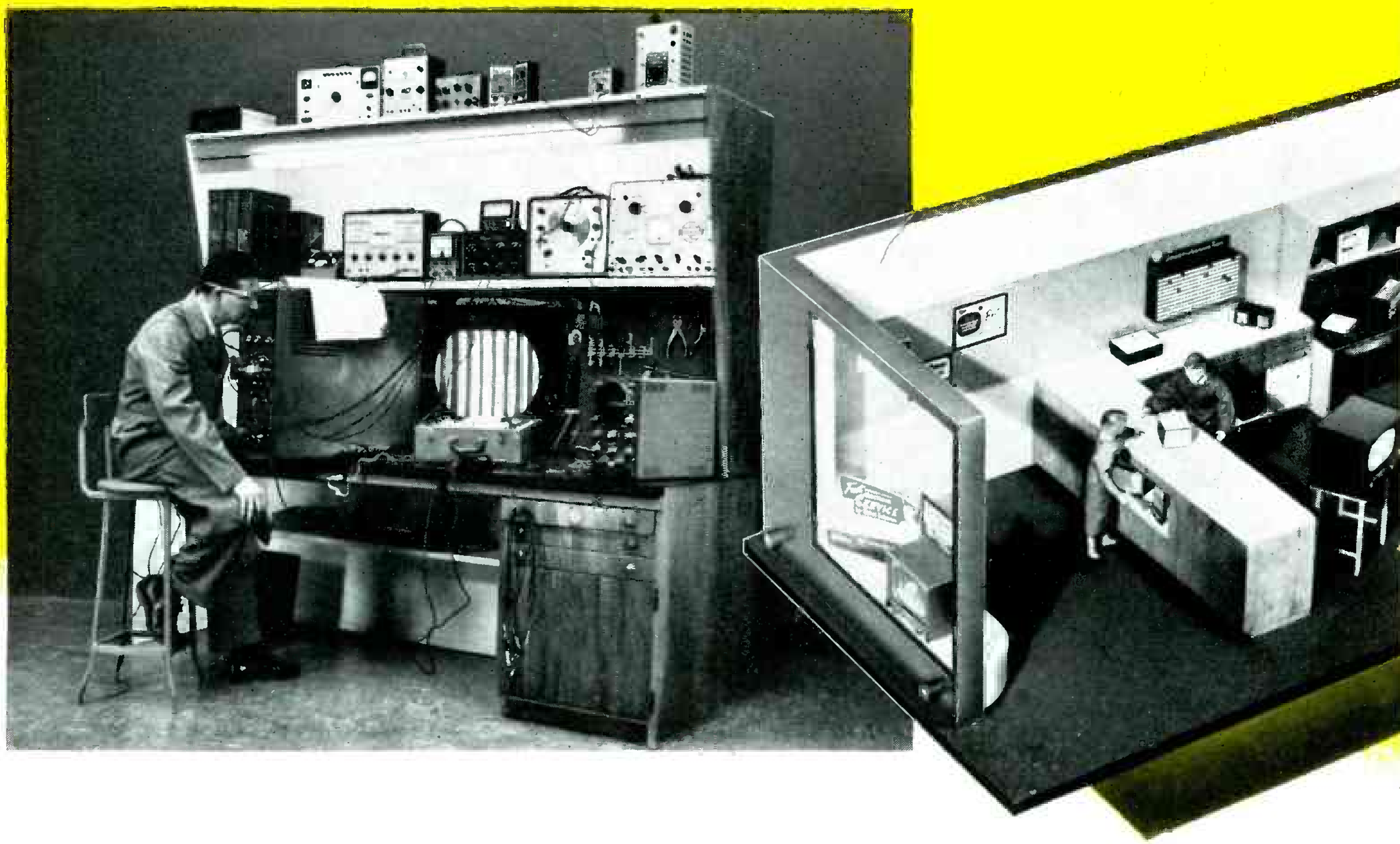
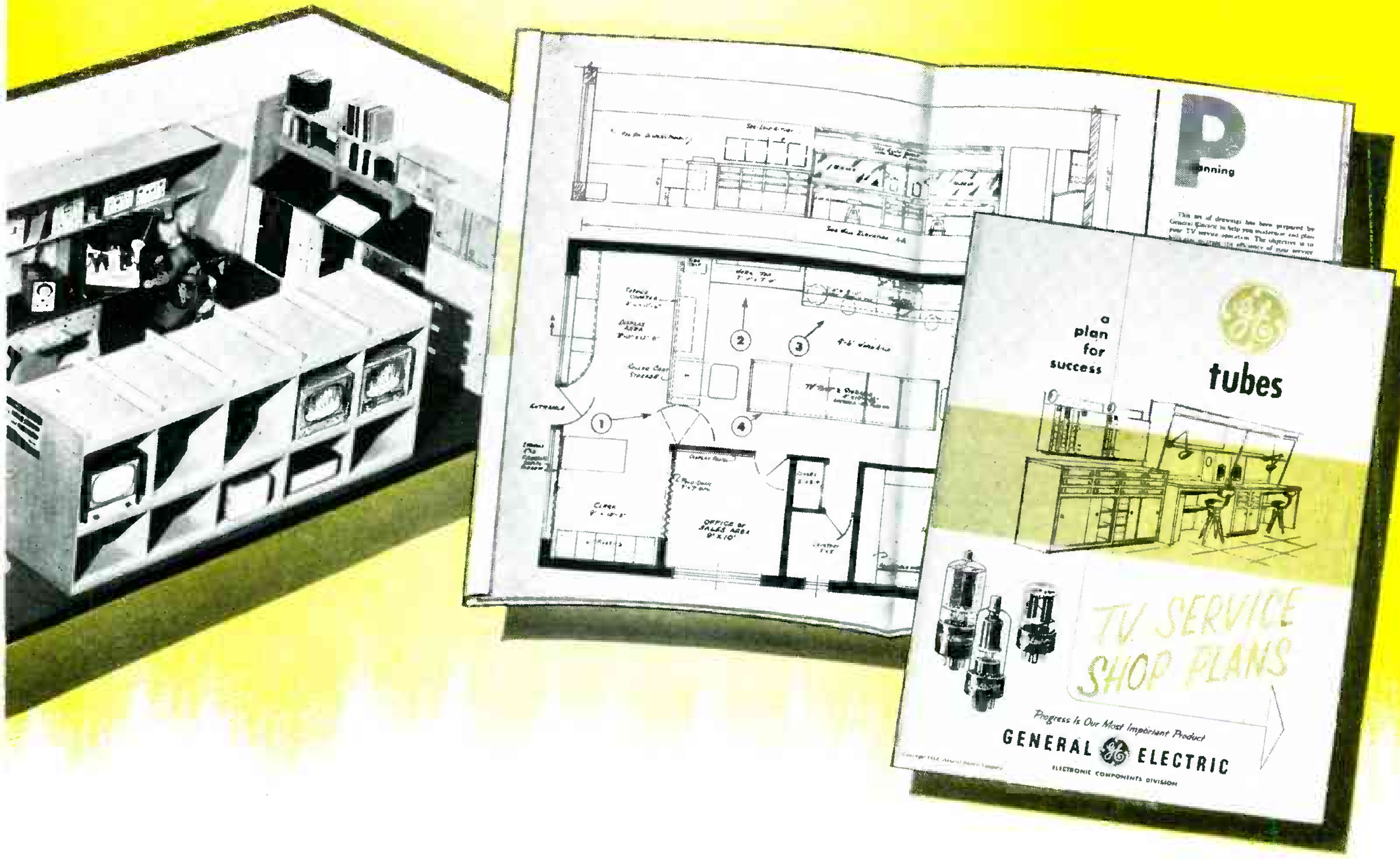


FIG. 4: NOISE SIGNALS for horizontally-polarized waves that are present during indoor pickup are shown in the (a) traces. The relative noise reduction that occurs when the waves assume vertical polarization is illustrated in (b).



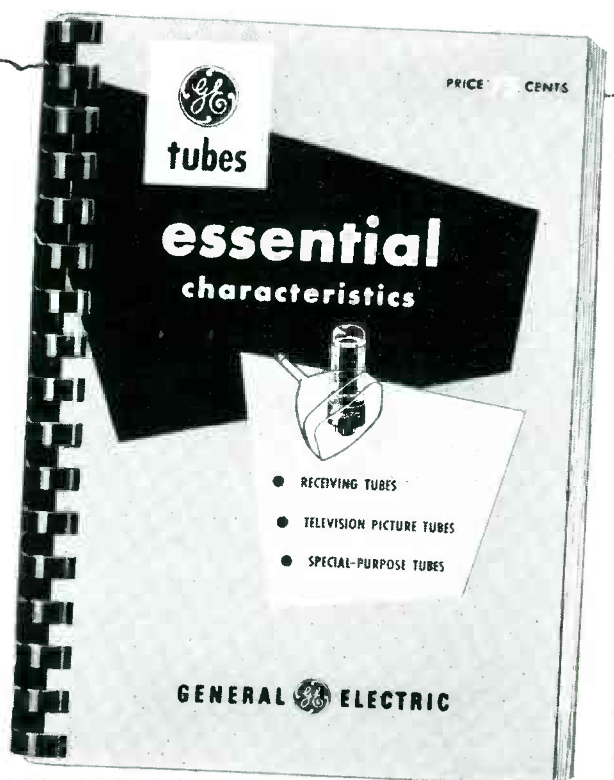


SERVICE DEALERS GENERAL ELECTRIC SHOP PLANS!

AND NOW

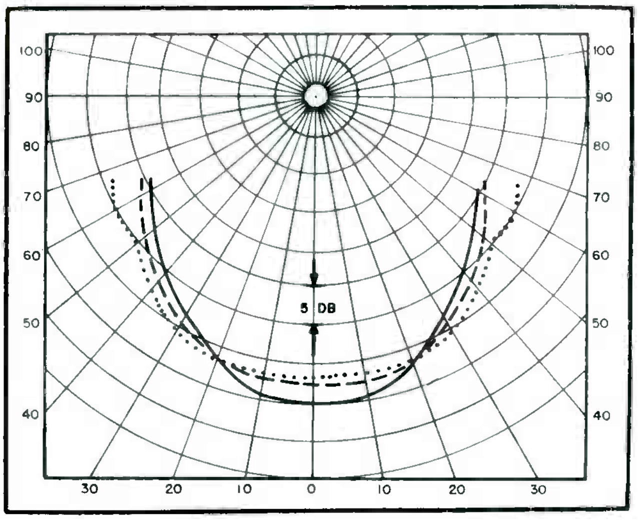
ANOTHER G-E BUSINESS-BUILDING, TIME-SAVING AID TO THE INDEPENDENT SERVICE TECHNICIAN...

Most complete tube guide ever published—the new edition of "Essential Characteristics"! Over 1500 types, with descriptions, ratings, and basing diagrams. Pocket size. See your General Electric tube distributor immediately!



ABE COHEN, engineering manager for University, applying a driver unit into a reflex trumpet preparatory to testing for polar-frequency response. Wide-angle trumpet, on stand, has just been similarly tested.

FIG. 1: POLAR PATTERNS at 1000 cps for a 4½′ directional horn (solid line), 2½′ directional horn (dashed line) and 4½′ wide-angle horn (dotted line).



Round and Wide-Angle Horns

How To Determine Which Type To Use In A Sound-System Installation

by LAWRENCE J. EPSTEIN
University Loudspeakers, Inc.

WITH THE ADVENT of *wide-angle* dispersion trumpets in the 40's and the subsequent introduction of a number of variations featuring advanced designs, Service Men often find themselves in a quandary on speaker choice. Factually speaking, while both directional and wide-angle type horns are popularly employed in the field today, the author has come to wonder whether the reasons for selection are equally factual.

If either type is occasionally compromised by improper application or installation, it has not been the fault of the Service Man. Advertising claims are easily misinterpreted, not so much by what is stated as what is *not*. Both type designs have a definite place in modern sound, but truly successful utility of the advantages of each is assured if we also appreciate the limitations.

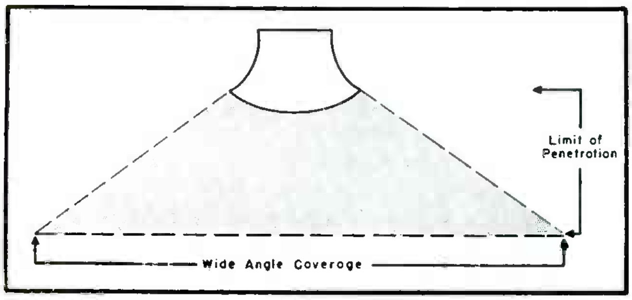
Trumpet Characteristics

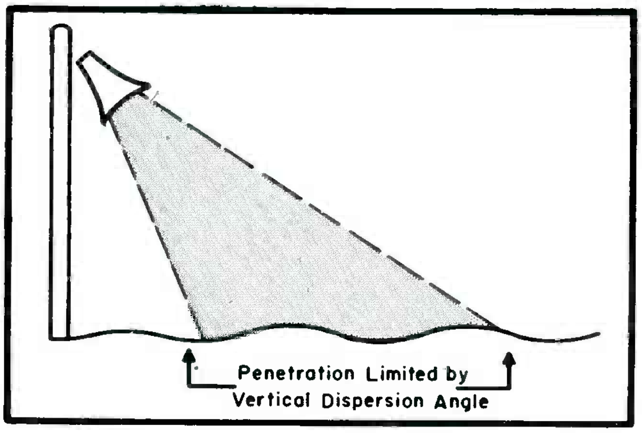
All too often the selection of a loudspeaker is predicated on habit, price, and insufficient understanding of loudspeaker characteristics. The latter is of inestimable value is planning a successful and *economical* system.

For example, it has been common practice to select heavy-duty trumpets primarily on the basis of initial cost, usually with the idea that only low frequency response is being compromised. A second glance at trumpet specifications will reveal a relationship between trumpet size (air-column length and horn-mouth diameter) and the angle at which the sound is dispersed. Note that the dispersion angle *decreases* as the horn size increases. Thus a gain in fidelity is accompanied by a loss of coverage off the speaker axis. On the other hand, if the sound is required to penetrate to as great a distance as possible, or override high ambient noise, the larger trumpets with their sharper distribution pattern will provide more sound intensity along the speaker axis than the smaller horns. The larger horns, in addition to

(*Continued on page* 44)

FIGS. 2a AND b: COVERAGE of wide areas with little depth that obtains when wide-angle trumpets are used as normally recommended.





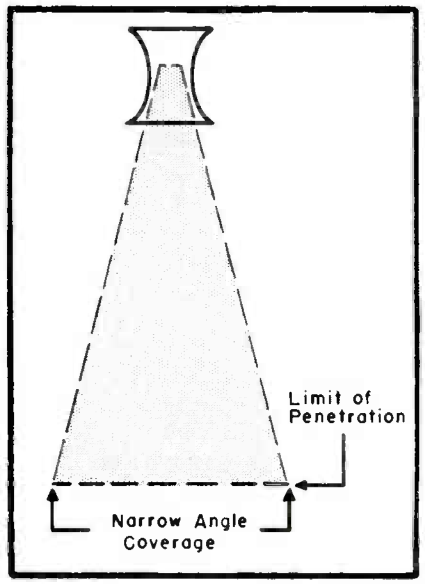
Round and Wide-Angle Horns

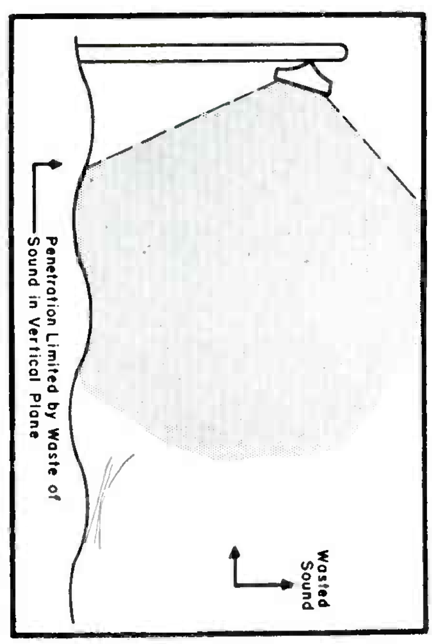
(*Continued from page 43*)

affording greater protection to the driver unit against low-frequency overload, distribute the load on the driver diaphragm more uniformly, thereby producing smoother overall response as well. Obviously, then, there are three essentials to be considered when selecting a trumpet; fidelity, distribution angle and penetration of distance or noise.

Four trumpet sizes are available for applications where directional projection characteristics are preferred. One type is a reflex trumpet with a 6½′ air column having a low frequency cutoff especially suited for reproduction of musical programs. Then there is the 4½′ air column trumpet, recommended for general applications requiring good music and speech characteristics. Also available is a 3½′ trumpet, with a slightly higher cutoff than that of the 4½′ horn, that is suggested where economy is an important factor in the planning of a music and speech system. Finally, we have 2½′ trumpets designed primarily for voice reproduction where a heavy-duty speaker must be relied on for continuous, highly intelligible speech reinforcement. The 2½′ and 3½′ trumpets will also provide excellent coverage of wide-angled areas. The 4½′ and 6½′ horns, with their sharper dispersion characteristics, will deliver *more* sound intensity on axis, and may therefore be used to greater advantages in covering longer distances or beaming sound to where it is particularly required. For determining sound-pressure corrections, relative to a given driver unit on a 6½′ trumpet, the data in table 1 (at right) should be used.

Since the advent of *wide-angle* projection, there appears to be considerable misunderstanding in the field





FIGS. 3a and b: COVERAGE of very narrow and deep areas that prevails when wide-angle trumpets are used in the reverse plane.

Air-column Length	**Deduct**
4½′	1 db
3½′	2 db
2½′	3 db

Table 1

regarding the relative merits of directional versus wide-angle horns. Properly applied, a wide-angle horn series is another contribution in solving certain sound problems; but by no means do such horns replace the round *directional* trumpet for general utility and in specific instances. This point is illustrated in Fig. 1 (p. 43), where we have a comparison of the polar patterns (horizontal plane) of a wide-angle 4½′ air-column projector and a directional round horn with equivalent 4½′ air column (taken at 1000 cps). Response of a round directional trumpet with only a 2½′ air column is also included to show what this smaller horn with a wider dispersion than the 4½′ directional horn will do. The wide-angle horn provides a much wider pattern than the equivalent round horn but at a *loss* of 3 db in the horn axis region, and a similar *gain* off speaker axis.

If we were to attempt to make up for that loss in order to penetrate to the same *distance* of projection, the power input to the driver on the 4½′ air-column wide-angle projector would have to be *doubled*. If it were not a matter of distance, but the need to overcome particularly troublesome noise conditions, again that loss of 3 db could make a big difference in intelligibility. On the other hand, notice how more closely the pattern of the 2½′ air-column round directional trumpet follows that of the wider 4½′ air-column projector. Though 2 db below that of the 4½′ directional horn in the axis region, it is 1 db better than the 4½′ wide-angle projector near the axis. Then, it too falls off below the wide-angle projector in the farther off-axis regions. The 2½′ round directional trumpet would not, of course, have the low-frequency characteristics of either the 4½′ directional horns, due to its shorter air column length.

Clearly, then, what the wide-angle projector has to offer is *uniformity* of wide-angle response, falling off less rapidly, off-speaker axis, than the *equivalent* directional horn. But, does *wide-angle* mean *more coverage?* Not necessarily; it all depends upon the configuration of the area to be covered. If the area is very *wide* but not too deep, the *wide-angle* horn

(*Continued on page* 56)

Input-Power Tests

(*Continued from page* 13)

easily locate the problem. First all tubes and pilot lights must be removed; this eliminates the external load from the transformer. Now, the wattmeter test can be made. If the unloaded transformer shows presence of more than a small drain, (never more than 1-1.5 watts) the transformer has an internal short and must be discarded. When making this test, you must be absolutely sure that all external loads have been disconnected from the transformer. In one set, heavy leakage was found through the rectifier socket itself, causing a high-voltage leak to chassis, indicating a short when the transformer was tested. A normal well-designed transformer will show only a small drain with no load; in some cases, only the initial charging surge will be read, the meter dropping back to zero.

Typical indications for the more common defects are about as follows: Shorted turns in high-voltage secondary, 50-100 watts; shorted turns in primary, 50-100 watts; short in heater secondary, 200-300 watts. Dead short in primary or filament windings will be in the fuse-blowing class.

To protect the wattmeter against shorts, it should never be used without fuse protection. If the wattmeter has a 300-watt scale a fuse of not over 3 amperes capacity, (the quick-blow type) must be inserted in series with one of the output leads. One should never use a slow-blow fuse in this circuit; the added current drain may cause meter damage, whereas the quick action of the regular fuse will usually save it.

Television set wattage readings generally run higher than radios, because of the increased number of tubes; power drains run from 125-150 watts for the series-filament sets using dry rectifiers (usually voltage doublers), up to 150-160 watts for sets using filament transformers with dry rectifiers, and on up to 200-225 watts for the larger sets, using full transformer-type power supplies. Color-TV set drains, of course, run even higher, with their larger number of tubes. The rating label on the set should be consulted, if there is any doubt as to the normal wattage. On some of the earlier color sets, with their long strings of tubes, the normal wattage might even go above the 300-watt range of the meter. Circuit refinements are bringing the color-set ratings into the 250-300 watt range.

Wattage-check instruments are available in both panel and portable types. In our shop we use two; one on the radio end of the bench and a wall-mounted duplicate, with fuse and outlet, at the TV end. The latter is fed through an isolation transformer and is used as a combination wattmeter and isolator for the chassis-connected types of TV sets to reduce the shock hazard. Incidentally, we found the transformer in this unit to be too small, with a maximum rating of around 150 watts; it overheated when TV sets had to be *cooked* for long periods of time. To carry this load continuously a 350-400 watt transformer is being installed.

When intelligently used, the wattmeter technique will prove to be the most useful, and the most used, on your test bench. Its applications are numberless and every day will bring out new uses for it.

Servicing Helps

(*Continued from page* 26)

so it does not affect circuit operation, a repair can be made. Open components need not be isolated so long as they do not intermittently restore themselves or short. Others, such as shorted or wrong-value components, must be isolated by cutting the proper risers with a very fine-toothed saw or a 1/32″ thick abrasive disk in a hand tool. (Diagonal cutting pliers should not be employed since they are likely to crack a module deck.) Then, a new component can be connected across the proper riser wires, usually on the opposite side of the printed board from the module.

All riser wires must be heated at the same time to insure removal of the module. Two methods are available for this simultaneous heating; One involves heating by a soldering iron with a hollow-square tip; the second requires dipping of the underside (dip-soldered side) of the printed board in one of the small solder pots which are now available. In either case, the holes can be cleaned and the new module inserted and resoldered either by individually soldering each riser, or by dipping in the solder pot.

Hum Reduction

Several cases of hum have been reported in RCA models 8-*EY*-4*DJ* and 8-*EY*-4*FK*, due to heater-cathode leakage in the 12AX7. This hum usually increases with use and the tube should be replaced.

For reduction of 60-cycle hum at both minimum and maximum positions of the volume control, an insulated wire, 2½″ in length, has been added between terminal 4 of the 12AX7 socket and terminal 2 of the tone control. Although both points are at -B potential, the addition of the wire cancels out a hum pickup due to circulating currents.

Regenerative Squeal Curbs

Under high-humidity conditions an electrolytic action may take place between the chassis mounting spacer (zinc die-casting) (on RCA models 8-*BT*-9*E*, 8-*BT*-9*J* and 9-*BT*-9) and two circular contact areas of the printed-wiring board used. The spacer is in direct contact with the two contact areas and provides the electrical circuit between them. An oxidized connection at this point will result in a poor contact which, in turn, may cause regenerative squeal.

To overcome the effects of this electrolytic action, a 3-point wire jumper may be added to interconnect the two contact areas mentioned and the printed-wiring at the third tuning capacitor mounting screw.

Short Cirucit Repair

Instances of intermittent short circuit of C_{14} (100 mfd) on RCA chassis 8-*BT* and 9-*BT* series, have been found to result from the chassis mounting spacer short circuiting to the printed wiring underneath the spacer. Any chassis that is removed from its case should be examined and any spacer on which the two mounting bosses are of unequal height should be replaced.

Critical Vertical Hold Sure

In some Motorola *TS*-537 chassis, critical vertical hold conditions have appeared; the trouble has been traced to the vertical hold control locking at one end of its range. Replacing resistor R_{606} (6.8 megohms) with a 5.6-megohm unit will eliminate this problem.

TV Antennas

(*Continued from page* 39)

impedance of the dipole could be raised at will to match the impedance of the receiver's input.

In field tests with the antenna it was found that noise and ghost-type signal-pickup was reduced when vertically-polarized waves were utilized; Fig. 4 (p. 39). The internal circuit of the vertical-rod antenna is shown in Fig. 5. The variety of switching combinations possible appears in Fig. 6.

The antenna is not intended to replace an outdoor type, for the gain, while high, does not equal that of a good outdoor antenna that has been properly installed at the proper height. It does, however, offer an effective compromise when one must use an indoor model due to building and location conditions.

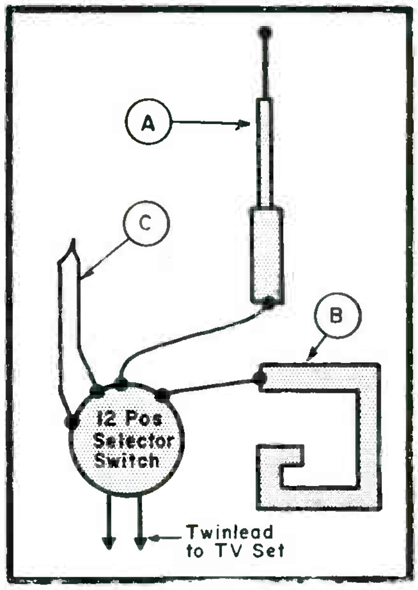
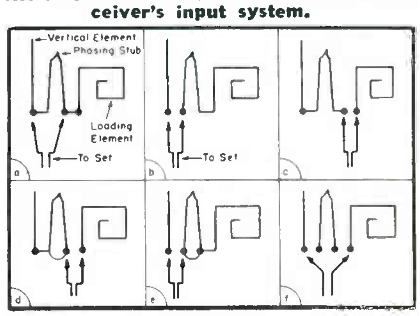


FIG. 5: BASIC CIRCUITRY of the vertical antenna*. The single rod (a) is mounted in a ball socket to permit a slight swivel to take advantage of any near-vertical signal energy. The loading element included in the circuit-selector housing (b) serves to maintain balance in twinlead lines. Also included in assembly is a phasing stub (c) harmonically related to TV channels. (*Snyder model 10-D; patent pending.)

FIG. 6: SIX TYPICAL SWITCH positions available with 12-position selector. In some instances one element is shorted out and used against the other, and in other cases all elements are in active use. It is also possible to omit one element for extreme cases of unbalance in the receiver's input system.



13-Transistor Auto Radio

(*Continued from page* 18)

back. The oscillator signal voltage is capacity coupled to the emitter of the 2N149 modulator, or mixer; *agc* is also applied to the modulator emitter and the signal from the *rf* stage is applied to the base. A 262-kc output is developed across the collector transformer of the modulator and coupled to the base winding in the first *if* stage by a .00001-mfd capacitor.

The first *if* stage is *dc* forward biased in the same manner as the *rf* stage. A pair of 1800 and 15,000-ohm voltage divider resistors (R_{96} and R_{97}) obtain a voltage from the 6.5-*v* line and emitter voltage is obtained from a static collector current of about .5 ma flowing through the transistor's emitter resistors. This current is varied by *agc* action on the emitter circuit applied through a 4700-ohm resistor (R_{98}) which raises the emitter voltage as signal is applied. The *dc* biasing circuits in these stages are *ac* bypassed to prevent signal degeneration.

The second and third *if* amplifier stages are very similar to the initial stage, except that *agc* is not applied. Transformer step-down windings are used at the input of each stage for impedance matching.

The primary tickler winding of the transformer in the collector circuit of the third *if* couples a signal to the 1N295 *agc* detector. The secondary winding here supplies signal to an infinite impedance audio detector through a 1N295 isolation diode. This prevents loading of the last *if* transformer, which is necessary to prevent dampening of the signal for signal-seeking purposes. The audio-detector load circuit contains a tone control (R_{155B}) and a volume control (R_{155A}), from which the audio signal is coupled into a driver transformer in the 2N109 audio preamplifier stage. This is a *pnp* medium-power driver circuit, drawing about 5 ma of *dc*. A 100-ohm stabilizing resistor (R_{132}) helps to maintain this operating point for temperature variations.

Automatic station tuning is provided by a miniaturized *wonder-bar* tuner (to be described next month); a trigger control circuit is provided to operate a tuner relay for this system. The complete circuit used to transform the signal voltage into current pulses for the relay appears in heavy lines in the lower right portion of the complete diagram on page 19.

The trigger signal is taken from the audio detector circuit; this actually consists of two separate voltages—one from the *agc* detector and one from the input diode of the audio detector. The audio-detector load voltage is negative and the smaller *agc*-detector voltage is positive. These two combine, and the result is a constant negative trigger voltage applied to the base of the trigger amplifier transistor as signal is received. This cuts off the 2N149 trigger amplifier, which in turn cuts off the 2N109 relay control transistor. The tuner relay in the collector circuit of the relay control stage is then deenergized, causing the tuner to stop automatically on the station being received. A 1N295 diode serves to discharge any excessive *back voltage kick* which may be developed across the relay winding as it is suddenly deenergized. This protects the 2N109 transistor from excessive collector voltages.

AM-FM Radio-Phono

(*Continued from page 15*)

ness control respectively across the output of the phono preamp and an auxiliary receptacle on the rear of the radio chassis. The auxiliary receptacle is suited for the playback of tape recordings or other sound sources. A tap on the loudness control connects to an additional receptacle on the rear of the chassis. This circuit provides a connection to the input of a tape recorder and allows any program material being handled by the radio-phono to be recorded simultaneously. The material being recorded can be monitored by the instrument speakers at any desired level, since the setting of the instrument loudness control does not affect the program level to the recorder.

The loudness control is compensated to improve low level high-fidelity listening. This is accomplished by a 22-mmfd capacitor (C_{150}) connected between the top and the arm of the loudness control which boosts the highs in relation to the mid-range frequencies as the loudness setting is reduced. A 1-megohm resistor (R_{155}), connected between the arm of the control and ground, boosts the lows proportionally by virtue of decreased low frequency loading on the signal circuit, as the loudness setting is reduced.

The first audio amplifier, consisting of one section of a 12AT7 dual triode, provides additional voltage gain for the system; however, some of this additional gain is lost to the treble and bass control circuits in the coupling circuit to the next stage.

The treble-control circuit is an *rc*-filter network consisting of R_{148}, C_{151} and the treble control (R_{149}). The series resistor (R_{148}) by itself provides essentially equal attenuation at all frequencies. With the treble control set at the top of its range, high frequencies are shunted around R_{148} through capacitor C_{151} to provide a boost in the treble response. A setting of the treble control at the bottom of its range provides a cut in treble response by virtue of the high frequencies being shunted to ground through this capacitor. The treble control provides a total range of 15 db in treble response. Normal treble response results with the control set to approximately 75% of full clockwise position.

The bass-control circuit is another *rc*-filter network consisting of a bass control potentiometer (R_{150}), R_{151}, and capacitors C_{152} and C_{153}. With the bass control set near the center of its range, capacitors C_{152} and C_{153} may be considered as a capacitive-voltage divider, which provides essentially equal attenuation at all frequencies. With the control set to the top (clockwise position), all frequencies are shunted around C_{152} to the output; however, any increase in high-frequency output at this setting is prevented by the high-frequency shunting effect of C_{153} through R_{151} to ground. This results in an overall boost in the low-frequency output. Maximum bass cut results with the control set at the bottom (counter-clockwise position) as both C_{152} and R_{150} represent a high impedance to low frequencies. Middle and high frequencies pass readily through C_{152}; however, their response is again limited at the circuit output by the voltage dividing action of C_{153} in series with

R_{151}. The bass control has an overall range of 15 db. Normal bass response results with the bass control set to approximately 75% of its full clockwise position. Bass and treble control circuit parameters have been chosen to provide minimum loudness changes with changes in control settings.

The output of the bass and treble control network is capacitively coupled to the grid of a cathode-follower stage. The cathode follower contributes no additional gain; however, it provides for a low-impedance coupling from its cathode circuit to the input of the power amplifier by means of a shielded cable and plug. Since the coupling impedance is low, we have freedom from hum pickup and loss of high-frequency response for any convenient length of cable.

The power amplifier chassis is mounted on a shelf at the bottom of the speaker compartment.

The plate power supply for the entire instrument is contained on the power amplifier chassis and consists of a conventional full-wave rectifier circuit employing two 5U4GAs. Filament voltage for all amplifier tubes in the power amplifier is provided by a single 6.3-volt secondary winding on the power transformer. To minimize 60-cycle hum, the filament winding is balanced by means of two 100-ohm resistors (R_{100} and R_{110}). The junction of the balancing resistors is returned to the common cathode connection of the bass amplifier output tubes. This places a positive bias on the amplifier filaments and removes the possibility of hum amplification in the amplifier resulting from heater-to-cathode emission within the tubes.

One unique feature of the power-amplifier system is the dual-channel power amplifier system. A crossover filter at the input to the power amplifier presents only frequencies above 2000 cps to the input of the treble channel and only frequencies below 2000 cps to the bass-channel input. Each channel contains inverse feedback from the voice-coil windings of their respective output transformers to the cathodes of their respective driver stages. In spite of the limited range of signal frequencies handled by each channel, the overall response of each channel has been found to be flat over the audio range.

The two-channel system affords low intermodulation distortion by virtue of the isolation between the high and low frequencies in the power output stages.

The bass channel consists of a 12AT7 twin-diode audio amplifier and phase inverter driving a push-pull-parallel power output stage comprising four 6V6GT pentodes. Maximum undistorted average power output of the bass channel is 22 watts.

The bass channel drives a two-speaker system designed to provide a balanced response from 20 to 2000 cps. A 15-inch low-range bass speaker connected across the 3.2-ohm secondary of the bass-channel output transformer provides response between 30 and 2000 cps. A 7-inch speaker connected in parallel with the 15-inch speaker that is in series with a 16-mfd crossover capacitor provides reinforcement in the response between 600 and 2000 cps. The 7-inch speaker is mounted within the forward cone space of the 15-inch speaker. This combination, in addition to producing a balanced response, provides fairly constant loading of the bass channel over its frequency range.

Color-TV Circuitry

(*Continued from page* 21)

has the same relation to (*G-Y*), as (*R-Y*) has to (*B-Y*), or that *I* has to *Q*. That is, an *I* detector nulls on a *Q* signal, and vice versa; an (*R-Y*) detector nulls on a (*B-Y*) signal; a (*G-Y*) detector nulls on a (*G-Y*) /90° signal. A (*G-Y*) detector does *not* null on an (*R-Y*) signal; a fact of key importance to the Service Man.

It has been pointed out that the earlier receiver arrangements included a *dc* restorer at each grid of the picture tube. The restorers were required because of *ac* coupling utilized in the chrominance channels. However, most present-day receivers make use of *dc*-coupled circuits from the outputs of the color detectors, through the color-difference amplifiers, to the grid of the color picture tube. These *dc*-coupled circuits, of course, retain the *dc* component of the complete color signal, and thereby eliminate three *dc* restorers.

Coincident with this trend to *dc*-coupled chroma circuitry has been the introduction of high-level demodulation, in which the outputs from the color detectors are applied directly to the grids of the color picture tube, thereby eliminating chroma amplifiers. The general arrangement of the high-level system is seen in Fig. 3 (p. 20). A pair of triodes are commonly used as demodulators, developing (*R-Y*) and (*B-Y*) at the plates of the triodes; a common cathode circuit for the triodes develops the (*G-Y*) signal. This arrangement is commonly referred to as a *bootstrap* demodulator system.

All of the early color-TV receivers utilized a flat-topped *if* response, in which the color signal was located on top of the response curve, as shown in Fig. 6*a* (p. 21). It is evident that simplified *if* circuitry can be realized by placing the color signal on a sloped curve, as indicated in *b* of Fig. 6.

The One-Gun Apple Tube

A one-gun color picture tube that has developed substantial interest is the *apple* tube under development by Philco. Basically, in this tube the screen is comprised of alternate stripes of color phosphors, as shown in Fig. 7 (p. 21). The single gun develops two beams, one of which is called the writing beam and the other the pilot beam. The writing beam operates at a relatively high beam current, and produces visible light from the phosphor stripes. The pilot beam is much weaker, and is utilized only to produce a *sync* signal from index strips to key chrominance circuits; the pilot beam is of constant intensity, and travels simultaneously with and slightly below the writing beam.

The writing beam is not of constant intensity, but is modulated by the complete color signal. To illustrate: When a red area is being televised, the beam intensity is brought to peak value as the red stripes are being crossed, while the beam intensity falls to zero as the green and blue stripes are being crossed. To reproduce a black-and-white transmission, the beam maintains its intensity while crossing all three primary color stripes.

The index stripes produce secondary emission when energized by the beams, and to separate the signal from the pilot beam from that of the writing beam, a 41.7-mc pilot oscillator is utilized, as shown in Fig. 8 (p. 21). The pilot signal amplifier is tuned to pass the signal sideband frequency impressed upon the pilot beam due to scanning so that the secondary-emission signal produced by *video modulation* of the *writing beam* is *rejected* by the pilot signal amplifier.

The arrangement shown in Fig. 7 (p. 21) produces solid color fields, such as red, or green, or blue, depending upon the setting of the phase-shifting network. This is the basis of operation of the apple-tube circuitry. It is evident that a color picture can then be produced by variation of the phase-shifting network in accordance with hue, varying the voltage from the pilot oscillator in accordance with the saturation of the hue, and varying the voltage on the writing grid in accordance with the luminance.

The Lawrence one-gun tube has also been under development for some time and currently is receiving considerable attention in the Du Mont labs. Up to now, one of the major problems confronting those conducting research on the tube, has been severe radiation generated by the tube's system. It has also been found difficult to provide adequate brightness, particularly on monochrome reproduction; b-w pictures have also been found to suffer from a lack of tonal quality distribution.

TEST INSTRUMENTS

TRANSISTORIZED BROAD-BAND VM

A TRANSISTORIZED broad-band audio-video voltmeter, *the Transvolter*, has been announced by Kay Electric Co., 14 Maple Ave., Pine Brook, N. J.

Instrument, a low-level unit, incorporates a negative-feedback amplifier for stable operation.

Operates on 110 v, with a built-in regulated supply; can also be powered by four mercury-cell batteries for portable operation. Frequency range is 10 cps to 10 mc; direct reading in volts and db. Frequency response of amplifier is said to be flat ± .5 db over range. Voltage range is 1 millivolt to 1 volt-full scale; 7 ranges will measure to 250 microvolts.

The audio-video amp has a maximum output of .25 volt at 75 ohms; gain up to 40 db.

° ° °

AUTOMATIC TUBE TESTER

AN AUTOMATIC TUBE TESTER, *model 123A Cardmatic*, which utilizes a punched card system to set and test automatically, has been announced by the Hickok Electrical Instrument Co., 10521 Dupont Ave., Cleveland 8, O.

Preselected voltages on screen, plate, grid or filament are tabulated on vinyl type cards which are inserted into the machine. These cards trip an automation mechanism to make electrical connections necessary for testing of tube.

Regulated dc-voltages available are: plate, 12 to 160 v; screen, 12 to 160 v. Combined plate and screen currents up to 100 milliamperes. Bias readings of .1 to 100 *v* can be obtained.

° ° °

VACUUM-TUBE PREHEATER

A VACUUM-TUBE PREHEATER, *FP22*, for intermittent troubleshooting has been introduced by Service Instruments Corp., 171 Official Rd., Addison, Ill.

Unit will accommodate up to 20 tubes at one time, including the series-filament types; 7 and 9 pin miniature tube straighteners are included. A *quick heat* switch is provided to increase filament voltages by 10%, which is said to accelerate gassy and intermittent conditions. Suspected tubes can be inserted into preheater and then placed in a tube checker while hot.

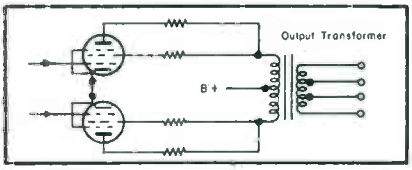
AUDIO

INSTALLATION AND SERVICE

Phono • Tape • PA

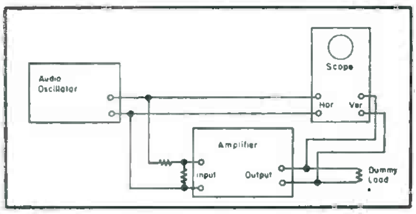
Cartridges • Needles • Amplifiers • Speakers

Output Transformer Replacement: Test Instruments Required . . . Components and Circuitry Changes Involved in Amplifiers to Match Results Obtained With Original Parts



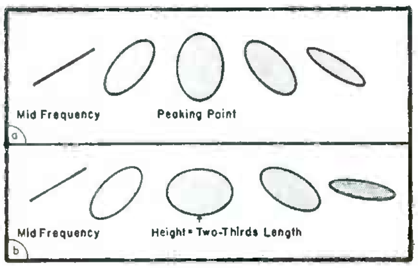
(Above)

FIG. 1: OUTPUT CIRCUITRY with pentodes connected as triodes. Screen-grid resistors can have values of 470 to 2200 ohms; plate-resistor values could range from 100 to 470 ohms.



(Above)

FIG. 2: TEST SETUP to check amplifier in which replacement output transformer has been installed.



(Above)

FIG. 3: AUDIO TRACE variations illustrating (a) peaking with too little margin of stability, and (b) correct rolloff. In the peaking and rolloff sequence, the initial trace shown represents mid-frequency. The center traces cover the peaking point; height of oval trace in (b) equals two-thirds of its length.

BEFORE THE ADVENT of amplifiers featuring substantial negative feedback, output-transformer replacement was a relatively simple matter. If an *exact* replacement was not available, one with the same specifications could be fitted in, making slight mechanical adjustment, if necessary, for the mounting. With modern amplifiers, utilizing a considerable amount of negative feedback, more than mechanical adjustment is often necessary. In fact, there are several amplifiers[1], which require transformers with special taps and windings, where only an exact replacement will do.

If these special types are not involved, and it is not possible to get an exact replacement, we must then look for a *nominal* replacement that has the same impedance rating from primary to secondary, the same power rating, and, if possible, the same specified frequency response. But, even though the nominal replacement does match the specs, we still may have a few problems to resolve.

As well as making any necessary *mechanical* adjustments, so that the transformer can fit in the chassis physically, it may be necessary to make some *electrical* adjustments so that the transformer *fits* from the performance viewpoint.

If the amplifier uses triode output tubes, or pentodes with the screens strapped to the plate so that they operate as triodes (Fig. 1), then a transformer that is a nominal electrical replacement will probably need little if any adjustment. But, if the output tubes operate in any kind of pentode circuit, whether auto or fixed biased, straight-plate coupled or partially-cathode coupled, it is more probable that some electrical adjustment will be needed before the amplifier operates correctly.

To determine the need for replacement one should initially check the performance of the overall amplifier, using the setup shown in Fig. 2. This test requires an audio oscillator that will provide sine waves from 20 to 20,000 cps and, if possible, up to 100 or even 200 kc, and also a 'scope. The input should be connected not only to the amplifier through suitable resistances, to get the right input voltage, but also to the horizontal deflection of the 'scope. The output of the amplifier, with the transformer fitted, should then be connected to a resistance load and also to the vertical deflection of the 'scope.

If the amplifier does not oscillate (as shown by a vertical deflection from the output) without input from the oscillator, you can proceed to check the frequency response and performance of the amplifier. The frequency should be run up the scale, carried on beyond the audible limit of 20 kc to see whether the response runs into a peak, as shown in (a) of Fig. 3, or rolls off properly as shown in (b).

Since few audio oscillators provide signals below 20 cps, a test for stability at the low-frequency end cannot be performed with the direct aid or the audio oscillator. To perform this check, therefore, one should intermittently short-circuit the output from the audio oscillator, so that the amplifier alternately amplifies almost its full level and then zero.

One must watch to see if the 'scope trace *bounces* vertically when the oscillator short is interrupted, indicating that the kick start given by the signal suddenly being applied produces a low frequency oscillation. Also it is

(*Continued on page* 59)

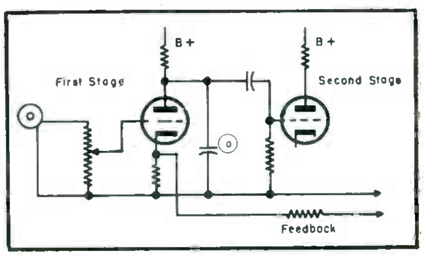


FIG. 4: IMPROVING high frequency rolloff in a feedback amplifier by adding a capacitor in the plate circuits (a).

[1]*Such as the unity coupled, ultra-linear or circlotron amplifiers.*

Round and Wide-Angle Horns

(*Continued from page 45*)

with a 120° horizontal x 60° vertical projection pattern would do a good job; see Figs. 2 *a* and *b* (p. 43). On the other hand, let us suppose the area to be covered was *very* narrow and *very* deep. In this case, the wide-angle horn could be mounted and used in a manner opposite to normal, with the horizontal dispersion of the horn operating physically in the vertical plane; Figs. 3 *a* and *b* (p. 44) show what would happen. Used in this manner, a wide-angle horn is satisfactory, *provided* the distance of depth is not greater than can be penetrated with the resulting sound output of the horn at the listening point. Note how in Fig. 3*b* much of the sound energy is wasted in upper space. Mounting angles are obviously very important, especially in the applications just discussed.

Now let's take a look at the round *directional* horn. From Fig. 4 *a* and *b* we see the area covered by a round horn with a moderate dispersion angle (neither wide nor too narrow). Because the vertical dispersion and sound energy is the same as that of the horizontal plane, considerable distance of penetration results. The actual configuration of sound on the ground surface would be a circle, becoming more of an ellipse as greater distance penetration is attempted. In fact, the pattern of Fig. 3*a* can often be duplicated by the round trumpet, angularly mounted for distance projection, without as much loss in sound pressure. Considering the selection of round trumpets available, it is easy to see why the majority of general applications and many special requirements will be satisfactorily met by these *directional* types.

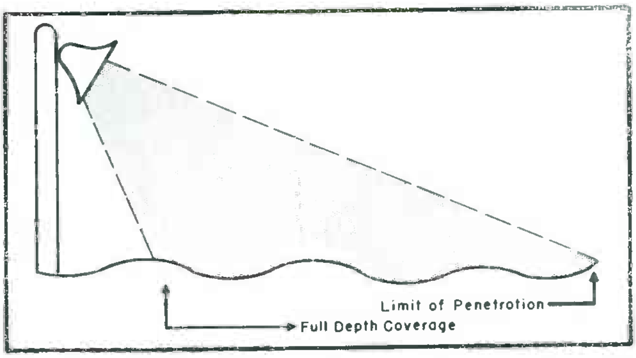
Aside from angle of dispersion, the considerations in selecting *wide-angle* horns are quite the same as with round horns; physical dimensions compatible with application requirements, and air column length to provide desired frequency characteristics. No *one* wide-angle horn should be expected to perform equally well for all applications any more than may be expected for round horns. The level and characteristics of ambient noise, the nature of the installation structural environment and acoustics, and the kind of program material are all important technical factors in determining the selection of the right *size* wide-angle horn. Given a choice of horn sizes (whether round or wide-angle) and a horn design which allows for the selection of driver units, driver and horn characteristics can be blended by the sound specialist to meet both technical and cost requirements.

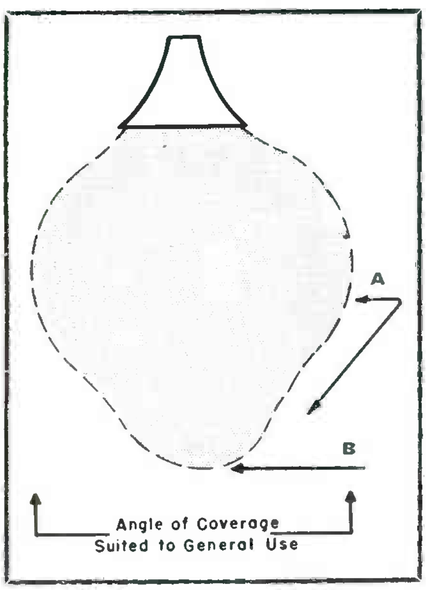
How Much Efficiency and Power?

There are many ways to approach this question of selecting a companion driver unit. We suggest that initially you establish the horn on the basis of function. For example, suppose a 6½' round trumpet is selected on the basis of on-axis sensitivity for greatest

(*Continued on page 58*)

FIGS 4a (below) AND b (right): COVERAGE provided by round directional trumpets. At point A in Fig. 4a (below) bonus penetration obtains due to greater on-axis energy. The limit of penetration appears at point B.





Driver	Frequency Response	Round Trumpets‡ 6½'[4]	4½'[5]	3½'[6]	2½'[7]	Wide-Angle 2½'[8]	4½'[9]
Type A[1]							
25 watts	85- 6,500	127 db	126 db	125 db	124 db	122 db	123 db
50 watts*	cps	130 db	129 db	128 db	127 db	125 db	126 db
Type B[2]							
30 watts	80-10,000	130 db	129 db	128 db	127 db	125 db	126 db
60 watts*	cps	133 db	132 db	131 db	130 db	128 db	129 db
Type C[3]							
50 watts	70-10,000	134 db	133 db	132 db	131 db	129 db	130 db
100 watts*	cps	137 db	136 db	135 db	134 db	132 db	133 db

1-9University *types MA-25, SA-HF, PA-HF, GH, LH, PH, SMH, Cobreflex and CLH, respectively.* **With proper value capacitor in series with driver.* ‡*Air-column lengths of the various horns are indicated.*

Chart showing sound pressure of various trumpets with different drivers and input wattages: Sound pressure readings taken at 4'; reduce by 6 db each time distance is doubled and 3 db each time power input is halved.

Round and Wide-Angle Horns

(*Continued from page* 57)

distance coverage. If the program is to consist mostly of speech, a moderately priced driver would be practical, such a unit providing 127 db with 25 watts input: *See driver chart at left.* Let us suppose, however, that the area to be penetrated is quite noisy. A more efficient driver unit, type *B*, could provide 130 db at 30 watts. Need more? Heavy-duty, type *C*, models are available to produce 134 db at 50 watts. The influencing factors determining the selection of the driver, *other* than sound pressure requirements, are amplifier power available and the cost of more amplifier power.

Its easy to see from the foregoing that on a watts-per-dollar basis, you can get more *sound* by using a more efficient driver than by pouring on more amplifier watts. For example, let us suppose you had selected a reflex trumpet because it offers the desired dispersion characteristics and meets frequency response requirements. The 25-watt type-*A* driver will yield 125 db on this trumpet. You need more? You can get a somewhat more expensive 50-watt amplifier instead, and obtain 128 db by using a capacitor of proper value in series with this driver to double power handling capacity. Or, the type-*B* driver, costing only a few dollars more can be used with a trumpet to provide the same 128 db at only 30 watts. If speech were still the only consideration and high sound pressure desired at a minimum cost, you might even consider the 2½' horn with a type-*C* driver. That combination will produce 131 db at 50 watts as against 130 db using the 6½' horn-type-*A* driver combination at the same 50 watts (with a series capacitor).

Obviously, horn-driver combinations can be juggled to yield desired sound pressures. Once the *horn* has been selected on the basis of dispersion and frequency-response characteristics, the driver should be selected to provide the sound pressure required. Bear in mind that as the smaller horns are used, dispersion increases and the available sound energy is more spread out.

What Frequency Response?

Naturally, if the program is to be both voice and music, a *wide-range* driver unit should be used. However, in the event a 2½' trumpet has been selected (say for reasons of dispersion, cost or physical requirements), a unit such as the type *A* driver can be successfully used, since its limited high-frequency response (6500 cps) will balance reasonably well with the high cut-off (200 cps) of the horn. If music is an important consideration, and for other good reasons a 4½' horn or even a 3½' horn is to be used, the type *C* driver will produce an aurally discernible improvement in low-frequency response over the type *B* unit because of its greater efficiency. Where the need is for the finest musical reproduction, a 6½' horn with either the types *B* or *C* drivers should be used.

It is not a simple thing to plan a good sound installation, nor is it a difficult thing to accomplish, if we make just a small effort to understand the factors involved. It is in seeking a *cure-all* to *do-all* that one flirts with disappointment. Any piece of equipment that makes noise of some kind will be heard somewhere by someone. It is in getting the sound to where we want it, to be heard and understood with the quality we want and with the least possible waste, that makes a *sound specialist* out of a Service Man.

Audio

(*Continued from page* 54)

important to notice what happens to the spot when you short-circuit the oscillator terminals. This should not bounce up and down, but should return to the center of the screen quite quickly.

If the trace does not obey this rule, it may be advisable to strap the vertical and horizontal deflection together, as a check on the deflection amplifiers in the 'scope. It may be that the bounce occurs in the 'scope amplifiers and not in the amplifier under test. But most 'scope amplifiers in modern equipment are above reproach in this respect.

If the amplifier exhibits either the bouncing effect at low frequency or the peaking effect at supersonic frequency, some adjustment to improve the margin of stability in the amplifier circuit is indicated. The best procedure is to clip out all of the small phase-correction capacitors.

It is possible that then the amplifier may oscillate, either at supersonic or subsonic frequency. If the oscillation is at supersonic frequency, the best remedy is to apply a suitable capacitor from plate to ground of the first tube; Fig. 4 (p. 54). The value of this plate-to-ground capacitor should be adjusted until the amplifier is not only stable again at supersonic frequency but, when the frequency run is made a smooth rolloff appears, not a peak.

This may require a plate-to-ground capacitor in the first stage, whose value may be as large as .001 mfd. If the response still shows some peaking with so large a capacitor, it may be well to try small values of phase-correction capacitors in the circuit (where they were previously connected) until a suitable rolloff is achieved at the *hf* end.

New Audio Developments

OUTDOOR THEATRE SPEAKER with a Humi-Gard cone said to be resistant to moisture and abrasion. Cone is made of a plastic-impregnated synthetic fabric. (Quam-Nichols Co., 234 E. Marquette Road, Chicago)

RECORD SPRAY said to eliminate static buildup and coat record grooves with a lubricating film to reduce coefficient of friction. (Lubri-Stat; Permo, Inc., 6415 N. Ravenswood Ave., Chicago)

MU-METAL shielded magnetic turnover cartridge supplied with sapphire stylus for 78 and diamond stylus for 33⅓ and 45. Features a cantilever-stylus-armature construction. (Recoton-Goldring 555 SDM, Recoton Corp., 52-35 Barnett Ave., L.I.C., N.Y.)

Traffic Appliance Servicing

(*Continued from page 32*)

must be clean, true and unpitted and free to move. The wells where the inset or stem set must be clean. Valve seats that are stuck (the type that unscrew) can be *freed* by heating over a hot flame for a minute or so and then immediately dipping in cold water. A stuck stem can be loosened similarly by heating the percolator without water for a few seconds and then with cold water.

Coffee stain removers can be used for cleaning. These removers not only dissolve coffee oils, but have a bleaching action. When this cleaner is used on aluminum bodies it is necessary to flush thoroughly to prevent possible staining.

PERCOLATOR shut-off data on strong or high position.

Types		Shut-Off Data
Camfield	P100	204°
Mirro	.....	195°
General Electric	13P30	Booster cuts out at 125°-150°
		Perking unit: 185°-200°
	P31	181°-195°
Presto		190°-194°: Continues to perk for 3-5 minutes
Sunbeam	.....	202°—Approximately
Universal	.....	204°
Westinghouse		155°-180°: First thermostat
		190°-200°: Second thermostat
	PE552	180°-190°
	PE561	200°—Approximately

Silver-Anniversary

AT 25th ANNIVERSARY celebration of the Precision Apparatus Company, Inc., recently held in Glendale, Long Island. Among the honored guests were (left to right): Mike Wolfe; Sol Weingast, president and co-founder; D. Lou Harris; Morris Zigman; Preston Mack, representing his late father, Pearce W. Mack, the first Precision rep, and Morris F. Taylor.

COMPONENTS

PW PLASTIC TUBULAR CAPACITOR

A PLASTIC TUBULAR capacitor for printed-wiring circuits, *BTS*, has been introduced by Pyramid Electric Co., 1445 Hudson Blvd., North Bergen, N. J.

Unit has been designed to meet requirements for minimum board space, close mechanical tolerances and operation under severe conditions.

° ° °

MINIATURE AUDIO TRANSISTOR TRANSFORMERS

MINIATURE AUDIO TRANSFORMERS for transistorized-circuit applications have been announced by Gramer Halldorson Corp., 2734 N. Pulaski Rd., Chicago 39, Ill.

A 150-*mw* series features units 21/32" high x 12/16" wide x ⅝" deep with mounting tab centers 13/16"; 300-*mw* series units are 13/16" high x 1⅝" wide x 13/16" deep with mounting centers 1⅝".

° ° °

SURGE-CURRENT LIMITER

A COMBINATION RELAY AND RESISTOR, *Surgistor*, for limiting in-rush current until tube heaters are warmed sufficiently to accept full voltage without damage, has been developed by Wuerth Tube Saver Corp., 9125 Livernois Ave., Detroit 4, Mich.

Unit is said to hold B+ voltages down temporarily to prevent cathode *stripping*.

° ° °

EXACT FLYBACK REPLACEMENTS

FIVE EXACT REPACEMENT flybacks for Admiral, Magnavox, Philco and Zenith chassis have been announced by Chicago Standard Transformer Corp., 3501 W. Addison St., Chicago 18, Ill.

HO-264 replaces Philco 32-8709-1 in one chassis and five separate models; HO-265 is used to replace Admiral 79C70-1 in portable model series T-101-N; HO-266 replaces Magnavox 360659 in portable model and chassis series 821; HO-267 replaces Zenith S-20099 in two chassis and twenty-four models; and HO-268 replaces Zenith S-23049 in three chassis and thirty-two models.

° ° °

PIX TUBE BRIGHTENER

A PICTURE-TUBE BRIGHTENER, Comet *SP43*, for electromagnetic or electrostatic focusing tubes has been announced by Anchor Products Co., 2712 W. Montrose Ave., Chicago 18, Ill.

Unit can be used in either series or parallel filament circuits.

ADVERTISERS IN SERVICE
MAY, 1957

BENCH-FIELD TOOLS

CONTROL CLEANER-LUBRICATOR

A SOLVENT, *Kleentrol*, for cleaning and lubricating controls, has been introduced by R-Columbia Products Co., Highwood, Ill.

Solvent which contains no carbon tet, will not harm wood, metal or acetate surfaces.

° ° °

TEST PROD KIT

A TEST PROD KIT, *6037*, featuring self-holding points, has been made available by General Cement Manufacturing Co., 400 S. Wyman St., Rockford, Ill.

In addition to basic test leads and prods, kit includes five pairs of adapters (banana plugs, alligator clips, etc.).

° ° °

SINGLE-POLE SOLDERING GUN

A 250-WATT SOLDERING gun with a single-pole built-in transformer has been announced by Gregg Electric Co., 2 S. Broadway, Lawrence, Mass.

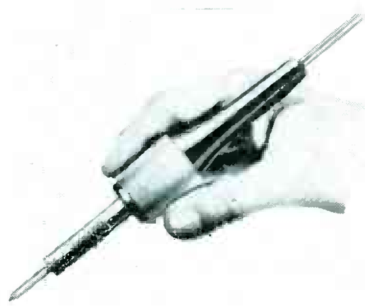
Tips available include pencil (5-inch) and chisel types. Trigger control claimed to be soft-action type.

° ° °

50-WATT SOLDERING PENCIL

A 50-*w* SOLDERING PENCIL, *24S*, with a ⅜" tip, has been developed by Hexacon Electric Co., 594 W. Clay Ave., Roselle Park, N. J.

Unit weighs 2 ounces. Has a stainless steel alloy for element housing. Tip and element are separate parts and replaceable independently.

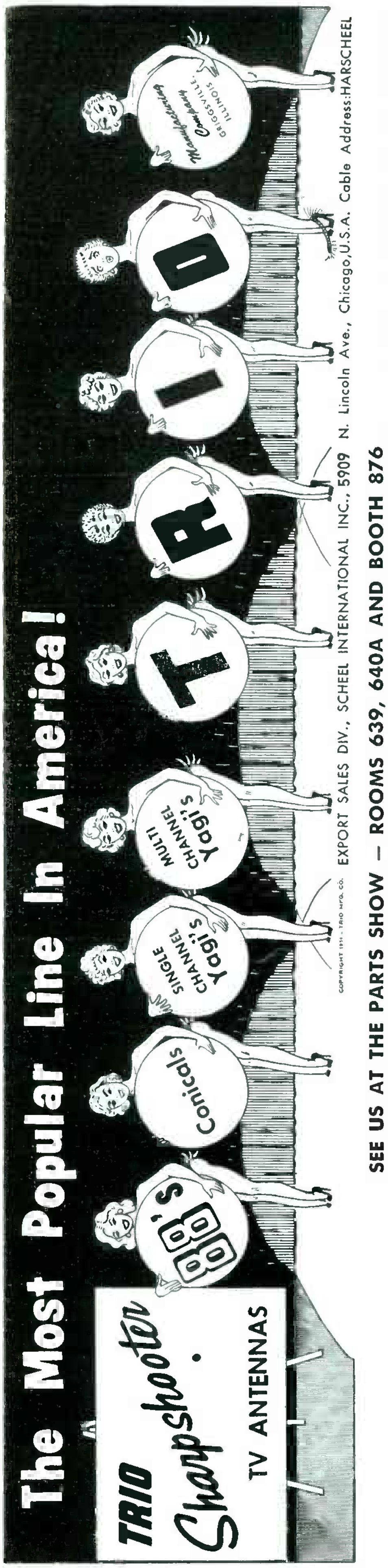


When . . .
You Change Your Address

▶ 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, enclose address label from your last SERVICE copy, 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.



PERSONNEL

Abe Kosakowsky has been promoted to assistant sales manager, jobber division, Pyramid Electric Co., 1445 Hudson Blvd., North Bergen, N. J. . . . *Eileen Johnson* is now sales correspondent and expeditor for the division.


Kosakowsky


Sundberg

Hugo Sundberg has been elected president and member of the board of directors of Oxford Electric Corp., 3911 S. Michigan Avenue, Chicago, Ill. He succeeds *Joseph D. Ceader*, who was elected chairman of the board. Sundberg previously had been vice president and general manager of the firm and its subsidiaries.

° ° °

Arch T. Hoyne, formerly in charge of the General Cement Manufacturing Co. division sales, has become eastern sales manager, with headquarters in Rockford. *William H. Dean*, previously G-C Electronics sales chief, is now west coast sales manager for all divisions, with offices at 3225 Exposition Place, Los Angeles, Calif.

° ° °

James M. Igoe has been promoted to distributor sales coordinator for the operations sales services department of Raytheon Manufacturing Co., 55 Chapel St., Newton 58, Mass. . . . *Robert F. Sim, Jr.*, is now manager of the distributor order service department for receiving and picture tubes.

° ° °

Jay J. Newman has been promoted to manager, new product and market development, RCA components division, Camden, N. J. . . . *Thornton F. Scott* is now administrator, advertising and sales promotion for the division.

° ° °

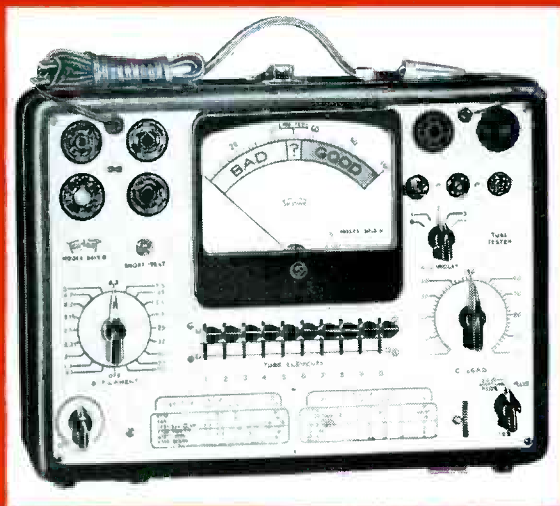
C. E. Seaman, formerly phono cartridge product manager, is now eastern regional sales manager for Electro-Voice, Inc., Buchanan, Mich. . . . *Frank Linter*, former assistant distributor sales manager, will handle the central region. . . . *Frank Stroempl*, formerly public-address loudspeaker product manager, becomes western regional sales manager.

° ° °

Julian K. Sprague, president of Sprague Electric Co., North Adams, Mass., has been named president of the board of trustees of the Mark Twain Research Foundation, Inc., Perry, Mo.

° ° °

Ricardo Muniz, formerly division general manager of the television-radio division of Canadian Westinghouse, has been appointed coordinator of manufacturing and engineering for the Magnavox Co., Fort Wayne 4, Ind.



The first
low priced
tube tester
to provide
DUAL SENSITIVITY
SHORT TEST

Triplett Model
3413-B Tube Tester
$79.50

BURTON BROWNE ADVERTISING

to do more

...today and tomorrow!

And here are just 2 answers that tell you why.

Question:

Why Will Triplett Model 3413-B "do more" tomorrow?

Answer:

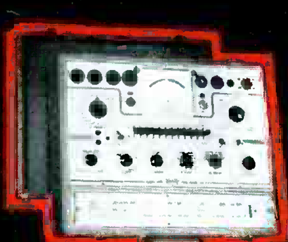
Because it will test *any new tube*. Unlike testers with preset panels of test sockets which become obsolete with the release of a new tube, Triplett flexibility of switching allows a set-up to test any new tube.

Question:

Why Will Triplett Model 3413-B "do more" today?

Answer:

Because it combines provision for conventional short test (0.25 megohms) with high sensitivity leakage test (2.0 megohms)—will test series string tubes without adapter. At only $79.50 today's and tomorrow's biggest value.



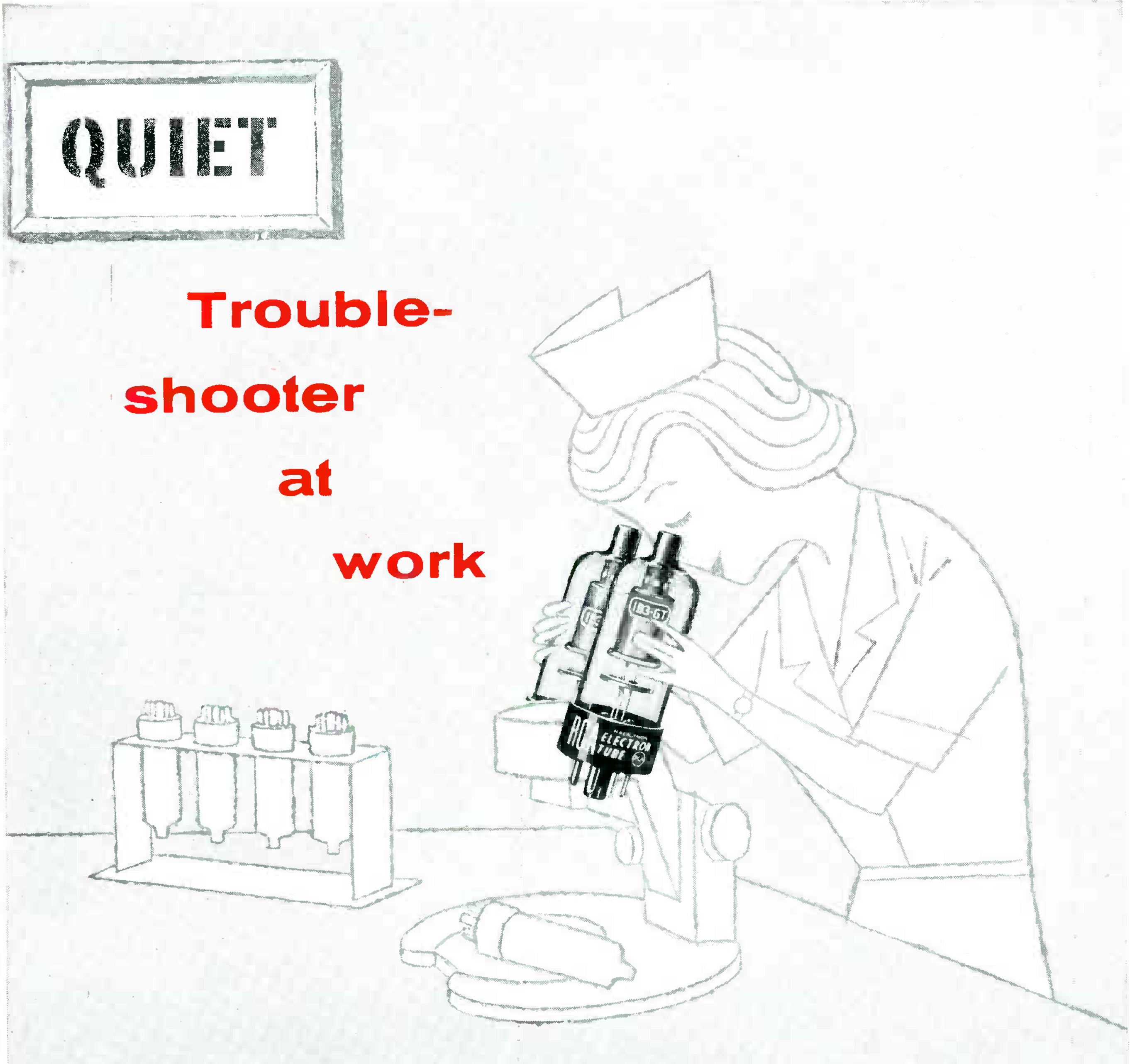
And for the ultimate in laboratory quality testing examine MODEL 3423 MUTUAL CONDUCTANCE TUBE TESTER $199.50. Proportional Mutual Conductance testing of *all* radio and TV tubes plus selenium rectifiers, crystal diodes, pilot lamps, thyratrons, transistors, etc., by a new patented circuit.

At leading Parts Distributors everywhere, see the finest and most complete line of test equipment by

TRIPLETT

Triplett Electrical
Instrument Company
Bluffton, Ohio

53 years of experience.



Here's how Microscopic Inspection by RCA helps reduce costly callbacks...

A bad tube, or a potential trouble-maker—can it get by this gal? Not likely. She's part of the specially trained RCA group of inspectors whose important job it is to find trouble and help prevent it from happening to *you*.

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

You gain valuable assurances from this *extra* care: (1) that popular TV receiving types shipped to RCA Tube Distributors have had the *extra* benefit of the MICROSCOPIC INSPECTION PROGRAM and (2) that you can always service your customers with the confidence that RCA TV Receiving Types are top quality replacement tubes.

When you order—tell your distributor "RCA only" and watch your profits grow.

RCA®

RECEIVING TUBES

RADIO CORPORATION OF AMERICA

Tube Division, Harrison, N. J.