

# SERVICE DEALER & ELECTRONIC SERVICING

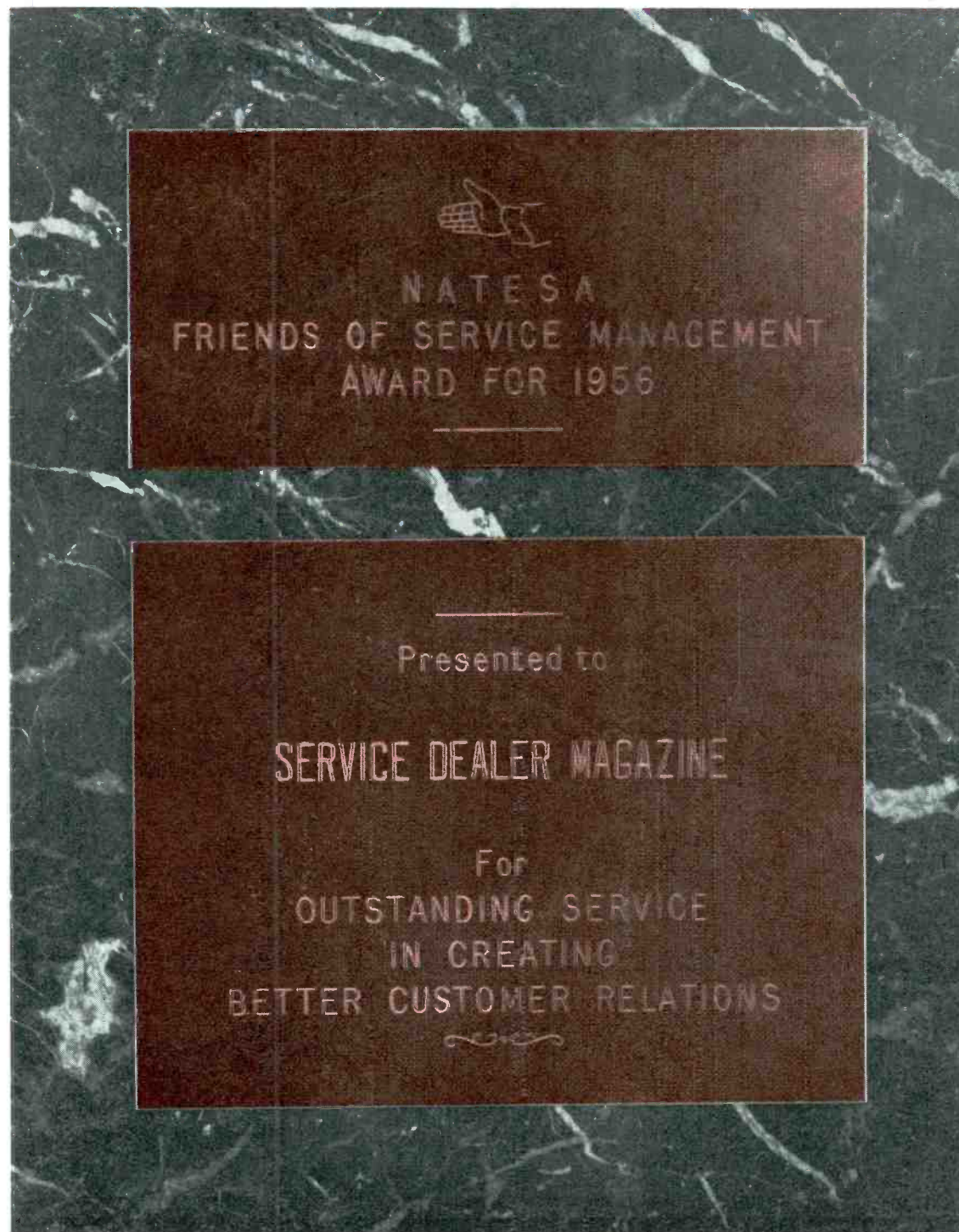
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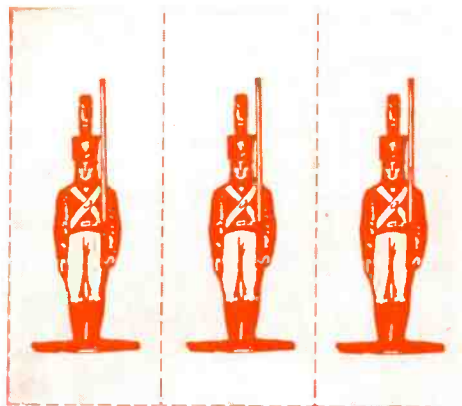
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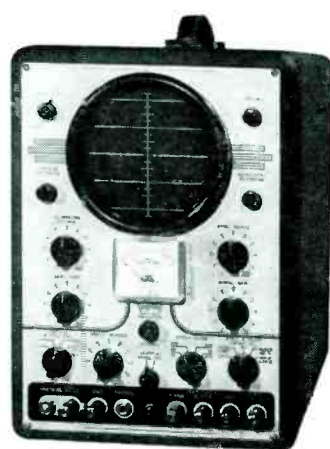
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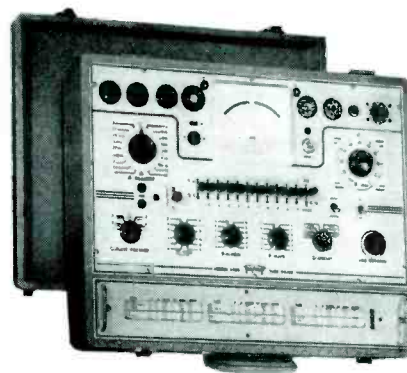
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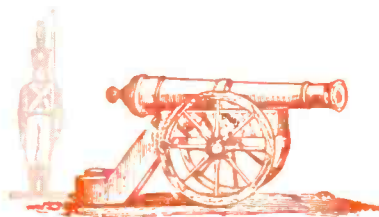
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SERVICE DEALER and ELECTRONIC SERVICING (formerly Radio-TV Service Dealer) is published monthly by Cowan Publishing Corp., 300 West 43rd Street, New York 36, New York, JUdson 2-4460. Subscription Price: \$3.00 one year, \$5.00 two years in the United States, U.S. Possessions, Canada and Mexico. Elsewhere \$1.00 per year additional. Single copies 50c. Second Class Mail privileges authorized at New York, N. Y.

POSTMASTER: SEND FORM 3579 TO SERVICE DEALER and ELECTRONIC SERVICING, 300 WEST 43rd STREET, NEW YORK 36, N. Y.

# SERVICE DEALER

## and ELECTRONIC SERVICING

VOL. 18, NO. 1

Member

JANUARY, 1957

EPA



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#### THIS MONTH'S FRONT COVER

NATESA Friends of Service Management Award for 1956 presented to Service Dealer & Electronic Servicing Magazine "For Outstanding Service In Creating Better Customer Relations"

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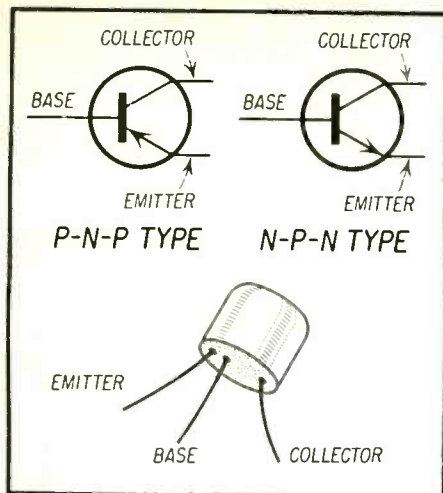


Fig. 1—Symbolic representation of P-N-P and N-P-N transistors.

THE small size, long life and superior performance of the transistor portable receiver is having the effect of rapidly displacing its vacuum tube counterpart. The buying public is "transistor" conscious and transistor portable receiver sales bear this out. It is important for the radio serviceman to know how the new transistor portable operates and the techniques involved in its servicing.

Fig. 1 shows the symbolic representation of the transistor and a view of the lead spacing. A P-N-P transistor always has the arrow pointing towards the base and the N-P-N type has the arrow pointing away. In circuit operation bias potentials must be applied to the elements in such a way as to cause conduction between the junctions. In the P-N-P transistor the collector will always be negative with respect to the emitter and the N-P-N will again be just the opposite.

### Transistor vs Vacuum Tube

A transistor is analogous to a vacuum tube in many respects. Fig. 2 shows a triode amplifier and an NPN transistor amplifier connected in what is known as the grounded emitter configuration. The input signal is applied to the grid of the vacuum tube and the amplified output is taken from the plate across the load resistance  $R_a$ . In the transistor amplifier the input signal is applied to the base and the output is taken across the collector load resistance  $R_1$ . The base in this example corresponds to the grid,

the collector to the plate and the emitter to the cathode. The grid return resistor  $R_0$  is comparable to the base return resistor  $R_2$ . In both cases the cathode or emitter is returned to ground through a by-passed resistor  $R_2$  or  $R_B$ . This resistor serves to bias the tube and additionally in transistor circuits is necessary to make the transistor stable with respect to temperature. A small residual current flows in all transistors. As the temperature of the transistor increases this current begins to "runaway," increasing rapidly. The increasing current is made to flow through the emitter resistor and a voltage is thus developed which tends to bias the transistor in the direction of cutoff. This action reduces thermal "runaway."

The grounded emitter configuration as described here is found in all of the stages of the transistor portables in one form or another.

Some of the basic differences between the tube and transistor are important to remember. The transistor by its very construction is rugged and exhibits long life. Operating potentials are quite low and the transistor is very susceptible to damage by overvoltages or reversal of the bias potentials. In addition the transistor is very markedly affected by temperature. Storage at a high temperature or excess heat applied while soldering can cause permanent damage.

### The Converter Stage

Figure 3 shows a typical transistor converter stage. The input signal is picked up by  $L_1$ , a ferrite rod antenna. The input impedance of the transistor is low and  $L_2$  is used to effect maximum signal transfer to the base. The collector

current flows through  $L_3$  which induces a current in  $L_4$  through the mutual coupling between them. The resultant oscillation is mixed internally in the transistor to provide the converter action.  $R_1$  provides temperature stabilization and operating bias for the stage.

$R_2$  returns the base to the battery and is generally adjusted to regulate the collector current to approximately 0.5 to 1 ma.  $C_3$  and  $R_3$  provide rf bypassing. The transistor used in this stage is designed for rf use. Some typical types are the 2N172/830 NPN unit made

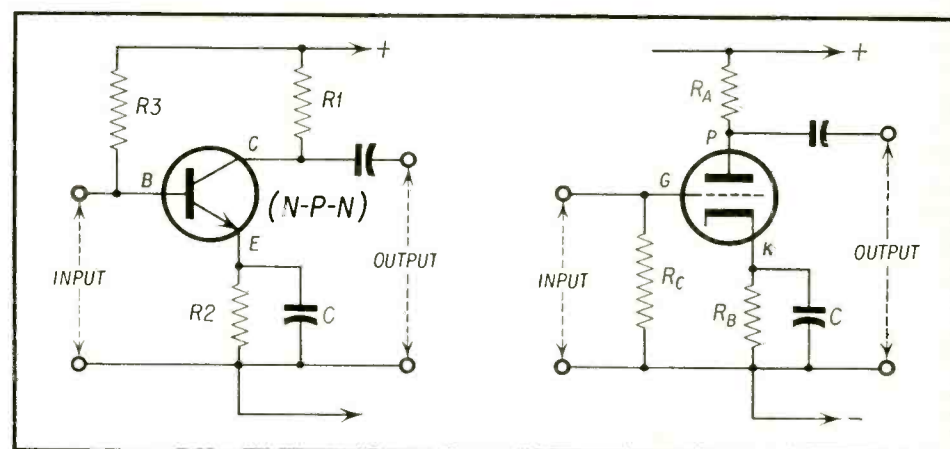


Fig. 2—Comparison of grounded emitter transistor amplifier with grounded cathode triode.

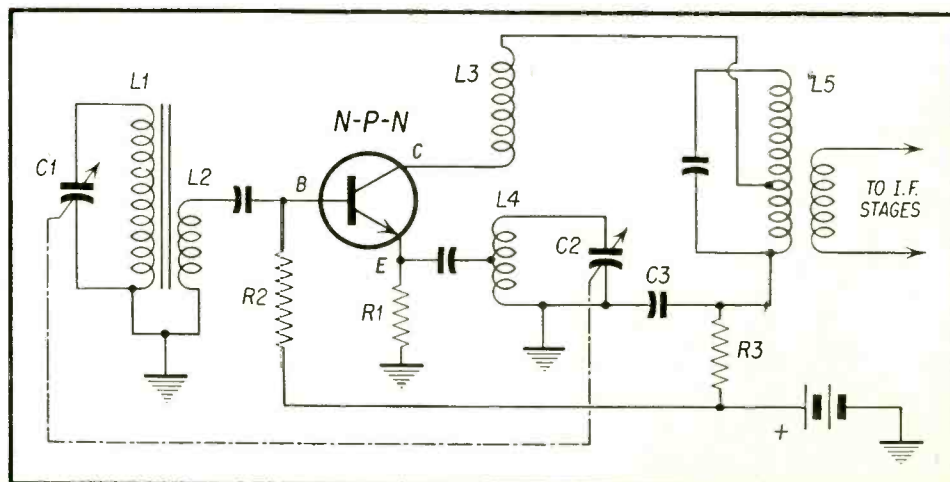


Fig. 3—Typical transistor converter stage.

# Receivers

PART 1

by STEPHEN E. LARRAD

by Texas Instrument, and the 2N112/CK760 PNP unit manufactured by Raytheon.

## I.F. Amplifiers

The intermediate amplifier stages of the present group of transistor portables once again makes use of the grounded emitter circuit. The *if* frequency is either 262 or 455 kc. 262 kc was chosen in the earlier models, to provide the best gain possible with the abilities of the then available transistors. This frequency is not as desirable as 455 kc from an image reduction standpoint and the more recently designed portables use improved transistors at the higher frequency.

Figure 4 is a partial schematic of the Emerson Model 842 transistor portable showing the *if* amplifier. Because of the low base input impedance the secondary of the *if* transformer is untuned and the signal is coupled to the base of the first transistor. The 330 ohm resistor in the emitter lead serves to provide the necessary bias and temperature stability and permits transistor replacement without selecting new component values.

The presence of the capacitance between the collector and the base of transistor often makes neutralization necessary. This neutralization is usually obtained by a small capacitor and resistor connected in series between the two bases of the *if* amplifiers and between the base of the second *if* amplifier and the detector as shown by the dotted lines in Fig. 4.

Two types of detectors are used in transistor superheterodyne circuits. Al-

[Continued on page 63]

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**Tube Placement Charts:** Top and bottom views are shown. Top view is positioned as seen from back of cabinet. Blank pin or locating key on each tube is shown. Charts include fuse location for quick service reference.

**Tube Failure Check Charts:** Shows common trouble symptoms and tubes generally responsible for such troubles. Series filament strings are schematically presented for quick reference.

**Complete Parts Lists:** Detailed parts list is given for each model. Proper replacement parts are listed (with installation notes where required). All parts are keyed to chassis photos and schematics for quick reference.

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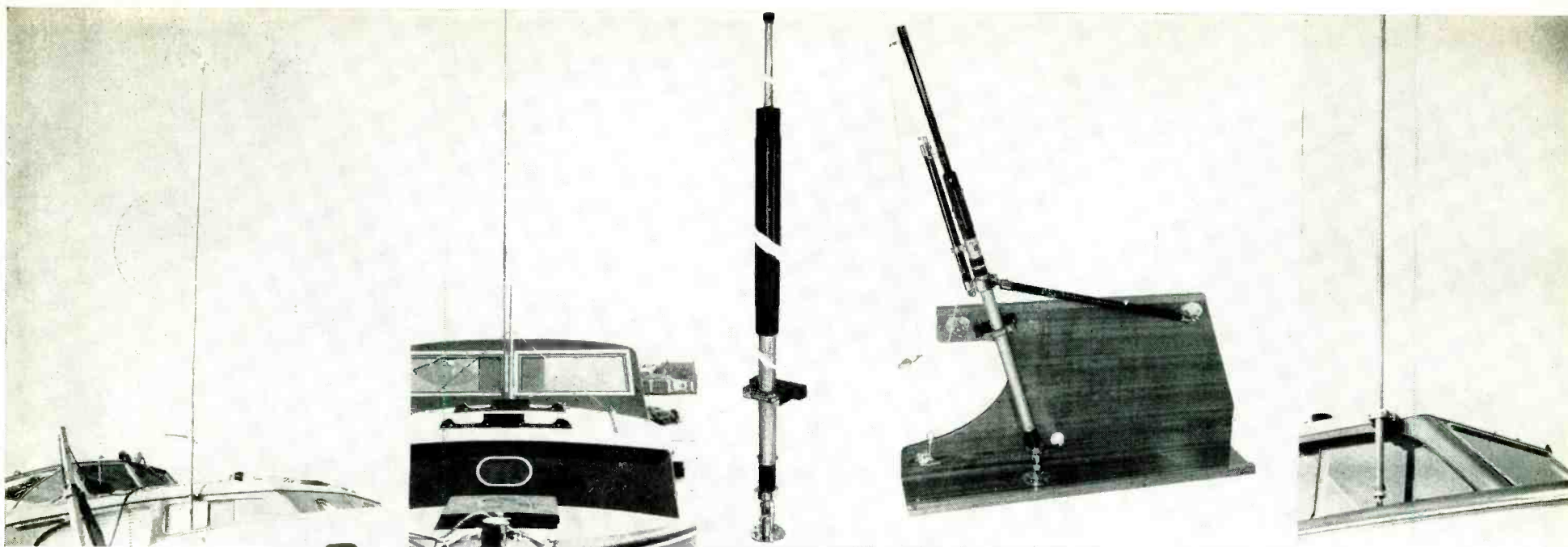
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Left to Right: Composite antenna using capacity "hat" and loading coil at top. Bamboo or other wood considered poor because of loss when wet. Next antenna shows centerline installation of antenna of author's design. This gives good elevation and keeps antenna out of the way. Next is a commercial motorboat antenna with swivel base and special side-mount insulator designed to permit lowering of the antenna. Next is a model of a typical side-mounted antenna with provision for "doubling" as fishing outrigger. Photos 3 and 4—Ray Jefferson, Inc. Next is an example of mechanically dangerous side mounting. Great strain in insulators results, and antenna may be accidentally broken off.

# Marine Electronics

## SMALL BOAT ANTENNAS: Practical Considerations

Part Seven

by ELBERT ROBERSON

**T**HE last installment touched on theoretical considerations connected with the installation of radiotelephone antennas on small powerboats. Now, let's get down to actual practice, starting at the bottom, since the bottom of the antenna system, or the ground connection, is as important as anything up above.

### Ground Connection

As mentioned previously, a metal hull, or a system of copper sheathing

on a wooden hull, constitutes the best available ground on today's small powerboat. However, for reasons connected with boat building more than electronics, this type of construction will not often be found; hence, it is usually necessary for the radio installer to provide a ground plate on the hull. The engine should *never* be used for a radio transmitting ground except as a temporary or emergency expedient.

A few boatbuilders are acquainted with the proper form of ground plate to provide for a radiotelephone, but as

may be expected in a rapidly growing field, there are a great many more who are not. Therefore, it falls on the electronic agency, either to specify to the boatbuilder or the yard servicing the boat exactly what is required, or, in some instances, to perform the installation themselves. In any event, this important job should not be left completely to another agency without full assurance that they know what they are doing. I will not soon forget an early experience in this realm when I asked at a shipyard if they could in-

stall a ground plate on a power yacht which they had in for winter storage. "Yes," the yard owner stated, "I know all about it."

Several days later I investigated and found yard workmen laboriously hammering a 18" plate of brass onto the bottom of the boat. Not only was this unduly expensive, but the size and material of the plate were entirely improper for a salt-water ground connection, and considerable re-work was necessary. When ordinary brass is exposed to salt water it corrodes rapidly

through electrolytic action between its constituents, zinc and copper, and thick material is not only unnecessary, but also expensive and hard to work.

A ground plate of at least 12-sq. ft. in area should be provided. Sheet copper of the kind used ashore for sheathing and flashing is quite suitable, and is obtainable in dimensions which are easily adaptable to the purpose. The ground plate may have any shape and it can either be fastened to the bottom planking or, on some boats, attached in a long strip to the keel and deadwood. If sufficient area cannot be installed in one piece, two separate pieces may be used, inter-connected, or else provided with separate ground bolts into the bilge. A ground plate should be located close to the telephone, so that the ground lead will be as short as possible, and separated from other metallic fittings on the bottom of the boat to minimize electrolytic action. Everdur bronze or Monel screws are a must for the fastenings and they should be spaced no more than a couple of inches apart around the periphery of the plate with lines of screws or copper nails closely spaced across the face to keep the plate snug against the hull and to avoid bulges or ripples in the plate.

Particular care should be taken in fastening the forward edge securely so that there is no possibility of its peeling off the bottom. Incredible as it may seem, there have been several accidents where ground plates have peeled off. No greater mess is imaginable than a sheet of copper wrapped around a propeller.

To bring the ground connection inside the hull, a bronze bolt of at least 1/4" diameter should be used. (See Fig.

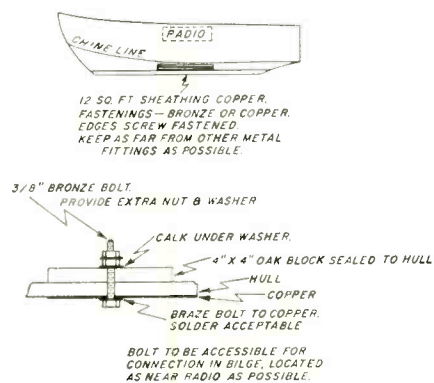
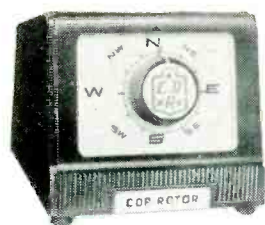


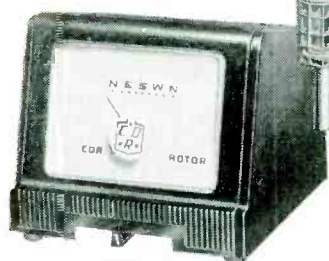
Fig. 1—Ground plate details



AR-22

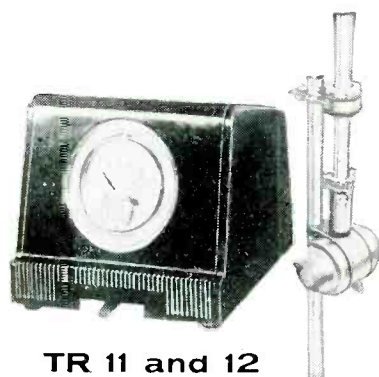


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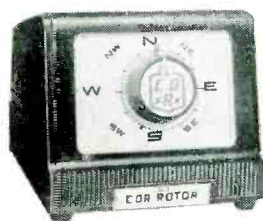


TR-4

# CDR ROTORS



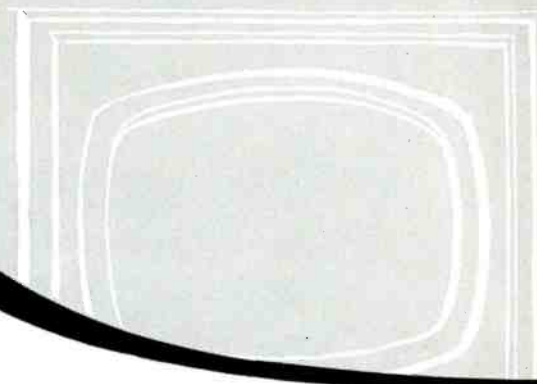
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1.) In order to avoid the frames (ribs) in the hull, bore the hole for this bolt from the inside. A 1"-thick piece of oak, approximately 4" square, should then be seated with bedding compound inside the boat over the hole, and the bolt inserted from the outside. The bolt should be secured in place, using a large bronze washer and nut on the inside, taken up as tightly as possible. The purpose of the oak pad is to give the nut a good solid bearing surface which will not squeeze down and loosen as it might if tightened into the comparatively soft planking of the hull.

### Antenna Types

There are several varieties of commercial antennas available for small powerboat installations. The first one to gain popularity was a long tubular telescoping whip mounted with stand-off insulators on the side of the boat's cabin. Since these antennas were so limber that they were mechanically insecure when fully erected, and often swayed to the point of dipping into the water on either side as the boat rolled, they were usually carried telescoped, which necessitated going out on deck and raising the antenna whenever transmission was desired.

The inconvenience of this arrangement soon led to the manufacture of antennas sufficiently light and compact to be carried fully extended at all times. In short lengths, such antennas often would not resonate on the lower marine-radiotelephone frequencies, so additional loading in the form of a coil was incorporated. This is the form of antenna most commonly available today.

While early marine-radiotelephone antennas contained many potential defects in the way of "lossy" coils and insulators, a few examples of which are still to be found, increasing knowledge of small-boat antenna problems has resulted in a number of commercial designs in which losses have been brought close to the practical minimum. However, it does behoove a marine-electronics agency to look carefully into the design of any antenna they contemplate using, with all of the loss factors mentioned in the last chapter of this series in mind. Particular attention should be



paid to the construction of the antenna loading coil and the mounting insulators to make sure they have the lowest possible loss factors.

Antennas under consideration should also be carefully analyzed for the possibility of electrical continuity being destroyed through corrosion or vibration. For example, the connection between the lower element, the included loading coil, and the upper whip section of the antenna should be such that the action of salt spray or mechanical working, as the boat rolls, does not cause an open circuit, which in today's high-"Q" antennas is sufficient to throw the transmitter completely off the air.

### Antenna Installation

The installation of a commercial antenna on a small powerboat, once the electrical factors have been decided upon, is largely a matter of mechanics. Although boats have, by tradition, long been fitted with masts for the support of sails, signal flags and, in the case of the more sensible commercial vessels, radio antennas, small-boat owners are reluctant to employ any of the long accepted standards of good rigging practice on their radiotelephone antennas. As a consequence, many phone antennas are mechanically insecure and even dangerous. Except in rare instances, there seems to be an insistence that the radiotelephone antenna be installed at the side of the boat where adequate support and guying is often impossible. To give an example of the forces which may be met, imagine picking up a length of metal pipe 18" long, holding it at one end by your hands spaced approximately 1" apart. The strain is tremendous. Now, imagine attempting to whip this pipe rapidly up into the air and back and forth, and some idea of mechanical strains in a seaway may be gained.

In locating the radio telephone antenna on a boat, electrical factors such as proximity to the radiotelephone must be considered, but mechanical factors also have an important part. The mounting for the antenna should be such that the points of support are widely separated in order that the leverage of the top section will not un-

[Continued on page 24]



## Answers Independent Service Dealers' Questions About "Captive Service"

### What is "Captive Service"?

It is the repair work done by service companies owned by set manufacturers — companies established by them to handle the profitable TV and radio set maintenance on receivers of their own manufacture — work that otherwise would be handled by Independent Service Dealers.

### Will "Captive Service" affect my volume of business as an Independent Service Dealer?

A conservative estimate by service association spokesmen indicates that in 1957 Captive Service Companies could do close to \$250,000,000 worth of TV and radio repair work.

### Does Raytheon compete with me through a "Captive Service" organization?

*No, indeed!* Raytheon does not have a captive TV-Radio service organization — does not now manufacture TV or radio receivers.

*Raytheon believes service is your business — serving you is Raytheon's.*

### How can I compete with the "Captive Service" organizations of big national companies?

Raytheon helps you do this. If you can qualify as a RAYTHEON Bonded ELECTRONIC TECHNICIAN, your service and parts guarantee is backed by a bond — a bond issued through Continental Casualty Company, one of the country's largest insurance companies. Here is real prestige for you. What's more, your work on all makes and models of sets is *bonded*.



### Will becoming a Raytheon Bonded Dealer mean I'll lose my "independence"?

Not at all. You become one of a group of TV-radio technicians known from coast-to-coast as the best in the business, yet you retain your own "independence." The Raytheon Bonded Program is nothing new. It's a proven program Raytheon has provided for more than 11 years — that has successfully helped build premium customer business for Independent "Bonded" Service Dealers. It's Raytheon's investment in your future.

### How does being a Raytheon Bonded Dealer help me compete with "Captive Service" companies?

- (1) Your TV-radio repair service is nationally advertised by Raytheon in TV Guide Magazine.
- (2) Western Union "Operator 25" is retained in 23,000 cities and towns by Raytheon to send customers to Raytheon Bonded Dealers.
- (3) You are *bonded* to service *all* makes and models of sets — a big advantage.

### Will I have other advantages over "Captive Service" organizations?

Yes, you'll be using Raytheon TV and Radio Tubes. They are perfect for your replacement work because Raytheon Tubes are designed to give quality performance in all Television and Radio sets.

### How do I get the whole story on the Raytheon Bonded Program?

Ask your nearest Raytheon Sponsoring Bonded Tube Distributor.

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Receiving and Cathode Ray Tube Operations

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Raytheon makes all these Receiving and Picture Tubes, Reliable Subminiature and Miniature Tubes, Semiconductor Diodes and Transistors, Nuclear Tubes, Microwave Tubes.



# Auto Radios for 1956 — CADILLAC

Another auto radio installation, removal, and service article; this one revealing many valuable "tricks of the trade" pertaining to auto radios in Cadillac cars.

by RALPH A. MOSS

Auto Radio Service, Bears of Brooklyn

THE 1956 Cadillac Auto Radios, Fig. 1, are nine tube electronic tuning sets. Model 7266505 fits all sedans; model 7266535 fits all convertibles and model 7266565 has the added remote controls and relays for rear operation in limousines.

Basically, all three receivers are identical in design, differing only in mounting and auxiliary control features. The convertible has no speaker blender control which is included in the sedan model. The limousine model has two extra control relays built into the receiver in addition to the remote control in the rear arm rest. After the rear control is turned on, only the rear controls can operate this radio.

## Mounting

The speaker-power-audio unit, Fig. 2A, is held by three mounting screws. The two dial lights are part of the wiring harness and must be unplugged from the top of the receiver prior to removal. Connect motor wires from antenna switch as shown in Fig. 2B. An interconnecting cable plugs into the left side of the speaker-audio unit. The "A" lead (black) connects to the fuse holder found in the wiring harness of the car. The antenna motor "A" lead (brown) connects to the fuse holder found in the wiring harness. Except on convertibles, the rear seat speaker lead must be disconnected from the body wiring harness to the output trans-

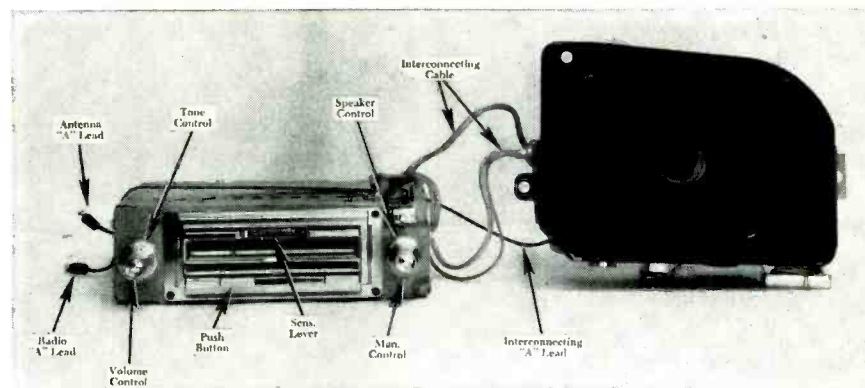


Fig. 1—Cadillac Auto Radio Models 7266505 and 7266535.

former on the power supply-audio unit. The antenna lead plugs into the right side of the set.

The antenna trimmer is located at the bottom of the set just below the antenna lead. Make this adjustment for maximum volume on a weak station, at about 1000 kc with approximately one foot of aerial exposed. Care must be taken when moving the set not to hit the exposed antenna switch lugs. However, if broken, a spot of solder at the bend of the brass lug will rectify the break very easily.

## Tuner

The Signal Seeking Tuner is an electronic and mechanical device incorporated into a conventional auto radio in such a way that change of stations is accomplished electronically by depression of a station selector bar or an auxiliary foot switch. The mechanical portion of the tuner provides for automatic tuning of the radio from the low to the high frequency end of the broadcast band, with a solenoid operated return to the low end of the band after

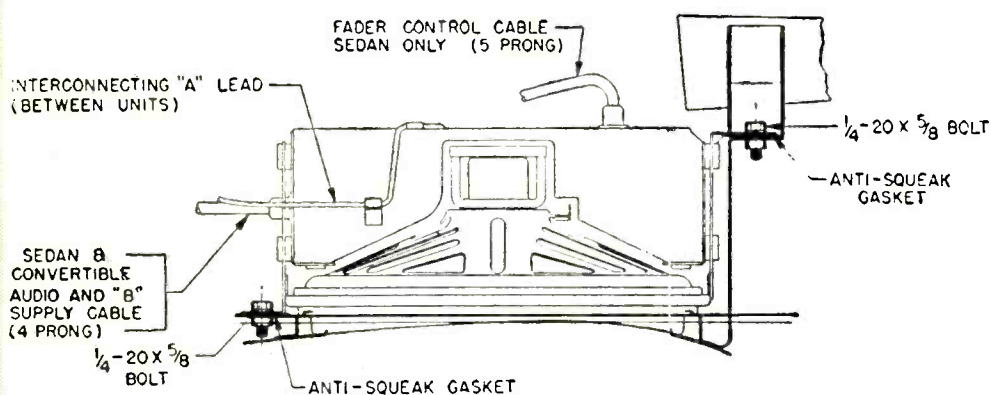


Fig. 2A—Speaker-power-audio unit in Cadillac auto radios. This unit is held in place by three mounting screws.

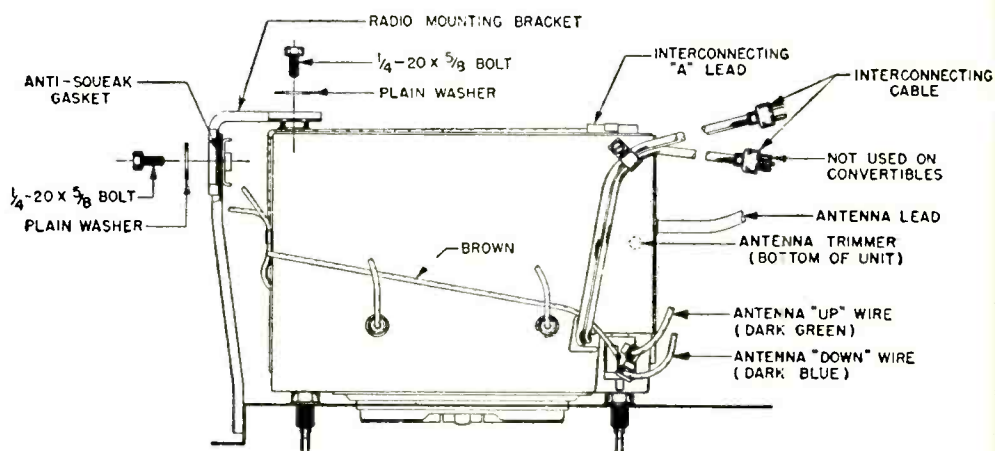


Fig. 2B—View of receiver showing interconnecting cables. Motor wires from antenna switch are shown in this figure.

the high frequency limit is reached. The electronic portion of the tuner provides a means whereby the incoming signal from a station stops the tuner on that station. The strength of the signal selected is determined by the setting of a four position switch on the radio called the sensitivity control. In the maximum sensitivity setting the tuner will select all stations which are ordinarily listenable, while in the minimum sensitivity position the tuner stops only on strong local stations. This control is effective only while the tuner is seeking and does not affect "on station" sensitivity.

### Push Buttons

There are five favorite station selector buttons in addition to the station selector bar or foot switch. Depression of any one button will cause the automatic mechanism to stop on a pre-selected station. The favorite station can be previously selected by the adjustment of a selector tab corresponding to that button.

When a button is depressed, the tuning mechanism is started but the radio is rendered inoperative until such time as the tuner reaches the frequency of the pre-selected station. At this point contact is made between the dial pointer and the selector tab restoring normal radio operation so the triggering circuit can automatically stop the tuner on the favorite station. The setting of the sensitivity control has no effect on the tuner stopping sensitivity when using pushbutton tuning.

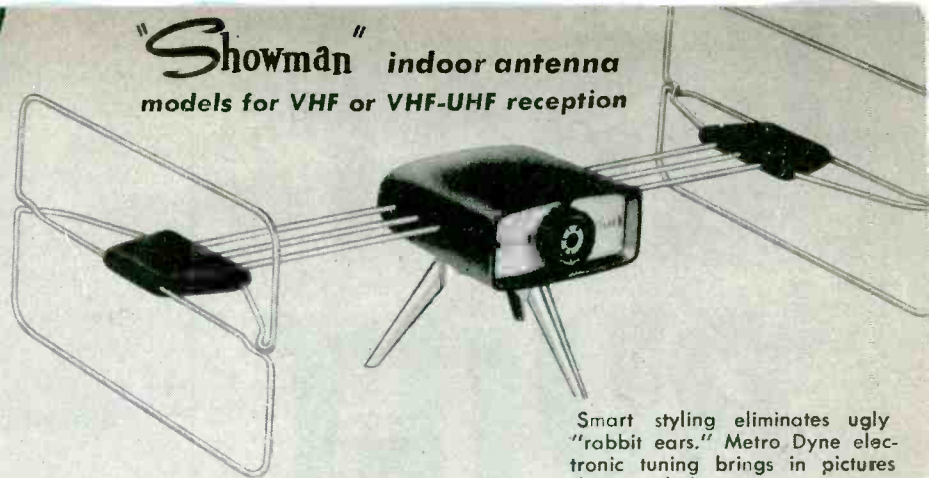
When the station selector bar is depressed, any previously depressed button is mechanically unlatched, returning the circuit to automatic signal tuning conditions.

### Pushbutton Set-up

1. Open the hinged door below the dial exposing the selector tabs.
  2. Tune in the desired signal nearest the left end of the dial.
  3. Move the first selector tab (one farthest left) until it lines up with the pointer tip.
  4. Repeat set-up steps 2 and 3 for the remaining selector tabs, choosing stations from left to right on the dial.
  5. Check the settings of each selector
- [Continued on page 61]

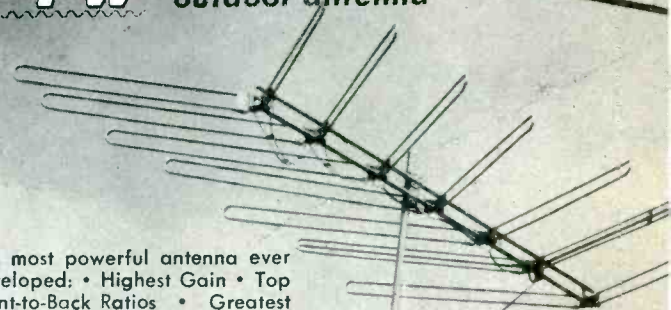
No antennas ever made can match the performance and sales appeal of these outstanding Channel Master models.

"Showman" indoor antenna  
models for VHF or VHF-UHF reception



Smart styling eliminates ugly "rabbit ears." Metro Dyne electronic tuning brings in pictures sharp and clear.

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The most powerful antenna ever developed: • Highest Gain • Top Front-to-Back Ratios • Greatest Mechanical Strength.

## MORE PROFITS for CHANNEL MASTER dealers

In every TV reception area Channel Master dealers are racking up new sales records with the most popular TV antennas on the market today. Superior products plus consistent consumer advertising is a double-barrelled profit combination you can't beat. When you feature the Channel Master line you always have that extra selling edge . . . that extra PLUS that means faster turnover . . . easier sales . . . bigger profits.

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# BEST BUILT



# YET

That's our claim—backed up by a solid majority of independent set makers who use them. Built to one standard of quality—Blue Chip Quality—Magic Mirror Aluminized Picture Tubes mirror twice the light to create a picture twice as bright. Tell your supplier you'd rather have Tung-Sol!

*Blue Chip Quality*

**TUNG-SOL®**

**Magic Mirror Aluminized  
PICTURE TUBES**

TUNG-SOL ELECTRIC INC., Newark 4, N. J. Sales Offices: Atlanta, Ga., Columbus, Ohio, Culver City, Calif., Dallas, Tex., Denver, Colo., Detroit, Mich., Irvington, N. J., Melrose Park, Ill., Newark, N. J., Seattle, Wash.

A "single-cable" Industrial Television Control System, which combines both visual observation and remote control throughout a plant over a closed-circuit television system, has been introduced by the Jerrold Electronics Corporation of Philadelphia.

A unique feature of this system is its ability to carry all functions—two-way pictures, two-way communications, remote control—over a single coaxial cable. Previously a separate cable had been required to carry each of these functions.



The line of Du Mont replacement television picture tubes available to jobbers and service technicians has been materially expanded. The widening of Du Mont's replacement picture tube line was announced by Robert G. Scott, general sales manager of the Cathode-Ray Tube Division of Allen B. Du Mont Laboratories, Inc.

"Almost every replacement tube requirement in sizes 12-inches diagonal can now be filled with original Du Mont quality products," Mr. Scott said. "We have added five tubes not previously in our replacement line and have reclassified 8 other tube types to show their interchangeability with type numbers not previously listed. As a result 13 new picture tube types have been added. They are in 12, 14, 16, 17, 21, and 24-inch diagonal sizes."



George Beaver has been named Magnavox field service engineer for the Chicago region with headquarters at the Magnavox Merchandise Mart offices.

An engineering graduate of Franklin University, Beaver was recently associated with a Pittsburgh appliance dealer as radio and television service manager.

In his new assignment, Beaver will serve in a liaison capacity between Magnavox dealer service departments and the factory.



Channel Master Corp. has announced the installation of a new steel tubing mill to manufacture electric-weld steel TV masting.

The Channel Master mill, installed at the cost of more than \$150,000, is the most modern steel tubing machine made today. It has the capacity to shape 150 feet of steel tubing per minute—gal-

# trade

vanized or plated. Translated into terms of tonnage, this means conversion of approximately 180 tons of steel sheet into steel tubing per day. The seam of the steel tubing is electrically welded under extreme currents of 30,000 amperes. An automatic zinc spray coats the seam so that it is practically invisible. The expanded production facilities provided by the new mill assures a dependable source of supply not subject to out-of-plant difficulties.



Industry is providing the means to help practicing television technicians learn the new techniques and acquire the added skills made necessary by the rapid technological progress and extensive changes in the service field. Local Industry Advisory Committees are being formed to help technical and vocational schools institute the course in Advanced Television Servicing Techniques, developed by the Radio-Electronics-Television Manufacturers Association (RETMA) for upgrading the skills of television technicians. This practical course is geared to provide practicing technicians with instruction in logical servicing procedures, the proper use of test equipment, new servicing techniques, proper methods of alignment, and new circuits. The course lays the ground work for successful training in color television.



The dollar volume of the electronics industry rose 15 percent in 1956 over 1955 despite some decline in TV set production, James D. Secrest, executive vice president of the Radio-Electronics-Television Manufacturers Association, said recently at a "Business Forecast Symposium" of the U. S. Chamber of Commerce. He predicted continued growth in 1957.

The greatest strides this year were made in industrial and military electronics although radio receiver sales rose sharply in 1956 except for auto sets, Secrest said.

"Industrial electronics, especially in automation techniques, employed by many non-electronic as well as electronic manufacturers, made forward strides in 1956 and appeared headed for continued expansion in 1957 and thereafter," he said. "Equipment sales were estimated at between \$900 million and \$1 billion in 1956."

The size of the electronics industry, measured in terms of factory production and sales, was \$5.9 billion and

# flashes

twice that figure when distribution, servicing, and broadcasting revenue are added, Secrest noted. A 10 percent growth is expected next year. Industry statisticians predict the entire income of the electronics industry will reach \$22 billion by 1966, he added.

"The outlook for 1957 is that at least another 7 million black and white television receivers will be made and sold and that color TV set sales will total several hundred thousand," he said.

• • •

Blonder-Tongue Labs., Inc., reports the following additional installation applications of their closed circuit TV units:

A Buffalo, New York Hospital, Edward J. Meyer Memorial, uses the camera to transmit X-Ray information to various locations, in conjunction with a Westinghouse X-Ray image intensifier.

An eastern textile manufacturer, Lion Brothers Co. in Baltimore, Maryland, links the third floor designing department with the first floor embroidery machine department in the production of insignia for major industry, the Armed Services and other customers.

A midwestern cement manufacturer, Southwestern Portland Cement in Fairborn, Ohio, checks composition and flow of slurry into a kiln, and thereby prevents costly damage due to congestion. It was formerly both dangerous and physically difficult for direct human observation.

A public utility, the Los Angeles Department of Light and Power, has a multi-camera setup for flame control in various generating stations. Automatic light compensating equipment maintains constant picture quality for 150:1 light variations. Heat, small quarters, and sensitivity of the human eye prevent direct observation. Also one man can observe several boilers.

An Army Base, Blue Grass Ordinance Depot in Richmond, Kentucky, observes hazardous operations via a Closed-Circuit network. Permits closeup viewing and evaluation at convenient remote locations.

• • •

Detailed plans which show how dealers can modernize their service shops to handle a greater volume of business efficiently and profitably have been prepared by the General Electric Company.

The plans provide for efficient work flow in a service shop by full utilization of floor space, time-saving work units and adequate space for testing and storage. The suggested work units are designed for economic construction, using standard building materials available at any building supply house. Detailed drawings permit the service dealer either to construct the shop units himself or turn the job over to a carpenter.

The shop plans booklet is available to radio and television service dealers through authorized G-E tube distributors.

• • •

CBS-Hytron, electron tube manufacturing division of the Columbia Broadcasting System, Inc., has been commended as a leading supporter of independent radio and television service-dealers by the National Alliance of Television and Electronic Service Associations.

Their 1956 "Friends of Service Management" award was presented on behalf of NATESA by television star Garry Moore to Mr. Charles F. Stromeyer, President of the manufacturing firm, on the CBS Television Network show earlier last month. In introducing the plaque to Mr. Moore and the television audience, Mr. Robert W. Hester of Kansas City, Missouri, NATESA President, said in part: "This plaque is symbolic of the esteem in which the independent TV-Radio service industry holds CBS-Hytron."

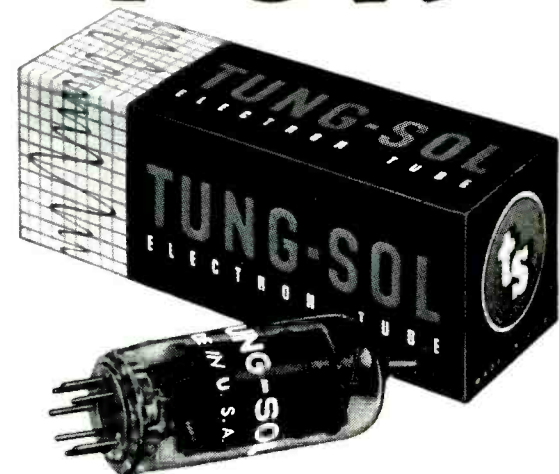
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The sale of radio-TV replacement parts rose to \$850 million in 1956 and is expected to rise another \$100 million next year, the RETMA executive said. Set servicing costs are estimated at close to \$1 billion this year and the total dollar value to manufacturers, jobbers, and service technicians at \$2.4 billion, it was noted.

• • •

Service Instruments Corporation, Addison, Illinois manufacturer of test instruments and accessories for service technicians, announces that the firm has changed its trade name to SENCORE. Formerly known as Senco, SENCORE was adopted to eliminate any confusion with other firms and also because the company has recently been incorporated.

# BEST FOR



# EVERY SET

All Tung-Sol radio, TV or Hi Fi tubes are engineered to one standard of quality—Blue Chip Quality. Whether they're for famous set makers or leading service dealers, Tung-Sol Tubes are identical in design and performance. Tell your supplier you'd rather have Tung-Sol!

*Blue Chip Quality*

**TUNG-SOL<sup>®</sup>**  
**RECEIVING TUBES**

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

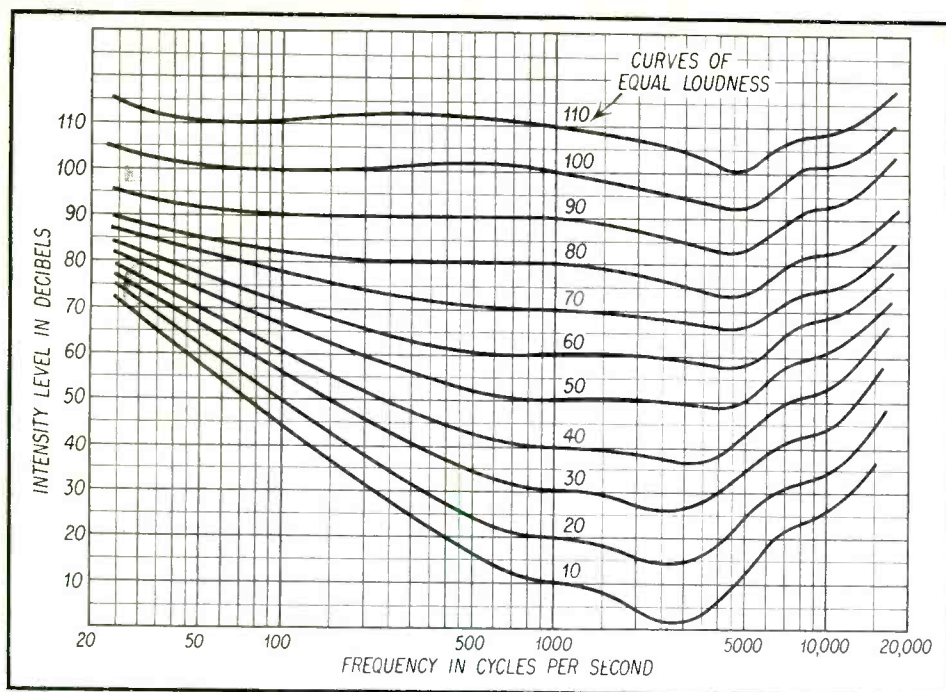


Fig. 1—Fletcher-Munson curves, showing how the human ear responds to tones of different frequencies.

HAVING investigated the need for tone controls in a high quality system, we are naturally led to the investigation of still another type of compensation present in high-fidelity installations—the “Loudness Control.” When this type of control first made its appearance in hi-fi rigs some five years ago, there developed a raging controversy among engineers and audio enthusiasts as to the merits of such additional “artificial” tone compensation. On the one hand, the purists said that the action of the loudness control, in introducing fixed amounts of bass and/or treble boost at low listening levels was contrary to all natural laws of human hearing. These people felt that if you had to play your music softly, it should sound as if you were sitting in the last row of the balcony of a concert hall, and not like a “canned” version of center orchestra seats. The other faction in this controversy felt, and still feels today, that anything that makes music sound more realistic and pleasing is a worthwhile investment. Without attempting to further the arguments of either side, it’s pretty obvious from an examination of today’s high fidelity components that the “pro-loudness-control” group seems to have come out on top. Practically any control chassis or complete amplifier

worth its salt now includes this type of compensation as a front panel control. Let us examine its purpose and method of operation.

### The Need for a Loudness Control

Next time you have a complete Hi-Fi rig on the bench for a check-up hook up an audio oscillator to one of the high level inputs (Radio, TV, or tape, for example) and, with a good speaker at the output end of this system, sweep the oscillator through the entire audible range from about 20 or 30 cycles to 10 or 15 kc. If your *ac vum* is hooked across the speaker terminals during this experiment and all parts of the system are in good working order you will note that the meter pointer will remain at a substantially constant setting, indicating that the electronic part of the system has uniform, or flat response. That

means that all the tones should sound equally loud, coming from the loudspeaker. You’ll find, however, that the low bass tones and the extreme treble tones seem much more diminished to your ears than do the middle range tones. These effects were investigated by H. Fletcher and W. Munson way back in 1933, many years before high-quality sound reproduction was even a practical reality. Fig. 1 is the result of their intensive research and is called the Fletcher-Munson curves. These curves point out what you may have suspected all along—that human hearing response is anything but flat. In fact, if you ever saw a set of curves like these as the response curves of a commercial piece of equipment, you wouldn’t even bother to turn on the switch.

Now the fact that we don’t hear all frequencies with the same intensity is of itself not enough of a reason to justify loudness-compensation controls. After all, our aim is still to hear the reproduced music just as we heard the original concert, and our hearing response doesn’t change from one ex-

average level of a live concert corresponds to 80 decibels, as listened to from a choice orchestra seat. The frequency response of our hearing mechanism would be as shown in Fig. 2. That is, at 50 cycles our hearing is down about 5 db. This doesn’t spoil the concert for us, because that’s the way music has always sounded to us at this particular level. Suppose we play the same selection on our hi-fi equipment, with one major difference. The living room is considerably smaller than the concert hall and there are next door neighbors to reckon with, so our average playback level is now only 50 db. At this level, our hearing response follows the curve of Fig. 3. You will note that the response at 50 cycles is now down some 25 db, or 20 db lower than during the actual performance. This effect is pretty obvious even to the inexperienced listener. All you have to do is vary the volume control from very loud to very soft and notice what seems to happen to the bass tones in particular. They all but disappear.

There are two good reasons why tone controls can’t be used to correct

# Loudness Controls in Hi-Fi

by LAWRENCE FIELDING

*Loudness controls, a comparatively new hi-fi device, are thoroughly discussed and analyzed by the author.*

perience to the other provided we listen both times at equal volume. Now let’s examine Fig. 1 in detail. Suppose the

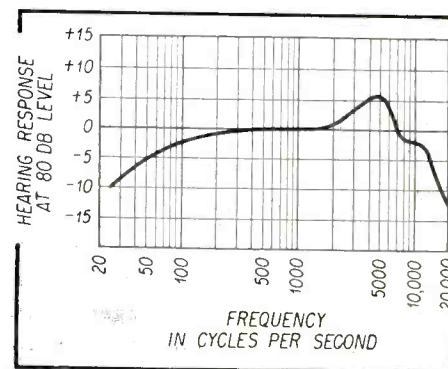


Fig. 2—Fletcher-Munson curves for human hearing at a level of 80 db.

this situation. First of all, the amount of bass correction necessary at very low

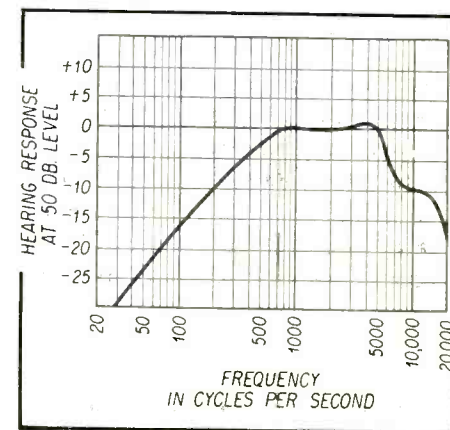


Fig. 3—Fletcher-Munson curves for human hearing at a level of 50 db.

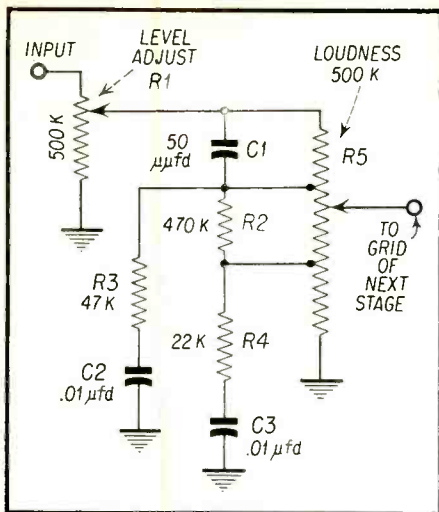


Fig. 4—Loudness control used in Grommes high fidelity Model 55C combined preamplifier and power amplifier. This type requires a second control.

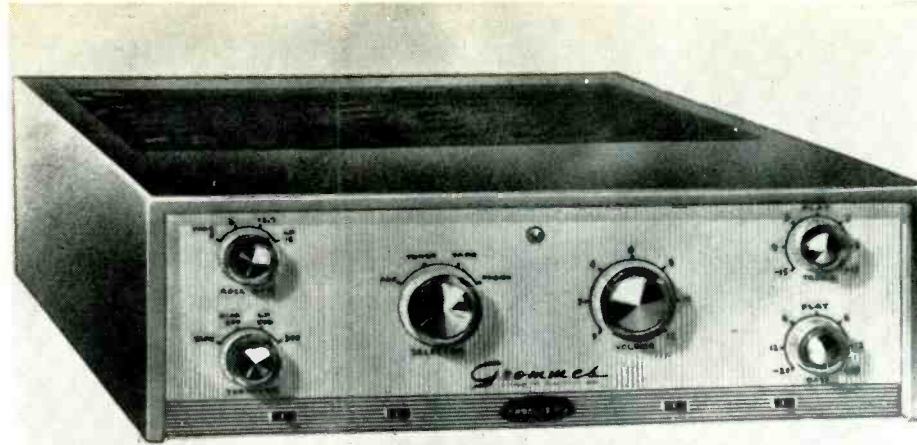


Fig. 5—Photograph of the Grommes high fidelity Model 55C combined preamplifier and amplifier showing the different controls and their arrangement on the front face of the panel. Automatic loudness controls such as the one shown above take care of the inherent inadequacies of ordinary tone controls, and provide a more flexible control of volume.

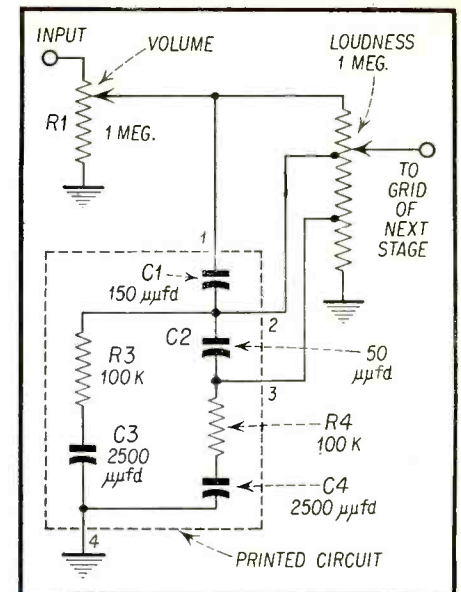


Fig. 6—Pilotone Model AA 920 loudness control circuit.

listening levels is quite high, and if you tried to compensate by ordinary bass boost controls there would be no range of control left for compensating for other deficiencies in the system as previously discussed in this series. Secondly, you could never be sure "how much" boost to apply unless you have some absolute reference, such as a live symphony orchestra in the living room. The automatic Loudness Control takes care of both of these problems automatically and simply.

### Types of Loudness Controls

All loudness controls found in hi-fi equipment are basically the same as tone control circuits, except that the amount of boost of both treble and bass is automatically adjusted as the volume control is varied. From the discussion above it can be seen that the louder the music, the less you will require this form of compensation. There are three basic configurations for accomplishing these results. The first type is illustrated schematically in Fig. 4. This circuit is used in the Grommes hi-fidelity Model 55C combined preamplifier and power amplifier. A photograph of the complete unit is shown in Fig. 5. This type of loudness control, as well as the one illustrated in Fig. 6 (Pilotone Model AA-920) requires a second control, alternately labeled "Volume" or "Level". The reasons for this secondary

volume control in series with the so-called loudness control will become apparent from the discussion which follows. Refer to the partial schematic of Fig. 6.

### How a Loudness Control Works

By way of explanation, it should be pointed out that R2 of Fig. 6 (as well as R5 of Fig. 4) is a linear taper control, having resistance taps at approximately 37% and 62% of full rotation, measured from the ground or "bottom" end of the potentiometer. That is, the lower tap in Fig. 6 includes about 370K of resistance and the upper tap measured to ground will read around 620K. Now, suppose that the arm of R2 is at the top of the control or fully clockwise. All frequencies will be sent on to the grid of the next stage with equal amplitude and no compensation will take place. This is the setting used when no "loudness compensation" action is desired. The "Volume" control, labeled R1 may then be used as a conventional control to vary the intensity of sound coming from the loudspeaker. It is true that the total impedance from the arm of the potentiometer R2 to ground will vary somewhat with frequency because of the shunting effects of capacitors C1, C2, C3 and C4, but there is no voltage divider action at any frequency and the grid of the next stage is not concerned with whether its impedance to ground

is 1 megohm (as it would be at very low frequencies when capacitors C2 and C3 seem like an open circuit) or less than 500K at middle and high frequencies when elements C1, C2, C3 and C4 reduce the overall impedance to ground by their shunting effect. Either value of grid impedance is sufficient to allow all audio frequencies to pass through with no attenuation and the loudness circuit is effectively out of the picture. Now suppose the arm of R2 is rotated counter-clockwise until the upper control tap is reached. A simplified drawing of this condition is shown in the partial schematic diagrams of Fig. 7A, B, C and D. At middle or high frequencies, C3 is a short circuit to ground, as shown in Fig. 7A. Under

these circumstances, the arm of R2 picks off a net impedance of approximately 86K, or about 1/5 of the total signal content of these frequencies (86K/466K). On the other hand, extremely low frequencies see a circuit somewhat as shown in Fig. 7B. That is, C3 looks like an open circuit and the signal voltage picked off at the arm of R2 is about 3/5 of the total signal at these low frequencies. (620K/1 Meg.) Having considered these two extremes it is easy to see that "in between" frequencies (from 1000 cycles down) will be sent on to the next grid in the same proportion between the two extremes illustrated. Thus it is that the net effect will be a bass-boost [Continued on page 57]

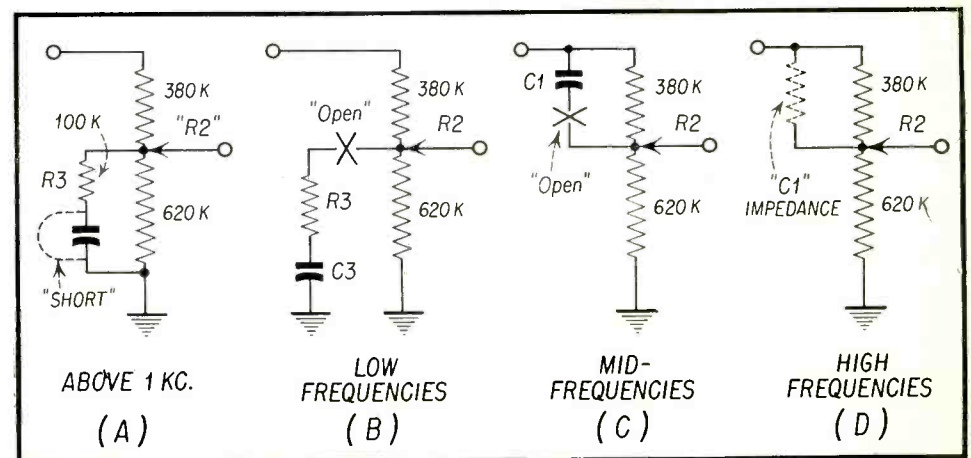


Fig. 7—A, B, C, D—Equivalent circuits of Fig. 6 at various frequencies corresponding to above 1 KC, low, middle, and high frequencies.

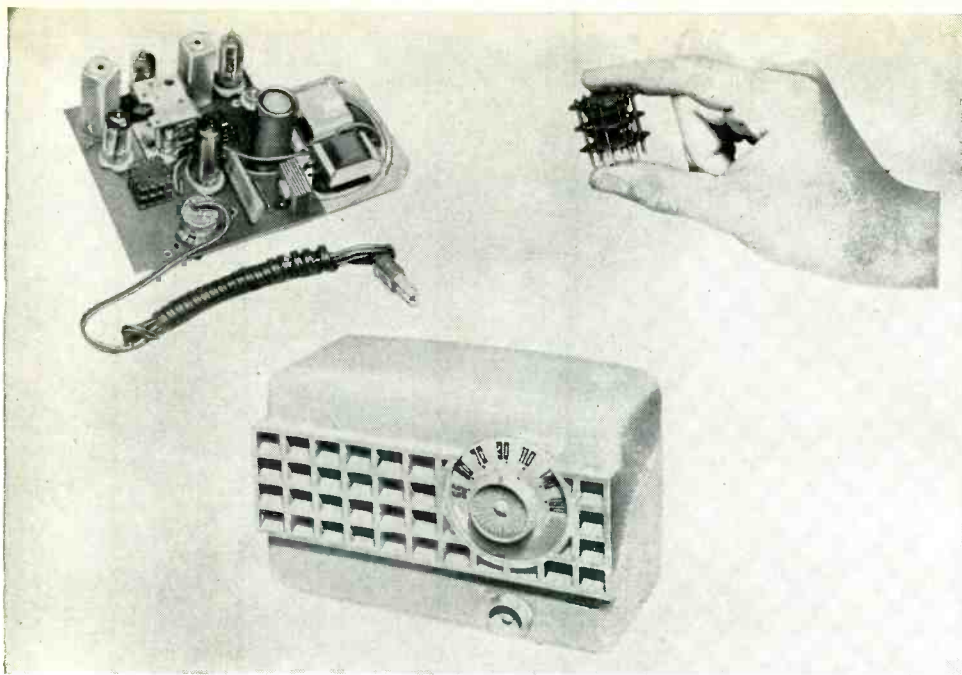


Fig. 1—AC/DC table model radio using modules. (R & D Electronic Labs.)

Printed circuit assemblies, modules and encapsulated circuit assemblies are beginning to appear with greater frequency in receivers, both radio and television.



by ALLAN LYTEL

Supervisor, Technical Information, Electronics Lab.  
Electronics Park, General Electric Co.

## Automation and Servicing

ONE of the most important recent developments in the field of electronics is the increased use of integrated component packages. While it is true that these have been on the market for a long time, and they have been used together with normal point-to-point wiring, the advent of printed circuits has given new importance to these sub-assemblies of components. These units may be divided into two general groups.

In the first group are combinations of resistors, capacitors, and inductors in many different ways to make passive networks which take the place of a number of different components in the equipment. Each package is treated as a component; it is placed in the circuit by a group of leads and the internal connections are used to make the wiring between the individual parts. From a servicing angle it is not possible to repair the package by taking it apart. Rather, if a component in the package is defective there are two possible solutions. The entire unit may be replaced, which is a quick and easy solution, or

it may be possible to replace the damaged component by adding a conventional component to the circuit. The use of the new part to replace a component depends upon the network as shown below.

The second group of packaged circuits includes a tube (or a transistor) so that this unit is actually a complete circuit. This is the circuit module. In some cases the tube or transistor is attached by means of a socket, while in others the active element is soldered in place. It is possible to repair a damaged module by taking it apart and replacing the damaged component but it is just not worth the time and effort for this when the entire module can be replaced. Once in a while it may be possible to replace the defective part by another conventional part as above. It is usually possible to replace the tube or transistor when this is defective.

A table-model ac/dc radio using modules is shown in Fig. 1. Here almost all of the component parts are contained in the modules which are wired to the board. Certain parts, such

as the volume control, the power resistor, and the tuning capacitor are not mounted as part of the module.

### R-C Networks

These are groups of resistors and capacitors designed for special circuit

application in radios, television receivers, and other types of electronic equipment. They consist of a special type of printed circuit. A ceramic plate is used with silver forming the capacitors and a resistive ink or tape making up the resistors. All of the components

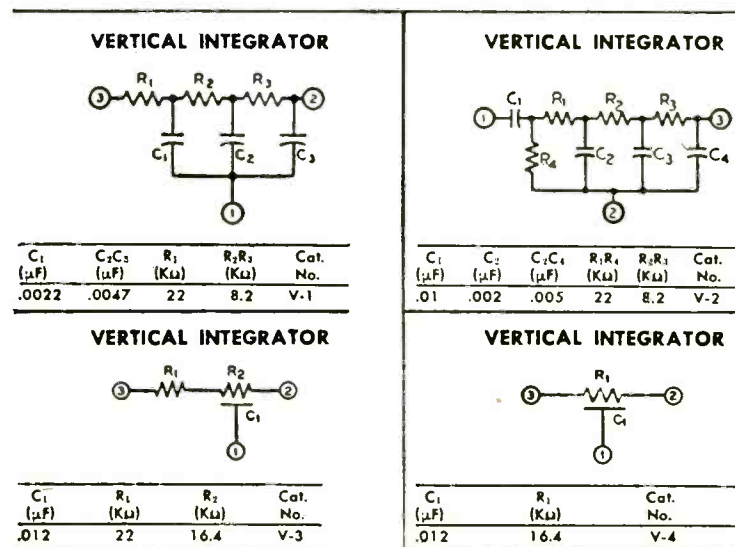


Fig. 2 — Group of vertical integrators. (Sprague)



are on the ceramic base-plate.

They are made by several different manufacturers and these new network-packages are to be found in many of the present-day receivers. For example, Figs. 2 and 3 show some of the less complex circuits as they apply to television. Fig. 2 shows a group of vertical integrators. Typical part values are shown. Take the vertical integrator shown in the upper right corner; if  $C_4$  were open it could be replaced by an external 0.005  $\mu\text{f}$  capacitor but if  $R_2$  were open, it could not be replaced without replacing the entire unit because there are no direct connections between the leads of  $R_2$  and the connections to the package.

Figure 3 illustrates examples of an other television circuit. These units are used for Sync Take-Off; parts values are originally taken for a specific application in a particular television receiver although the substitution of parts is allowed in some applications. In every case, the servicing data supplied by the manufacturer will list and indicate the part number and the supplier. The or-

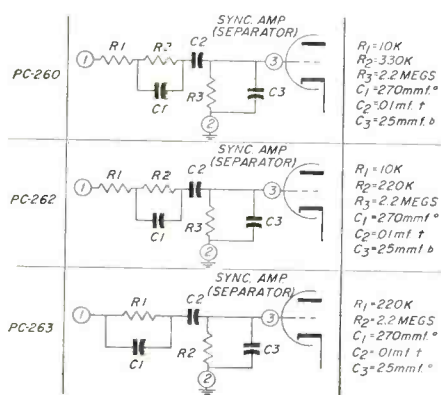


Fig. 3 — Sync-Takeoff circuit.  
(Centralab)

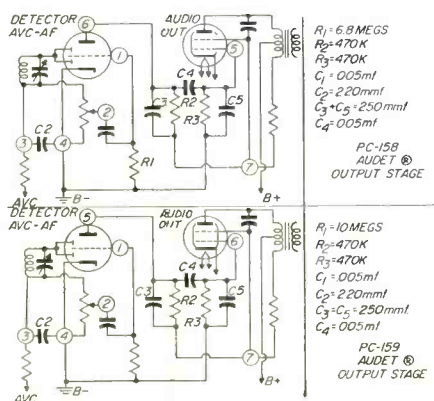


Fig. 4 — Interstage coupling unit.  
(Centralab)

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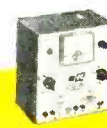
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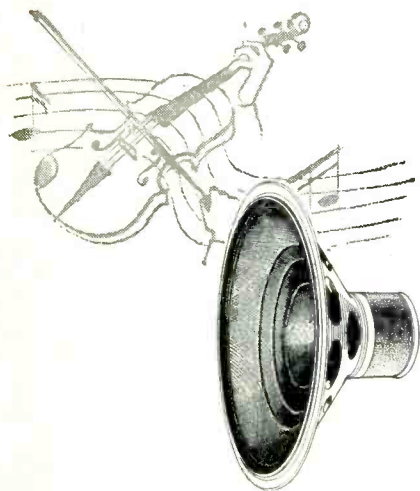


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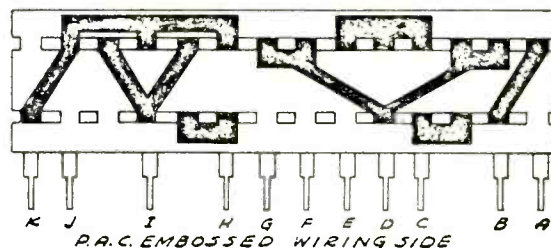
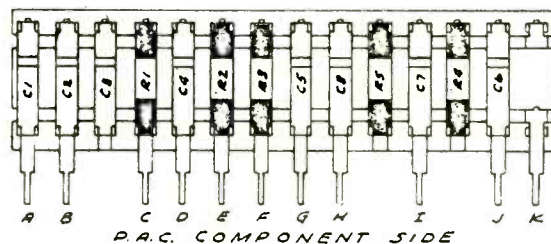
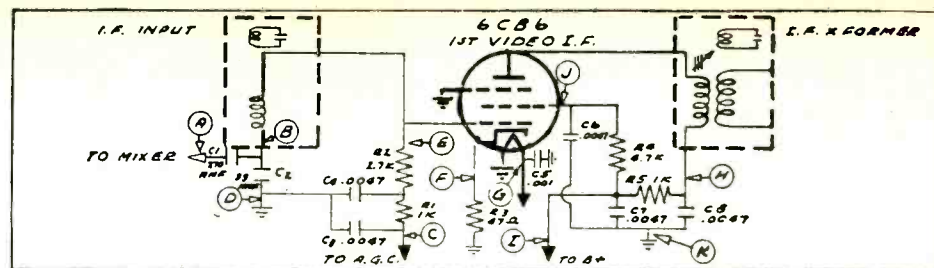
North American Philips Co., Inc.  
100 E. 42nd St., New York 17, N. Y.

organizations which make these packages also publish listings of their own numbers for these parts as well as the numbers assigned by other manufacturers of similar parts.

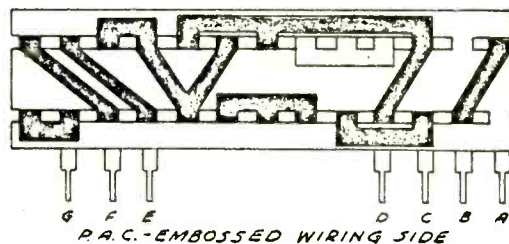
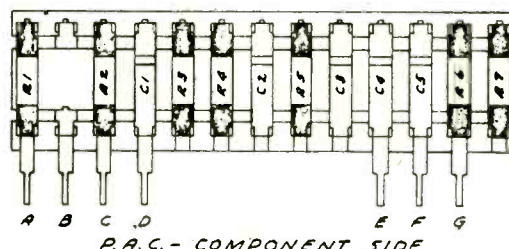
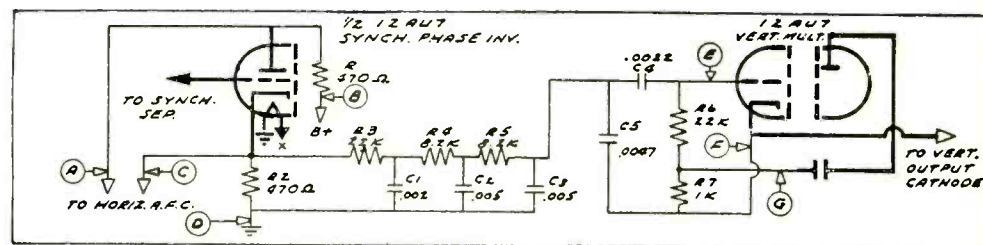
Several more complex networks are shown in Figs. 5 and 6. In Fig. 5 inter-stage coupling units are shown connecting the detector and avc stage to the audio output stage. There are 8 components which would normally require 16 connections but here there are only 7 connections. Here is how this unit can be of help in servicing. Suppose that this is a part of a small table model radio which is inoperative. An audio signal on the grid of the output stage is heard in the speaker but the same signal applied to the triode grid of the preceding stage does not produce an audio output. If the tube checks good, the package is replaced because the trouble is between the two tubes. It is not necessary to look any further to find the defective part. Since the defective part must be a component in the package, the entire unit is replaced, thus saving valuable time.

### PAC—Packaged Assembly Circuit

A different approach to these units is shown in Fig. 8—the Erie PAC. This is an encapsulated network thicker than the other packages and as long as desired for a particular application. The base material is a printed circuit with clips for the components and wiring between them for the given use of the PAC. The resistors are molded composition and the capacitors are of the ceramic tubular type. Notice that in the PAC the components are the same as the normal parts except that their mounting and use is different. They are treated in the same manner as the other circuit packages for servicing except that there are usually more individual resistors and capacitors in the PAC. ■■



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Fig. 5—Encapsulated circuit units are shown above. The top illustration shows the circuit and physical layout of a typical first video stage. The bottom unit shows a phase inverter and vertical integrator.



S. R. COWAN

## Ad Libs

### Our Front Cover

With the turn of each New Year it is customary for the average man to make resolutions, many of which are never kept. The old expression, "His intentions were good but his execution thereof was awful" is too true. In that vein we have often resolved not to boast or brag—but here again, by means of this issue's front cover once again we break a resolution.

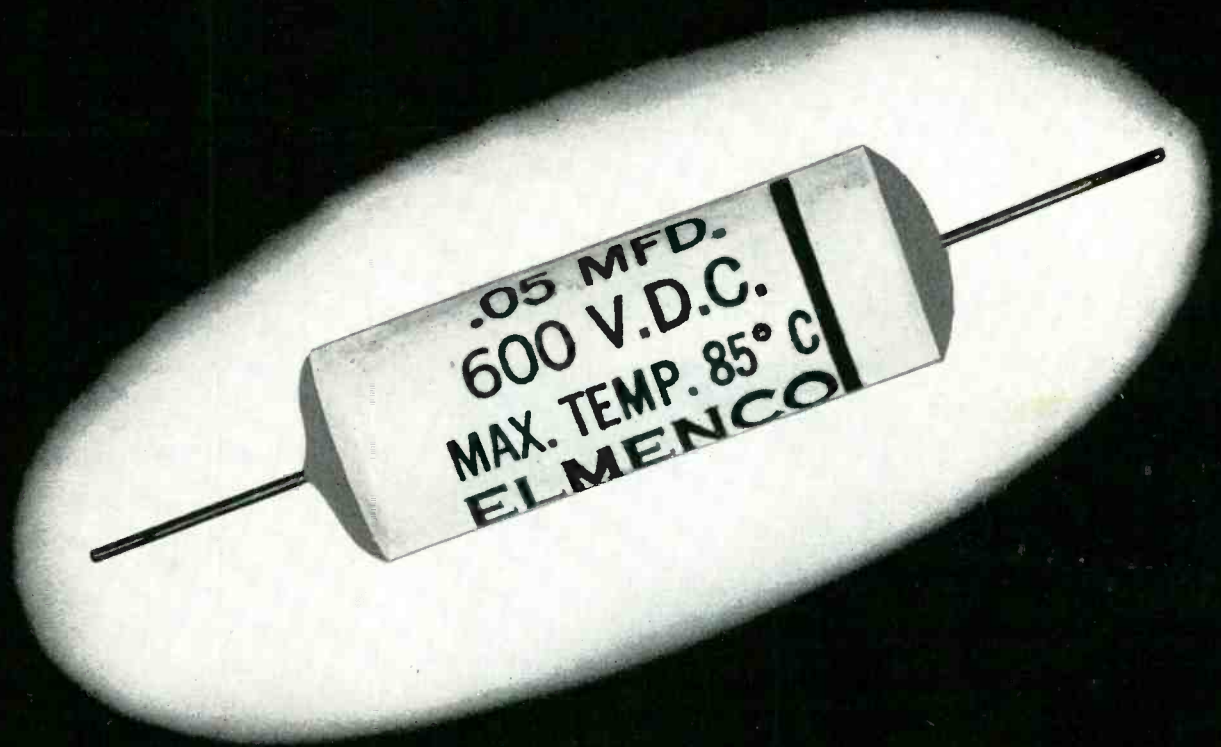
Only one technical magazine devoted to the interests of the radio-TV-electronic service fraternity—*this magazine*—has been fortunate enough to win what might be called the two "Oscars" awarded by the men who make up and represent the service industry. In fact, the two "Oscars" are shown on this issue's front cover.

It is common knowledge that every man's severest critic is his wife and, after her, his colleagues and customers. In establishing the editorial policy of this magazine we merely abide by the wishes and needs of our subscribers and we then do what they say they want to have done. In the selection of the articles which are to support that policy, our task is not quite that simple. That our editorial staff has been able to satisfy the wishes of the nation's professional radio-TV service fraternity to the extent that their efforts have been rewarded in the past and again in 1956 with the highest Awards is most gratifying. On behalf of the entire staff—we thank you. This token of service-



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men's esteem is conducive to even greater effort.

### Now 16 Pages of TV Schematics

As promised, starting with this issue you'll find 16 pages of Schematics—and future issues will carry that many, and possibly more. These schematics are a basic working tool for the average serviceman and generally give him sufficient information enabling him to trouble-shoot fast and make most necessary repairs. On rare occasions a technician may find that he needs additional

information not provided by these schematics but by and large such an experience will be the exception.

The value of schematics lies not in the quantity of them that are available but rather in the quality. With pride we point out that our schematics are not published on a "hit-or-miss" basis. They are selected first on the basis that they are the *most-needed* by most servicemen at that particular time. Our schematics are, in many cases, released long before they are available from any other source. Many distributors of TV

receiver lines have told us that we have provided them with needed schematics long before the manufacturer could oblige them.

For over a year our schematics have covered set maker's *complete lines* which means that a single spread of schematics would cover upwards of 5 chassis and as many as 20 models—or that particular set maker's *entire line for that particular year*. Also, these sheets are prepared so that no other manufacturer's schematic backs them up. It might further be added that our schematics can be filed easily and properly in their alphabetical order, simplifying locating them when necessary. Finally, note how legible these schematics are! If you can offer suggestions as to how we can improve them further, don't hesitate to let us know.

### "Contact" Is Doing Fine

For the past several months our department called "Contact" has served as a link between, 1) manufacturers of electronic devices who are seeking qualified service firms capable of acting as their branch service agencies and, 2) those technically qualified and financially sound service firms and independent servicemen who wish to be appointed as factory-trained service agencies, in areas where they are situated, for manufacturers of electronics devices.

To date eighteen fine electronic equipment manufacturers have asked us to help them locate branch service firms in eighty-one different cities. Over 160 service firms and independent servicemen have sent us information about themselves and have asked to be considered as prospects for factory branch designation. This is a new type of service being rendered by our publication on behalf of both the manufacturer and service firm—and happily it is working well for their mutual benefit. Undoubtedly as time passes "Contact" will be a tremendously vital factor, and we are delighted to be able to serve both sides, and without cost to either.

However, even in the short time "Contact" has been in effect one very disturbing matter has come to light. We have received thirty-odd requests for listings as potential factory branch designees from servicemen who sent in their

replies on two-cent postcards, or on what appears to be scrap paper. Some even wrote in pencil. Some of the writers, whose intentions obviously are sincere, simply sent a hand-written note in on a rubber-stamped bill-head, or on the back of a service job-order form. Many of these ill-considered replies merely said, in effect—"I want to be a factory service branch for a manufacturer of 2-way radio, or closed-circuit TV firm"—without even attempting to tell us what their experience is, or what test equipment they have—or anything that would help us get an idea about their capability or background.

Now if you sat here at our desk with a letter from a multi-million dollar manufacturer who seeks factory branch service firms in six different cities—would you recommend any one of the servicemen who was so "indifferent" as to request consideration by means of a hand-written, in pencil, request on scrap paper when in your files you also have applications from service firms that gave you complete data on a fine letterhead about their operations, etc.? The answer is obvious!

So, dear reader, we regret the necessity for doing so, but what we have said previously must be said again. To be considered "a businessman" one must act like a businessman. One should have, at the very least, a printed businesslike letterhead. In applying for jobs, (and that is precisely what "Contact" strives to do—get jobs for the applicants or give jobs to men who seek them), the applicant should give complete and pertinent facts about himself and his service operations to justify his being given favorable consideration.

In conclusion, let it be known to all readers that the more we know about you from your letters the more likely it is that we'll be able to place you in "Contact" with an electronic equipment manufacturer who needs and wants your services. ■ ■

# Hate to Install Antennas?

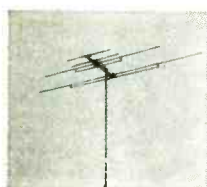
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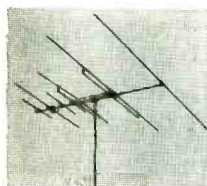


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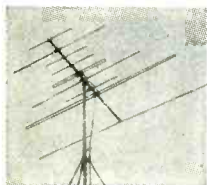
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# Approach to Captive Service on Long Island

by R. T. GUIDERA

Executive Secretary of R.T.G. of L.I., Inc.

No blows were struck!

No blood was spilled!

Not even an angry word was spoken, and as a matter of fact, they all joined together at a friendly luncheon prior to publicly discussing the merits and qualifications of captive service.

Who were these peaceable people who met to talk with each other! Only the proponents of captive, factory, and independent TV service. With the heat that has been generated throughout the nation over this very controversial subject, one might think that at such a meeting a battle royal would have been inevitable.

This was not the case at the Radio and Television Guild of Long Island Captive Service Forum on December 9, 1956 at the Hotel Roosevelt in New York City.

The Forum held at the conclusion of the Electronics Fair of Long Island, which was also sponsored by the RTG of LI, was a fitting end to a week of trade association activities conducted by this energetic and well organized group of technicians from the suburban New York area.

The electronics trade show held in rural Farmingdale, Long Island was an outstanding success. More than 6500 spectators endured a long journey and inclement weather just to view the interesting and varied displays of 36 exhibitors who occupied 43 booths.

Included in the overall attendance was an estimated 2200 technicians and servicemen. Some of these had come from as far off as Minneapolis.

The Radio and Television Guild used the Fair to promote its activities before the general public. This in itself shows the progressive attitude of the RTG

of LI in protecting the interests of its members which in turn helps the manufacturer and distributor alike. As will be noted later, this is a step in the direction of effectively competing with both factory and captive service.

The Fair which began December 6th ended on the 8th and then on Sunday, the 9th of December, the Guild moved its activities to the Roosevelt for the Captive Service Forum.

Eight speakers were asked to participate on the panel which was exceptionally well controlled by moderator Murray Barlowe, President of the Radio and Television Guild of Long Island.

Panelists included the following personalities: Bert A. Bregenzer, Penna Federation of Radio and Television Service Associations; Dan Creato, RCA Service Company; Vice-President Peter Langer, Sylvania District Service Manager; John H. Miller, G.E. Co., Manager of Product Service; Frank Moch, National Association of Television and Electronic Service Associations; John F. Rider, Rider Publications; Paul H. Wendel, Editor, Service Management; Jack Wheaton, Empire State Federation of Electronic Technicians' Association.

At the onset of the forum, moderator Barlowe indicated to all of the panelists and the audience of over fifty East Coast service organizations that speakers would be allowed seven minutes for opening statements and that only written questions submitted by spectators would be answered. Spectators were not limited to any number of questions and panelists could take all the time necessary to answer these queries.

The discussion brought out that cap-  
[Continued on page 22]

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# AUTOMATIC CHROMA CONTROL CIRCUITS

Automatic chroma control circuits are distinctly associated with color TV receivers. This article explains their manner of operation with specific references to circuits used in color TV receivers.

By **BOB DARGAN** and  
**SAM MARSHALL**

From a forthcoming book entitled  
"Fundamentals of Color Television"

**A**UTOMATIC chroma control (*acc*) does for the chroma amplifier section of a color receiver what *agc* does for the *rf* and *video if* section of a black and white receiver, that is, it maintains the chroma amplifier output signal value constant over a wide range of input signal values. Referring to *Fig. 1A* we observe that the *agc* control voltage is obtained from a signal fed into the detector or video output section. In *Fig. 1B* we observe that the *acc* control voltage is obtained from a signal fed into the chroma amplifier.

In color receivers such an action provides constant color reproduction under varying signal and noise conditions, which conditions could otherwise vary the chroma content of the reproduced scene, and hence affect the saturation.

In a black and white receiver having a good *agc* (keyed, or its equivalent) the video carrier amplitude fed into the video detector is kept constant. Because the carrier is at its peak value

during the horizontal sync pulse, the *agc* system samples this carrier amplitude during this period. This makes the system independent of modulation data.

In comparison to a black and white receiver, in a color receiver the 3.58 *mc* burst signal level determines the value of the developed *acc* control voltage, and therefore the overall gain of the chroma amplifier section. Thus, if the burst signal level is reduced for some reason beyond the operator's control, the developed *acc* control voltage is reduced. However, a reduced *acc* voltage means a reduced bias on the chroma amplifier, which increases the gain and the output is maintained constant.

There are a few different systems in which *acc* is developed and applied in various color receivers. Two of these will now be described.

## Emerson Chassis 120319 ACC

Automatic chroma control voltage in the Emerson Chassis 120319 is derived

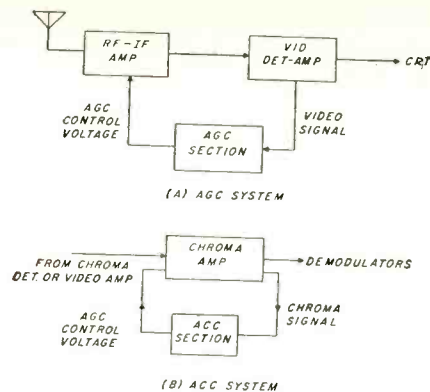


Fig. 1—ACC and AGC compared.

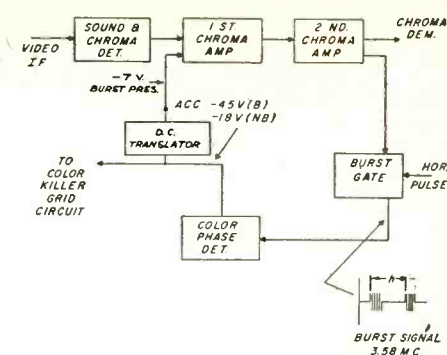


Fig. 2—Block diagram of ACC system used in Emerson Ch. 120319.

from the color phase detector as shown in the block diagram of *Fig. 2*. Here a branch of the output of the 2nd chroma amplifier is fed into a burst gate. The burst gate output provides a 3.58 *mc* burst signal which is fed into a color phase detector. The latter develops a negative voltage proportional to the burst signal amplitude. This negative voltage is applied to the 1st chroma amplifier via the *DC* Translator, controlling its gain, and providing the required *acc* action. The *DC* Translator enables a change in voltage at a particular average *dc* level to be moved to another average *dc* level.

A simplified version of the *acc* circuit is shown, in *Fig. 3*. Here we observe that a 3.58 *mc* burst signal applied at point A of V18 produces a negative voltage of  $-45$  at the diode plate shown at point B. This voltage is transferred via the voltage transfer network *R130*, *R131*, *R132*, *R133*, and *R206* to point C, the color killer grid bias connection, and point D, the 1st chroma amplifier grid

connection (through *L19*).

In this analysis we are not concerned with the color killer action, the latter having been discussed in the previous issue. However, it must be observed that the voltage developed at point B provides the bias in both the *acc* action and the color killer grid.

Notice that at point D the nominal value is indicated as  $-7.0$  volts. In actual use this value can vary between  $-2.0$  and  $-12.0$  volts. Further, the voltage range in this case varies with the burst pulse amplitude, the greater the burst voltage the greater will be the negative voltage developed at point D. Thus, the *acc* action in this circuit is analogous to the *agc* action in a conventional black and white receiver.

## RCA CTC5N ACC

In the RCA CTC5N *acc* is obtained in the manner shown in *Fig. 4* which illustrates a block diagram of the stages involved. Here we observe that the output of the 1st video amp is fed into the

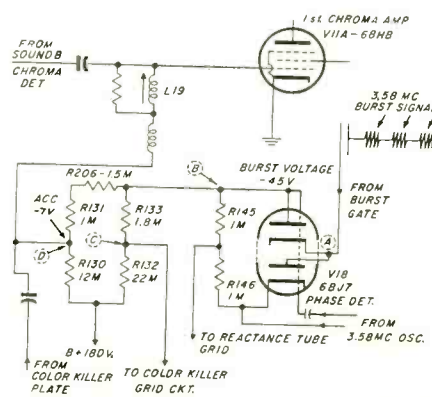


Fig. 3—Simplified circuit of ACC system used in Emerson receiver.

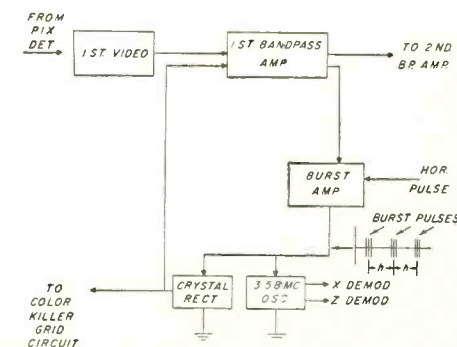


Fig. 4—Block diagram of RCA CTC5N ACC section. Note use of crystal rectifier.

1st bandpass amplifier. Here the color video portion of the composite video signal is extracted for further processing.

In addition to being fed into the 2nd BPA, the output of the 1st BPA also feeds the burst amplifier. The latter extracts the 3.58 mc burst pulse and feeds it into the grid side of the 3.58 mc crystal oscillator. Here grid leak bias is developed proportional to the burst pulse amplitude. Along with this dc bias a certain amount of 3.58 mc CW is also present. This component of CW is rectified by a crystal diode rectifier. The latter produces a rectifying action which results in a negative voltage being developed across the rectifier load resistance. This voltage is fed into both the color killer grid circuit and the control grid of the 1st bandpass amplifier. Thus, an increase in burst signal voltage produces an increase in negative acc voltage, which in turn reduces the gain of the 1st bandpass amplifier, thereby maintaining the chroma signal output constant.

In Fig. 5 we show a partial schematic where we trace the incoming composite video signal as it progresses through the circuit beginning at T701 the chroma takeoff point. As the signal is processed

through V701-A and T702 into the burst amplifier V702-B it is shorn of all video information except the 3.58 mc burst pulse shown at the plate of V702-B.

This burst signal provides the correct frequency and phase at which the 3.58 mc crystal oscillator operates.

It must be borne in mind that V704 is always in a state of oscillation, so that a steady negative bias is present at the control grid of V704. The presence of a burst signal provides an additional 3.58 mc CW signal, the negative half of which is rectified through the diode CR701, providing a total bias effect proportional to the increased oscillator bias plus the rectified burst signal bias. Obviously the bias amplitude depends on the incoming burst signal amplitude, which in turn depends on the chroma signal amplitude. This bias finds its way to the control grid of V701-A through R704 and the parallel low frequency peaking circuit comprising L701 and R703.

Notice that this circuit provides an acc threshold control R171-B. This control fixes the initial operating bias of the 1st bandpass amplifier and is adjusted as follows:

[Continued on page 57]

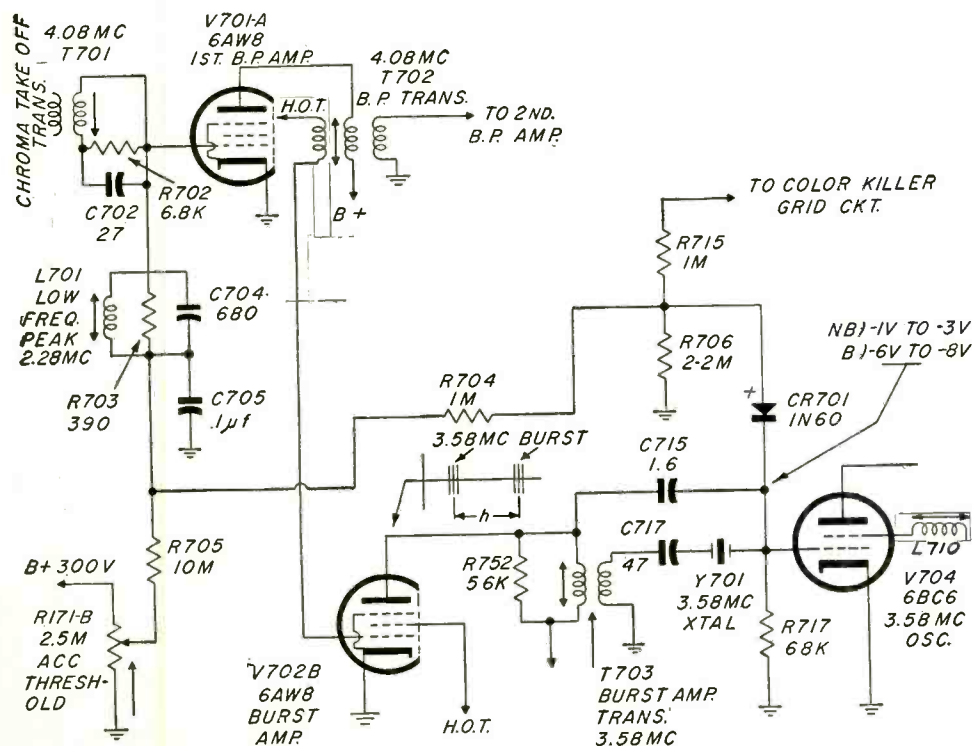
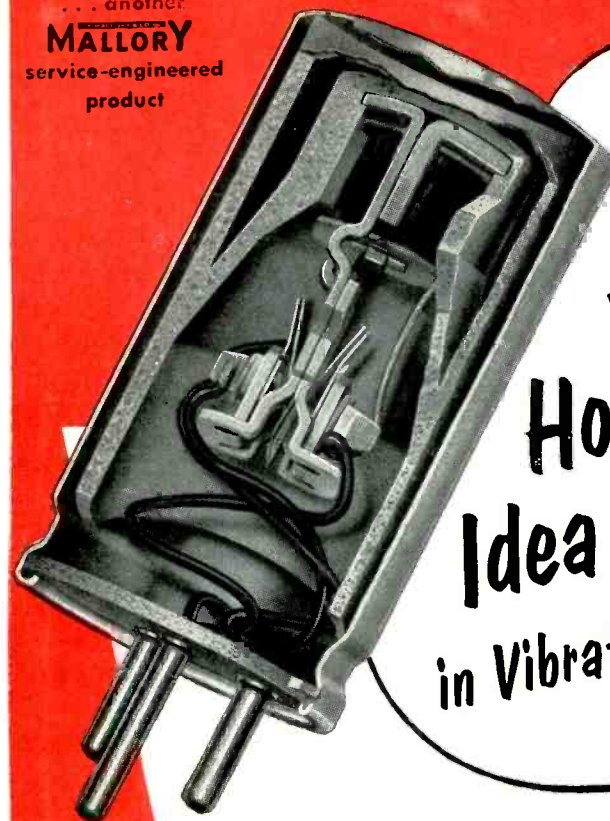


Fig. 5—Partial schematic of RCA CTC5N color TV receiver, showing details of ACC section.

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## CAPTIVE SERVICE

[from page 19]

tive service offers a threat to the independent serviceman which is legally within the means of the manufacturer. This being so, the question then becomes one of ethics and of how the independent might approach the captive service giant and effectively compete with it.

Most of the panelists acknowledged

the fact that the independent is successfully competing with the factory service conducted by RCA Service Company. Dna Creato speaking for that firm underlined this by stating that his organization now services less than 10% of the RCA receivers in use. In 1947 and 1948, he further stated, at the inception of mass TV sales, RCA instituted a compulsory factory service contract policy so obviously RCA Service Co. serviced 100% of all sets then sold by the parent company.

Rider was very practical in his approach, advising that television service is now a big, competitive business and that there is room for neither emotion nor sympathy. He suggests a careful review of the industry by the independent serviceman and the use of associations to provide a means of competition. He opined that the position of the independent serviceman is weak, but by supporting a well organized and administered association, the independent would enhance his position and be able to compete on the same level as the industrial giants now entering the field of TV service.

Reading from a prepared statement, John Miller of G.E. indicated that the basic service policy for General Electric was launched with the intention of providing "the kind of service which gives maximum support to our sales program." Also, "that the responsibility for carrying out this policy is placed with the appliance and TV set distributors." There are two exceptions to this last. In the Toledo and Columbus areas the Product Service Department of GE is operating its own retail service centers. Mr. Miller contended that General Electric services less than 25% of the GE receivers now in the hands of consumers and that the company policy is not in opposition with accepted norms.

In answer to questions from the floor concerning the GE service centers, Miller contended that they do not have a favored position in opposition to the independent and that eventually these will be expected to operate at a profit of their own without subsidy from the manufacturer.

A statement was read concerning the service policy of Sylvania. This company's representative, reading from a press release over the General Service Manager's name, stated that the present independent service is sufficient for that company's needs and that there are no plans for Sylvania to enter the service industry. However, several members of service firms who were in the audience got Mr. Langer to concede that in Buffalo, N. Y. there is a factory-owned Sylvania Distributor that handles retail service for the firm, competing with all the independents in that area.

Jack Wheaton and Bert Bregenzer, the two state association representatives,

pointed out an important fact that appears to have been overlooked by the manufacturers. The best sales force for receivers is the independent salesman who is asked over and over each week by receiver owners to give an endorsement as to the merits of this brand or that brand of receiver. They indicated, and reasonably so, that the independent cannot logically be expected to endorse the product of a manufacturer having in mind the fact that that manufacturer is also his strongest competitor for retail service work.

They, like several of the other speakers, also suggested that the independent investigate the possibilities of diversification of activities into industrial electronic servicing and not limit themselves just to home television and radio service.

From the standpoint of the independent serviceman, John Rider probably summed up the afternoon's activities most effectively when he answered a question, "how would you combat captive service?"

His answer had some very interesting thoughts which were also presented in his opening statement. First, he, like the two association speakers, urged servicemen to diversify and expand their service operations; second, he urged servicemen to pool their resources with other independents in some association; third, he urged active support of that association with the dues necessary for it to function effectively; fourth, he would see that this association had outside help and was not dependent upon the overtaxed time of its officers; and last, he would want that association to aggressively compete with captive service by selling the quality of independent service while continuing to do a better job than the manufacturer in the service field.

If Rider's reply is to be the independent serviceman's approach to captive service, then the Radio and Television Guild of Long Island has begun to compete effectively with its greatest competitive threat. By stopping to examine objectively the situation at the forum and promoting the independent at its Electronics Fair, the RTG of LI and its members have given indication that they will successfully compete with the manufacturer in the service industry.

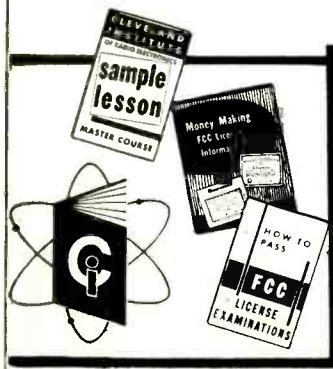
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## TRADE LITERATURE

A disc record timing *chart* for professional studios and high fidelity fans who cut their own records has been announced by George Silber, president of Rek-O-Kut Co. Presented in easy to read time table form, the chart gives the playing time in minutes for various diameters (in inches) cut into seven, ten, twelve and sixteen inch records, using either a standard three mil or microgroove one mil stylus. For standard stylus, the chart has readings for 33 1/3 and 78.26 speeds cutting 120 or 150 lines per inch. Readings for microgroove stylus are for 33 1/3 and 45 r.p.m. speeds, cutting 210, 216, 240 and 270 lines per inch. *The Rek-O-Kut Recording Time Table* may be obtained by writing to: *Rek-O-Kut Co., 38-01 Queens Boulevard, L. I. City, N. Y.* There is a 20¢ charge to cover handling and postage.

The Hoffman Radio Division, Hoffman Electronics Corporation, has just made available a *chart* listing the major components used in every television chassis which has been made by the company. The chart covers every chassis Hoffman has made since its first TV receiver in 1948. In addition, a Model-Chassis index is provided to serve as a reference guide to the chassis number if only the model number of the receiver is known. The charts and reference guides are currently being mailed to all Hoffman distributors, A.D. accounts, service and parts agencies and parts jobbers, as well as to all 1955 subscribers to the Hoffman Service Data manual.

A new illustrative bulletin describing electronics testing equipment was issued by Simpson Electric Company, Chicago. The six-page *brochure, No. 2056*, gives concise descriptions and specifications of products in the extensive Simpson Electric line of testing instruments designed for use by radio, television, and refriger-

ation technicians. New instruments described among others are the Varidot Generator, Model 434; and the 7-inch Colorscope, Model 458. Also shown is the Capacohmeter, Model 383-A, an in-circuit capacitor leakage tester which can also measure capacitance of good capacitors as well as perform a variety of other tests. Other testers listed include ohmmeters, a vacuum tube volt-ohmmeter, and a volt-ohm microammeter. Copies of *Bulletin 2056* may be obtained by writing *Simpson Electric Company, 5200 W. Kinzie St., Chicago 44, Ill.*

*"Blocking Oscillators"* edited by Alexander Schure has recently been published by *John F. Rider Publisher, Inc.*, as one of their new books in the Electronic Technology Series. This book gives a non-mathematical but comprehensive explanation of the operating features, pertinent design factors and the more important applications of blocking oscillator theory.

A new book, *"How To Make Good Tape Recordings,"* by C. J. Lebel, vice president of Audio Devices, Inc., is available only from *Audio Devices distributors*, or by direct mail from *Audio Devices, Inc., 444 Madison Ave., New York 22, N. Y.* The price: \$1.50 paperbound, \$2.50 clothbound.

*Blonder-Tongue Laboratories of Westfield, New Jersey*, is offering a new illustrated general catalog covering its consumer products, TV distribution units, TV installation accessories and closed-circuit TV equipment. Specifications and trade prices are shown for each item in the line. Copies of this catalog plus specification sheets for individual units are available at no charge from the company's sales department.

Availability of a new edition of the *Quick Selection Guide for Television Picture Tubes (ETD-1001C)* has been announced by the *General Electric Company*. The purpose of this new booklet is to help designers select a particular tube from the large number of types now on the market. It classifies each of the 211 tube types both by size, bulb structure and deflection angle,

and lists the following information: whether it is aluminized or not, external conductive coating capacitance, type of ion-trap magnet, face, dimensions and style of anode terminal. This publication may be obtained from *G-E Tube Sales, 1 River Road, Schenectady 5, New York*.

*Merit Coil & Transformer Corp., Chicago*, has announced publication of Merit's 9th Consecutive *All-Industry "REPL" Guide*. Designated #409, the

guide offers a completely new format, including 128 pages of the most accurate and complete coil and transformer replacement information available from any source. There are approximately 20,000 models and chassis, and 155 brand names of manufacturers—practically every TV set produced up to early 1956. A new feature of the Merit "REPL" Guide is 6 1/2 pages of flyback schematics which provides "quick-reference" information. The

[Continued on page 60]

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## MARINE

[from page 7]

duly strain the mounting insulators and fastenings.

If the antenna is to be mounted alongside a cabin structure, try to choose a point which will provide for a side-mounting insulator high off the deck and widely separated from the lower or base insulator.

A number of very successful and handsome antenna installations have been made by mounting the antenna with a suitable base insulator on deck or the top of the cabin at the centerline of the boat. Small antennas not over 12 feet in height should not require guys. Larger antennas in this position may be guyed three or four ways by  $\frac{1}{8}$ " stainless rigging wire, using "egg" insulators at each end of the guys.

Antennas which must be lowered for passing under bridges may have a quick-release "pelican hook" spliced into the forward guy for disconnecting from the deck connection. If the other guys and the lead-in wire are planned properly, they need not be disturbed in such an operation.

When a guyed antenna is used a few feet of the upper ends of the guy wires can advantageously be used as extra loading capacitance, making a form of "umbrella" antenna.

The lead-in insulator is electrically very important, and should be of low-loss composition and mounted so as not to collect moisture. (See Fig. 2.) The wire from the antenna proper to the lead-in insulator should be heavy copper, very well insulated, so that chance contact against metal parts of the antenna base or the wood of the hull will not permit leakage loss. Inside the boat, the antenna lead should likewise be heavy and well insulated and routed away from light wiring or other metallic objects. Plastic clips may be used for securing well-insulated antenna wires in place, but the old Navy and commercial-ship practice of mounting lead-ins on stand-off insulators should be followed whenever possible. The antenna lead should be secured so that movement of the boat or chance contact with its personnel will not dislodge it, thereby de-tuning the antenna circuit and reducing operating efficiency.

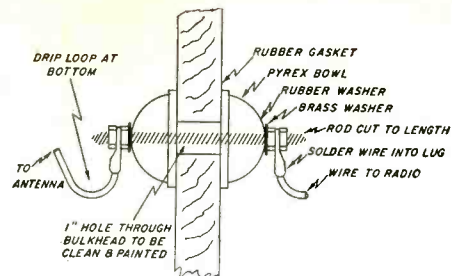


Fig. 2—Cut-Away view of antenna lead-in insulator for deck or bulkhead installation.

### Tuning

Tuning a radiotelephone is simplest if certain preliminary steps have been taken in advance. Before taking the radiotelephone to a boat, set it up on the shop bench, connect the proper input voltage, and tune the tank circuit of the transmitter for all channels to be used. This does two things—first, it makes sure that the radiotelephone is operating properly on all channels, and it eliminates one operation to be performed on board the boat, where conditions are never as favorable as at the home base. Over a period of several installations, using your shop dummy antenna, it will also be possible for you to approximate the initial settings for antenna coupling, and in some instances, for antenna loading, so that aboard the boat, only minor readjustments of these circuits need be made.

The first step in tuning the radiotelephone transmitter is to resonate the plate circuit on all channels with the antenna disconnected. This is accomplished through connecting a milliammeter of suitable range in the plate circuit of the *rf* power amplifier, either through a jack or to terminals provided for this purpose. The larger radiotelephones have milliammeters incorporated in their design. On each channel adjust the plate circuit for minimum plate current by means of the coil taps, capacitors, or slug tuners. In this initial setup make certain that you tune to the fundamental frequency and not to a harmonic. Make sure the amount of inductance for each channel (or the capacitor setting) has a reasonable relation to that of the other channels and in case of doubt, while in the shop check the output frequency with an absorption wave meter. It is also possible to pre-resonate the *rf* amplifier

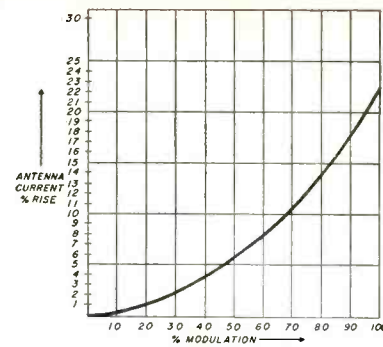


Fig. 3—Antenna I vs. modulation.

circuits with no power applied—the equipment "cold"—by using a grid-dip oscillator.

As a rule of the thumb, antenna coupling can be increased up to the point where the *rf* amplifier draws its rated current or just slightly below. While adjusting the antenna coupling, whistle into the microphone (on your dummy load) to make sure that the output modulates upward. An upward modulation of about 22% in antenna current represents 100% modulation. (See Fig. 3.) Coupling should never be increased to the point where the antenna current wavers or drops with modulation since poor communications and splatter will result.

With initial tuning steps performed in the shop, it should now be possible to tune the remaining circuits on the boat with a minimum of time and trouble. Equipments having antenna-current meters incorporated can be very simply tuned through observing this meter. If the equipment has no meter, a portable *rf* ammeter can be connected in series with the antenna lead, using the shortest leads possible and the least disarrangement of wiring to avoid later de-tuning. In case of such de-tuning, adjustments can be made, for

instance, using slightly more inductance than required, to compensate for the removal of your antenna meter. Antenna tuning can also be gaged by observing a plate milliammeter in the output stages and, in conjunction with this, a portable field-strength meter. The arrangement adapting a portable volt-ohm-milliammeter for *rf* measurements shown in Part II of this series (June 1956) is very handy for this purpose.

After transmitter tuning has been finished, the receiver input circuits can be aligned. It is also wise to make preliminary adjustments at the shop in this end of the equipment, so that only "touch up" is required on the boat. Care should be taken that the receiver is not tuned to an "image" frequency, especially when peaking the circuits by noise response.

Portable *rf* generators (and grid-dip oscillators) are available which are helpful for receiver tuning. However, it is possible to use the radiotelephone transmitter itself to supply the signal on which to tune. On intership and other channels which have the same receiving and transmitting frequency, simply connect the transmitter-oscillator plate circuit to the receiver "B"-plus through a suitably high value resistor. Apply just enough power to sustain oscillation. If the receiver blocks, it can still be tuned accurately by using your voltmeter on the *avc* bus.

For tuning shore telephone channels by this system, it will be necessary to carry special crystals ground to the shore transmitting frequency. Using this little "gimmick" is a lot easier than carrying along a test oscillator, and will insure your always having a signal to tune up on. ■ ■

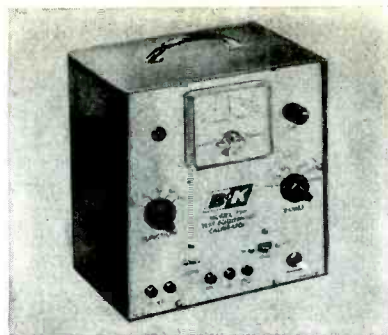


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## TEST EQUIPMENT CALIBRATOR

A low-cost, laboratory-type test equipment calibrator with accuracy of 1% or better on all of its voltage sections is now offered by B&K Manufacturing Co., Chicago. The B&K Model 750 Calibrator quickly checks test equipment accuracy and reveals how far an instrument is off. The unit can be used to calibrate VOM, VTVM and other meters, signal generators, sweep and marker generators and oscilloscopes.

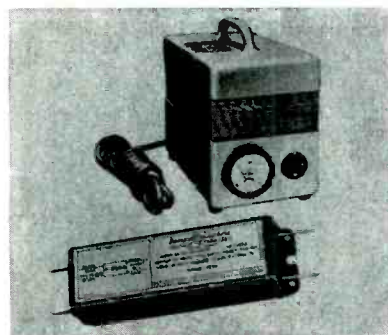
(Check 103 on inquiry card for more information)



## VOLTAGE STABILIZERS

A new series of constant voltage stabilizers recently announced by Acme Electric Corporation of Cuba, New York, is claimed to have features particularly significant to equipment engineered to extremely close voltage tolerances. Output voltage stabilization is automatically obtained by a parallel combination of a fixed capacitance and a magnetic core inductance and is further improved with a compensating winding.

(Check 107 on inquiry card for more information)



## HEATHKIT PUSH-PULL SCOPE

The Heathkit Model 0-10 oscilloscope incorporates improved vertical linearity, better sync stability, especially at low frequencies, and much-improved over-all stability of operation, including less vertical bounce with changes in level. These improvements make it even more ideally suited for color TV servicing, and for critical observations in the electronic laboratory. The response of the vertical amplifiers is only down 1½ db at 3.58 mc.

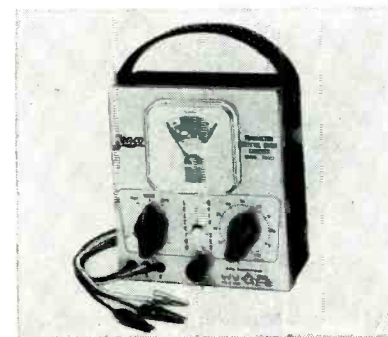
(Check 104 on inquiry card for more information)



## SENCO TRANSISTOR CHECKER

Service Instruments Co. has announced a new transistor and crystal diode checker, Model TDC 22. The new checker features test leads so that the transistors and crystal diodes do not need to be completely removed from the circuit. This avoids excessive heat being applied to the component and also the possibility of connecting the component backwards after the check is made. A control varies the battery voltage for different gain transistors.

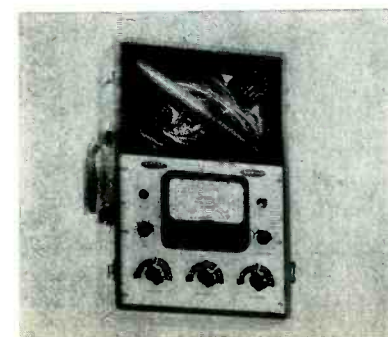
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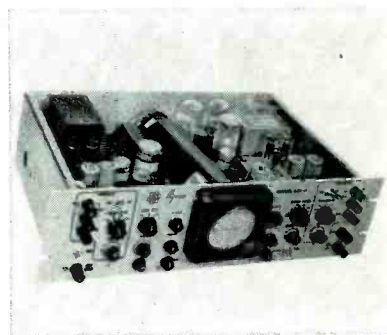
## TV RECEIVER TESTER

The Philco Service King, Model 8500, is a multi-purpose, portable instrument for servicing both black-and-white and color receivers. The instrument checks emission, video drive, grid control, gas, and leakage of color and black-and-white picture tubes. The meter can be used to measure dc voltages up to 1000 volts, up to 30,000 volts with the supplied high voltage probe, and as an ohm-meter.

(Check 108 on inquiry card for more information)



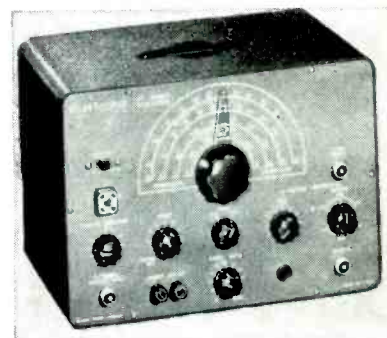
# SERVICE DEALER & ELECTRONIC SERVICING NEW TEST EQUIPMENT



## HYCON OSCILLOSCOPE

Hycon's new Rack Mounted 3" oscilloscope is only 5¼" high by 11" deep with a 19" width to mount in standard relay racks. The instrument responds from DC to 300 KC and is flat from DC to 150 KC. Horizontal and vertical amplifiers are identical and balanced. All operating controls are grouped for maximum efficiency and flexible performance. The 3 inch CRT is flat-faced and a tight tolerance type with recurrent or triggered sweep.

(Check 106 on inquiry card for more information)



## KNIGHT SWEEP GENERATOR

Allied Radio Corporation announces the release of the new Knight-Kit RF Sweep Generator Kit. This easy-to-build instrument is said to provide high accuracy and reliability at extremely low costs. Designed for use wherever coils or circuits must be accurately adjusted for resonance and proper band-pass, it is recommended by Allied for manufacturers of *if* transformers, coils and tuners as well as other electronic components.

(Check 101 on inquiry card for more information)



## JERROLD SWEEP GENERATOR

A wide-band sweep frequency generator, designed for laboratory or production test usage where high stability and extreme consistency of output are essential, has been introduced by the Jerrold Electronics Corp. Known as the Model 900, it supplies a sweep signal at any frequency from 0.2 mc to approximately 1,000 mc, with sweep widths as high as 300 mc or as low as 0.1 mc. The output is within ±0.5 db from 200 KC to 250 mc; ±3 db from 250 to 1000 mc.

(Check 102 on inquiry card for more information)

## CENTURY REJUVA-CHECK

Century Electronics has made available the Rejuva-Check, Model RJC-1 which performs the following functions. Tests: Checks cathode emission. . . . Indicates shorts and leakage between elements. . . . Estimates the remaining useful life of the CRT. Repairs. . . . Clears inter-element shorts and leakage. . . . Removes cathode surface contamination. . . . Restores emission giving new life to weak dim tubes. It can be carried in the tube caddy on calls.

(Check 109 on inquiry card for more information)



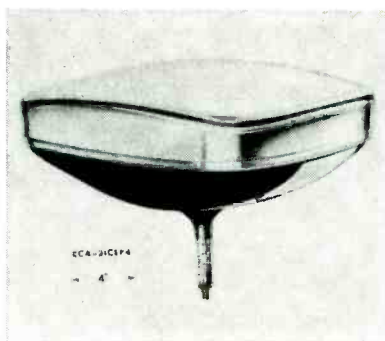
# SERVICE DEALER & ELECTRONIC SERVICING

## NEW tubes / transistors

### 110° PICTURE TUBE

The new RCA 21CEP4 directly viewed, rectangular glass picture tube has a 110° deflection angle and a 21 3/8" diagonal envelope. The length is approximately 5 1/2" shorter than types having the same size faceplate and 90° deflection. The tube features a neck diameter of only 1 1/8" which permits beam deflection with only slightly more power required than to scan 90° deflection angle tubes. The need of ion-trap magnets has also been eliminated.

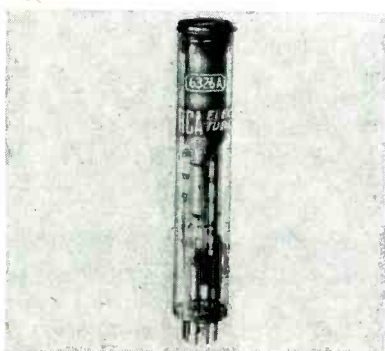
(Check 113 on inquiry card for more information)



### VIDICON CAMERA TUBE

The 6326-A is a small camera tube intended primarily for use in compact color television cameras utilizing the method of simultaneous pickup of the film or live subjects to be televised. This method employs three 6326-A's—one for each channel—to produce the information necessary for the formation of a color-television image. The 6326-A is also suitable for use in black-and-white TV cameras for film or live pickup. Resolution is about 600 lines.

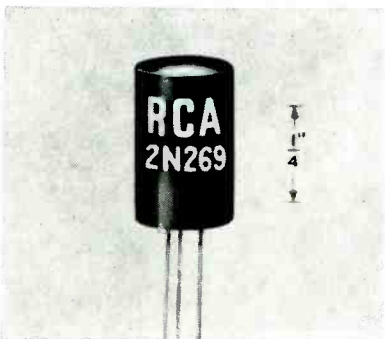
(Check 119 on inquiry card for more information)



### JUNCTION TRANSISTOR

The RCA 2N269 is a junction transistor of the germanium P-N-P type designated for use in low-level, medium-speed, "on-off" control circuits with particular reference to bistable (flip-flop) and gating circuits of electronic computers. The 2N269 has a maximum emitter current of 100 milliamperes, a maximum collector current of 100 milliamperes, and a minimum large-signal dc-current transfer ratio of 35 at a collector-to-emitter -0.15 volts.

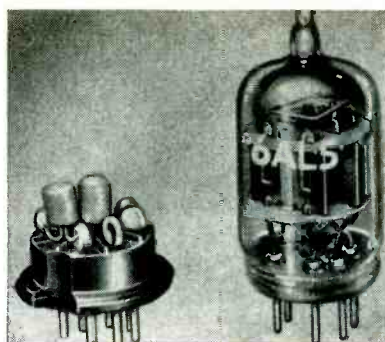
(Check 116 on inquiry card for more information)



### GZ34 CATHODE TYPE RECTIFIER

Amperex Electronics Corp. has released data on their GZ34 rectifier tube. The GZ34 is an octal-base, indirectly heated, cathode-type, full-wave rectifier operating on a 5-volt heater. It replaces without change such tubes as 5U4G, 5V4G, etc. Benefits are better voltage regulation with lower power supply impedance, cooler operation due to lower voltage drop, and higher power output due to increased power supply voltage. Output ripple is also reduced.

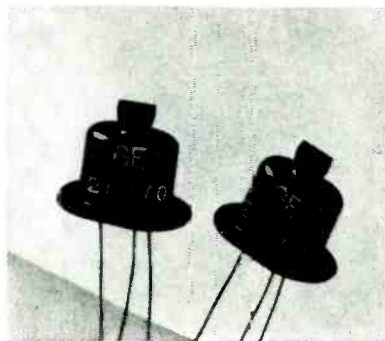
(Check 114 on inquiry card for more information)



### DUAL DIODE REPLACEMENT

Type 60-7788 is a small, compact plug-in selenium rectifier that has been especially designed by International Rectifier Corporation to replace the 6AL5 tube in many TV sync discriminator circuits. These subminiature selenium rectifiers offer advantages over the 6AL5 tube, since they are much smaller in size. They also do not require any heater power, thereby offering a higher reliability factor than the conventional vacuum tubes.

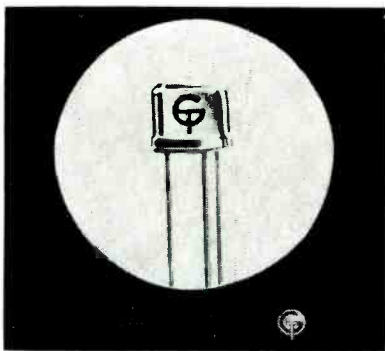
(Check 118 on inquiry card for more information)



### HIGH FREQUENCY TRANSISTOR

A new high frequency transistor for radio hobbyists and do-it-yourself devotees, priced about the same as its nearest comparable electronic tubes, was announced by General Electric Co. This marks the first time that the price of a high frequency transistor has reached the price level of equivalent electron tubes. Designated 2N170, it has a power gain of 22db at 455 KC with a usable gain at 4 megacycles and is capable of dissipating 25 milliwatts.

(Check 111 on inquiry card for more information)



### GERMANIUM TRANSISTOR

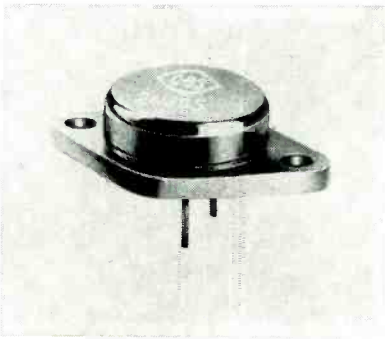
General Transistor Corp., manufacturers of transistors and other semi-conductor products, announced the production of a new germanium P-N-P alloyed junction 3-lead transistor. Known as type GT-109, it is designed primarily for use in low frequency push-pull stages such as audio amplifiers, portable radio audio output stages and low frequency rf amplifiers. Used in class B circuitry, the GT-109 offers high efficiency and low battery drain.

(Check 112 on inquiry card for more information)

### HIGH POWER TRANSISTOR

Low priced power transistors, intended expressly for use by experimenters and radio amateurs, have been announced by CBS-Hytron. The advanced-engineered CBS types 2N255 and 2N256 are P-N-P alloy-junction germanium transistors which have high power handling capability coupled with high current amplification. Electrically, the 2N255 and 2N256 are similar. The 2N255 is for use with 6-volt power supplies and the 2N256 with 12-volt supplies.

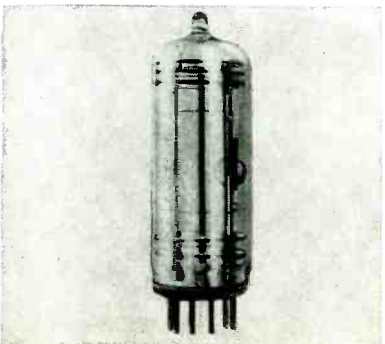
(Check 115 on inquiry card for more information)



### MINIATURIZED CRYSTAL UNIT

A new 1000 cycle miniaturized crystal unit has been developed by the James Knights Company for applications in the low frequency range requiring both extreme stability and miniaturization. The new unit, the JK-G7J, is specially processed and sealed in a glass-enclosed vacuum. The JK-G7J has a higher merit factor due to its vacuum enclosure, and a secular stability of less than .002% per year. Temperature stability is ± .012% from -40° to +70°.

(Check 117 on inquiry card for more information)



## SEALED TV TRANSFORMERS

A complete replacement line of TV transformers, flybacks, yokes and coils in hermetically sealed plastic containers is available from Rogers Electronic Corp. This moisture-free, dirt-proof packaging extends shelf-life indefinitely, and minimizes failures and callbacks. The transformers also have built-in moisture protection. Storage without protection introduces a risk of subsequent failure dependent on exposure to humidity and dust.

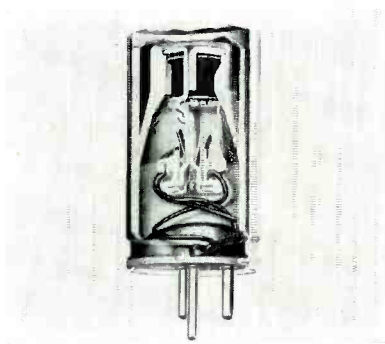
(Check 121 on inquiry card for more information)



## "BUTTON-LESS" VIBRATOR

A completely new design in vibrator construction is featured in the new Series 1600 vibrator announced by P. R. Mallory & Co. Inc. The design eliminates the usual button contacts as the vibrating reed and side arms themselves, made of special contact alloy, act as the contacting elements. The new design affords far greater contact area with the wear distributed over a larger surface. Vibrator life is increased 50 to 100%.

(Check 128 on inquiry card for more information)



## CONTACT PROTECTORS

A complete line of contact protectors which prolong the life of switches and relays by eliminating arcing is now available in handy package form from the component distributors of Federal Telephone and Radio Company, a division of International Telephone and Telegraph Corporation. Protectors are packaged in identical or varied mixed lots according to requirements. In all, a complete line of 56 different types of protectors is available in packages.

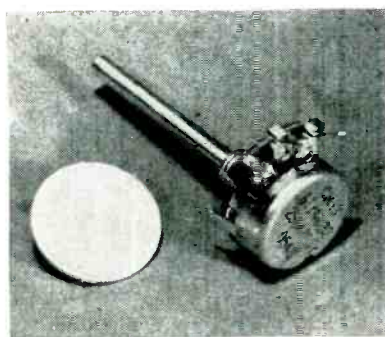
(Check 127 on inquiry card for more information)



## MINIATURIZED CONTROL

Clarostat Series 44 miniaturized control is built to meet the small space limitations of transistorized assemblies such as hearing aids, pocket radios, portable radios, TV sets, portable test equipment and printed circuits. The diminutive control measures only 21/32" in diameter by 5/16" deep and is available in resistance ranges of linear, 200 ohms to 5 megohms; Tapered, 1500 ohms to 2.5 megohms. Tolerance: plus/minus 20%; above 100K, 30%.

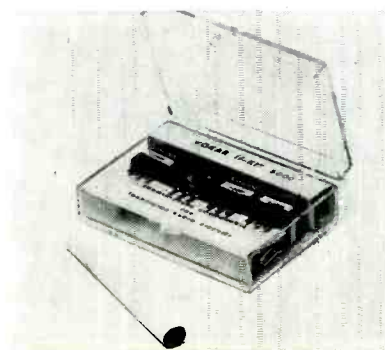
(Check 122 on inquiry card for more information)



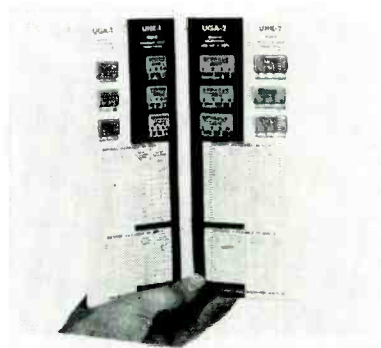
## TRANSISTOR I.F. KIT

Vokar Corporation announces production of the new IF-Kit 5000 containing key components for a 6 transistor portable radio which can be built by amateurs, technicians, hams and experimenters. Subminiature Vo-Tron components in each kit are: Three 455KC IF transformers and one 455KC oscillator coil, the same components Vokar is currently making for a number of portable radios. They are impedance-matched to popular transistors.

(Check 125 on inquiry card for more information)



# SERVICE DEALER & ELECTRONIC SERVICING NEW COMPONENTS



## STABILIZED DISC-CERAMICS

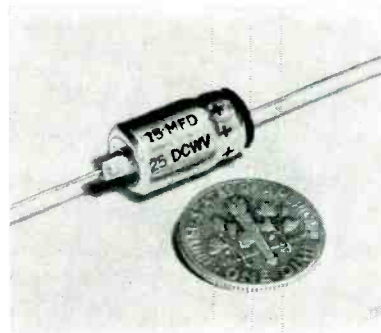
Ceramic disc capacitors with three new excellent capacitance temperature stability characteristics have been announced by Cornell-Dubilier. They are known as Types JA, JB, and JC. All three Tiny-MIKE disc capacitors are designed for applications requiring minimum change in capacitance at any temperature within their respective operating ranges. Insulated with phenolic and wax vacuum impregnation they have high insulation resistance qualities.

(Check 126 on inquiry card for more information)

## MINIATURE ELECTROLYTIC CAPACITOR

A miniaturized version of the hermetically-sealed aluminum-can electrolytic is announced by Aerovox Corporation. Designed as Aerovox Type XPP, the tiny electrolytic is designed for applications where size and weight must be kept at a minimum without undue sacrifice of operating characteristics and service life. Such tiny electrolytics are particularly suited for transistorized radios, hearing aids and other assemblies requiring high capacitance values.

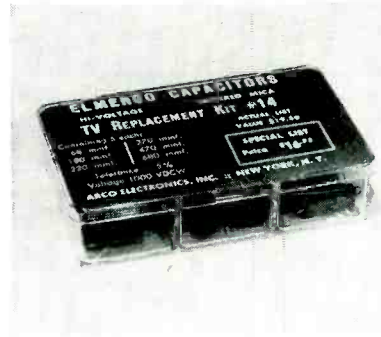
(Check 123 on inquiry card for more information)



## HI-VOLTAGE CAPACITORS

Arco Electronics, Inc. has made available a kit which contains an assortment of the most popular hi-voltage "Elmenco" silvered mica high voltage capacitors used in TV circuits. This kit, no. 14, contains 5 each of the necessary sizes ranging from 69  $\mu\mu\text{f}$  to 680  $\mu\mu\text{f}$ . All condensers have a voltage rating of 1000 VDCW, a tolerance of plus and minus 5%, and are supplied in a handy compact plastic container. The size is imprinted on each.

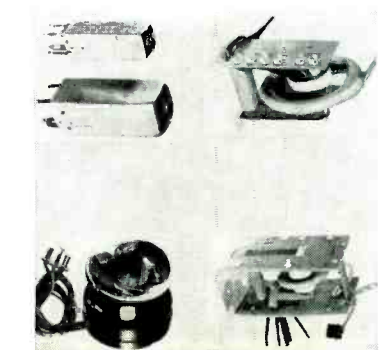
(Check 129 on inquiry card for more information)



## REPLACEMENT COMPONENTS

In keeping with their reputation for manufacturing a complete line of transformer, yoke and coil replacements, Merit introduces the following new products: MDF-79 and MDF-80 for replacement in over 200 models and chassis of Motorola, Hoffman and Hallicrafters. Merit flyback HVO-59 and HVO-61 are replacements for many G.E. transformers. The HVO-62 flyback transformer is made for over 100 Magnavox models.

(Check 124 on inquiry card for more information)



# CONTACT

This section of SERVICE DEALER AND ELECTRONIC SERVICING serves as liason office between 1) Manufacturers of Electronic devices who seek qualified service firms capable of acting as their branch service depots, and 2) Technically qualified, financially sound Service Firms or Independent Radio-TV Servicemen who seek to be appointed as Factory-Trained Branch Service Agencies for Electronic Equipments Manufacturers in the areas where they are situated.

Advertising run in this section costs \$15.00 per column inch.

## TECHNICIANS BELL TELEPHONE LABORATORIES

... world communications research and development center now has openings for qualified technical aides in the fields of:

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We are fully licensed, experienced and qualified to install and service the following:

- Mobile and Marine Radio
- Broadcast and TV Station Equipment
- Aircraft receivers and transmitters
- Garage Door electronic openers
- Radiation electronics devices
- Inter-com. P.A., and Sound installations
- Closed circuit TV.

College graduate, hold 1st Telephone (since 1917), 1st Telegraph with Radar rider and sea service licenses. Bank references furnished. Manufacturers or users of above mentioned types of electronics equipment, write to:

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Hold First Class FCC radio-telephone license. For 4 years was radio station engineer. Since 1948 have serviced radio, TV, audio, mobile, marine, aircraft radios, closed circuit TV and industrial electronics equipment. Competence proven. *Write for further details.*

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### INDUSTRIAL ELECTRONIC DEVICE AND TEST EQUIPMENT MANUFACTURERS

For years we have devoted our efforts exclusively to the maintenance\* and calibration of electronic devices such as: Counters, PH Meters, Metal Locators, Geiger Counters, PEC units, Scopes, VTVM's, Generators, Power supplies, etc. \*(We sell no devices or equipment).

Our facilities are available to manufacturers and users of electronic devices and electronic test equipment. We invite inspection of our facilities and abilities. *Write:*

**Cleveland, Ohio Firm, c/o Box 1103,  
Service Dealer & Electronic Servicing**

### TECHNICIAN WANTED

Radio-television service organization situated at Salina, Kansas has opening, on contract basis, for a thoroughly competent technician. Give details in first letter.

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## Branch Service Agencies are now being appointed by



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Kearfott's rapid growth in the development of advanced aircraft navigational systems and components has created permanent positions for qualified men. These openings are for trade school graduates with at least 1 year experience, to wire and assemble special electro-mechanical test equipment from schematics and wire diagrams.

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*For interview, write or phone Mr. Paul Kull.*

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## RCA SERVICE CO., Inc.

# RIDER SPEAKS

**T**HERE are times when the reactions of people are not only strange but inexplicable, but I suppose that it can be expected because the human being is a very complex mechanism.

The subject of factory service and captive service seems to be the topic of discussion whenever and wherever we come in contact with men who earn their livelihood in the servicing business. Strange as it may seem, our suggestion that diversification of activity is one of the most important steps in the fight against factory service has, on occasion, aroused negative comment.

Diversification of service effort by the industry is long overdue. We have advocated it for more than 20 years, and today we believe in the idea more strongly than ever.

Admittedly, our thoughts concerning the solution of the factory and captive service problem are not in line with the thinking of those who have advocated a much more hostile and vindictive effort. In all the years of our association with the servicing industry in America we have never believed in appeasement. We have always been ready to fight for a point, but there are many ways in which the word "fight" can be interpreted.

There is no doubt in anyone's mind that the issue at hand has a number of facets. There is a moral aspect. By virtue of past performance, the servicing industry has a moral right to expect that it will face competition by the manufacturers. Unfortunately, however, the world is too materialistic to give the moral aspect of an issue its full weight. There are times when the moral right becomes the victor, but in this case we don't believe (and we say this with every ounce of conviction in us) that winning a moral victory by having the manufacturers cease factory service operation is going to provide the answer the servicing industry is seeking.

It is an acknowledged fact that factory service is serious competition to the

operations of the servicing industry, but even if this competition had not developed, other problems which require solution would have grown bigger and bigger. Now that this whole thing has been brought to a head there is an opportunity to find the answers which will bring a solution to something more than the problem of factory competition. Let's look at some of these.

Diversification of effort is a trend which has taken hold in all fields. The banker suggests a diversified portfolio for his client seeking good investments. He wants to be certain that his client will not be hit too hard if something happens to the stocks and bonds issued by companies in the oil industry, so he advises his client to invest not only in oils, which may show great promise, but also in electronics manufacturing, metal industries, utilities, aircraft and so forth.

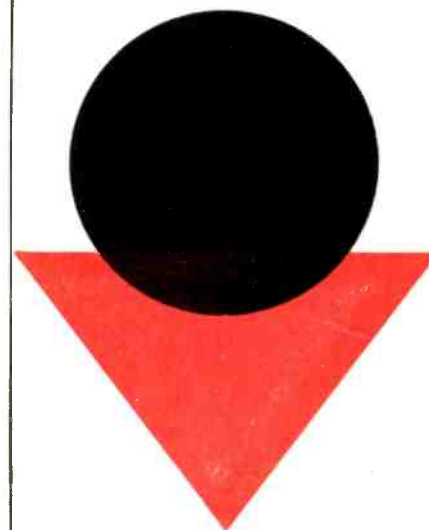
Each day manufacturers are merging with companies that are not necessarily producing similar products, or buying up companies which are producing different types of products. The idea is a simple but effective one; often economies are effected which make operations more potent. But equally important (if not more common) is the idea of diversifying sources of income.

As further proof of the need for diversification, is it not significant that in the electronics industry, which is so close to the operations of the servicing industry, the manufacturers selling products to the public who are most likely to remain in business after the battle is over are those who have already or who presently are diversifying the nature of the products they sell?

One more prominent example of diversification is the supermarket. Little by little, the supermarket is becoming a point of sale for more and more items not identified with nourishment. Books, records, radios and personal items are being exposed for sale to the people

[Continued on page 55]

## WANTED



## TV and Electronics Servicemen

If you are interested in contracting for servicing and maintaining manufacturers equipment in the following Electronic fields please advise us of your facilities.

### Electronics Fields

Mobile Radio  
Garage Door Openers  
Marine Radio—Airplanes  
Industrial Electronic Maintenance  
Sound Installation and Maintenance (PA)  
Intercommunication Systems (Home and Industrial)  
Radiation Electronics  
Broadcasting  
Closed Circuit TV

We will forward all inquiries to Manufacturers who are interested in obtaining such service.

## Service Dealer and Electronic Servicing

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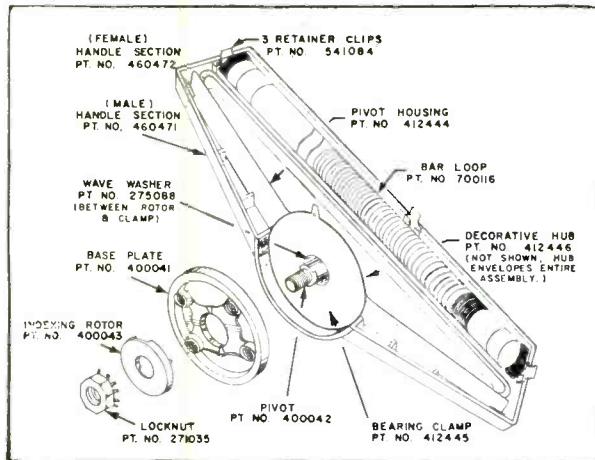
### The Work Bench

Admiral 22A2: Unusual tube trouble	Jan. 27
Admiral 22A3AZ, no horizontal or vertical sync	Feb. 31
CBS Color Chassis 205, Malfunctioning I Channel	Aug. 34
CBS Color Chassis 205, No Color Reception	Oct. 32
Du Mont RA-105: Insufficient vertical sweep	Jan. 43
Du Mont RA-164, -165 Overload Conditions	Dec. 37
Emerson Chassis 120 169-B, horizontal afc not functioning properly	July 27
GE 21T7: Sound bars in pix	Jan. 27
GE 21T30 "J" line, horizontal frequency trouble	May 44
Magnavox Chassis 103 Series, no horizontal and vertical sync	July 27
Motorola Color Chassis BP-902A-01, no color sync	Aug. 35
Philco RF-38, Deflection CPI, unsymmetrical raster	Mar. 17
Philco TV 350, intermittent overload	Mar. 17
Philco TV 440, no horizontal or vertical sync	Feb. 31
RCA KCS48T, arcing high voltage	Oct. 35
RCA KCS82, AGC circuits	Nov. 16
Sylvania chassis 1-462, overload conditions	Dec. 37
Westinghouse Chassis V-2315, weak sound, and distorted	Apr. 44
Zenith 19L26, loud buzz	Apr. 45
Zenith 22T20, horizontal frequency out of range	May 45

### Video Speed Servicing Systems

Admiral 19F1A	July 37
Admiral 21A3AZ	Apr. 37
Crosley Chassis 402, -1, -2, -3, etc.	June 39
Du Mont RA312, 313	Mar. 37
Du Mont RA 340/341	Apr. 39
Emerson 120162A	July 39
Emerson Chassis 120220-D, 120239D, F	Jan. 33
Emerson Chassis 120292	Sept. 41, 42
G.E. "O" line	Oct. 45
General Electric "S" line	Dec. 33, 34
Motorola Chassis TS-326B	Aug. 37
Philco TV 353	May 35
Philco TV 400	May 37
Philco 440 Chassis	Oct. 43
Raytheon 21T42	Nov. 33, 34
Raytheon Chassis 24T3	June 41
RCA KCS72	May 37
RCA Chassis KCS97	Sept. 43, 44
Silvertone Chassis 128-16	Aug. 39
Stewart Warner 21-9300 Series	Mar. 39
Sylvania 1-521	Nov. 35, 36
Sylvania Chassis 1-532-3, -4	Dec. 35, 36
Sylvania 1-533-1, -2	Feb. 39

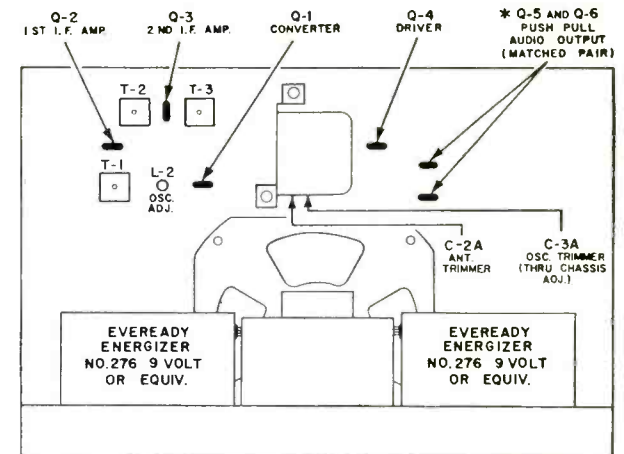




**ROTATABLE HANDLE COMPONENT PARTS**

**RESISTANCE READINGS FOR CHASSIS 120309 120328**

SYMBOL	TERMINAL B	TERMINAL C	TERMINAL E
Q1	165K $\Omega$	3.3K* $\Omega$	1500 $\Omega$
Q2	4K $\Omega$	3800* $\Omega$	330 $\Omega$
Q3	2K $\Omega$	3.3K* $\Omega$	1000 $\Omega$
Q4	4.2K $\Omega$	500 $\Omega$	3.4K $\Omega$
Q5	3K* $\Omega$	22 $\Omega$	2.9K* $\Omega$
Q6	3K* $\Omega$	18	2.9*K $\Omega$

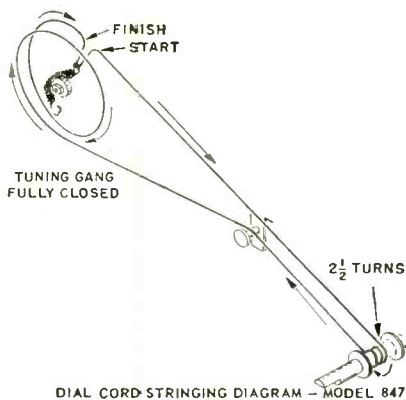


\* NOTE: IF ONE OF THESE TRANSISTORS Q-5 OR Q-6 BECOMES DEFECTIVE, REPLACE BOTH OF THEM WITH A NEW MATCHED PAIR. (PT. NO. 815014)  
**TRANSISTOR AND BATTERY LOCATION DIAGRAM**

**CONDITIONS FOR VOLTAGE AND RESISTANCE READINGS**

1. Voltages indicated are positive d.c., resistance is ohms, unless otherwise noted.
2. Measurements made with voltohmmyst or equivalent.
3. All measurements taken between points and chassis, unless otherwise indicated.
4. Before taking resistance measurements, turn on-off switch to the "off" position (or disconnect batteries). Then remove transistors.
5. Volume control at maximum, no signal applied for voltage measurements.
6. Nominal tolerance in component values makes possible a variation of  $\pm 15\%$  in readings.
7. K is Kilohms, MEG is megohms.

VOLTAGE READINGS ARE SHOWN ON SCHEMATIC



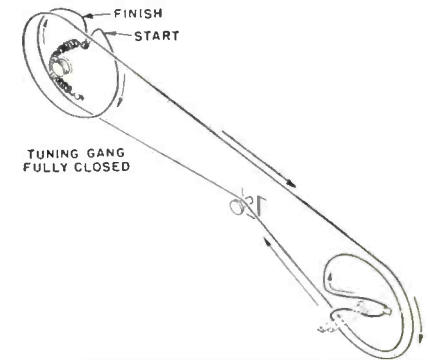
DIAL CORD STRINGING DIAGRAM - MODEL 847

**TYPES OF TRANSISTORS AND CRYSTALS**

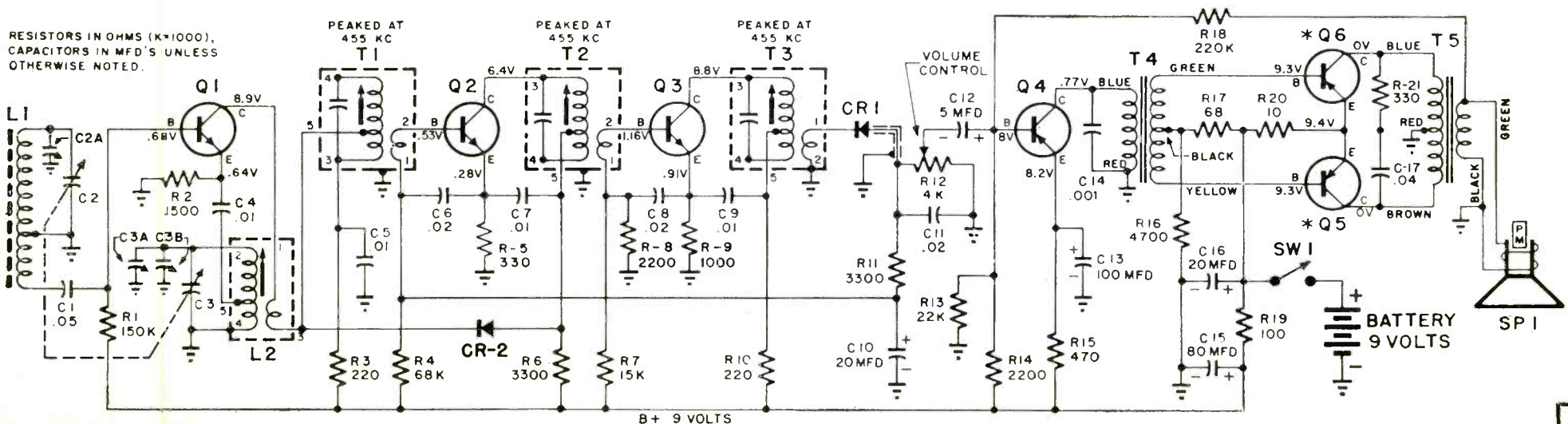
- Q1—NPN Converter
- Q2—NPN 1st I.F. Amplifier
- Q3—NPN 2nd I.F. Amplifier
- Q4—PNP Audio driver
- Q5, Q6—PNP (Matched Transistors)  
Audio Output
- CR1—1N295 Diode Detector & A.G.C.
- CR2—Auxiliary A.G.C. Diode

**POWER SUPPLY**

Two—No. 276 (9V.) Eveready Energizers or equivalent.



DIAL CORD STRINGING DIAGRAM - MODEL 844



RESISTORS IN OHMS (K=1000), CAPACITORS IN MFD'S UNLESS OTHERWISE NOTED.

CHASSIS HS-507, Models 76T1 and 76T2

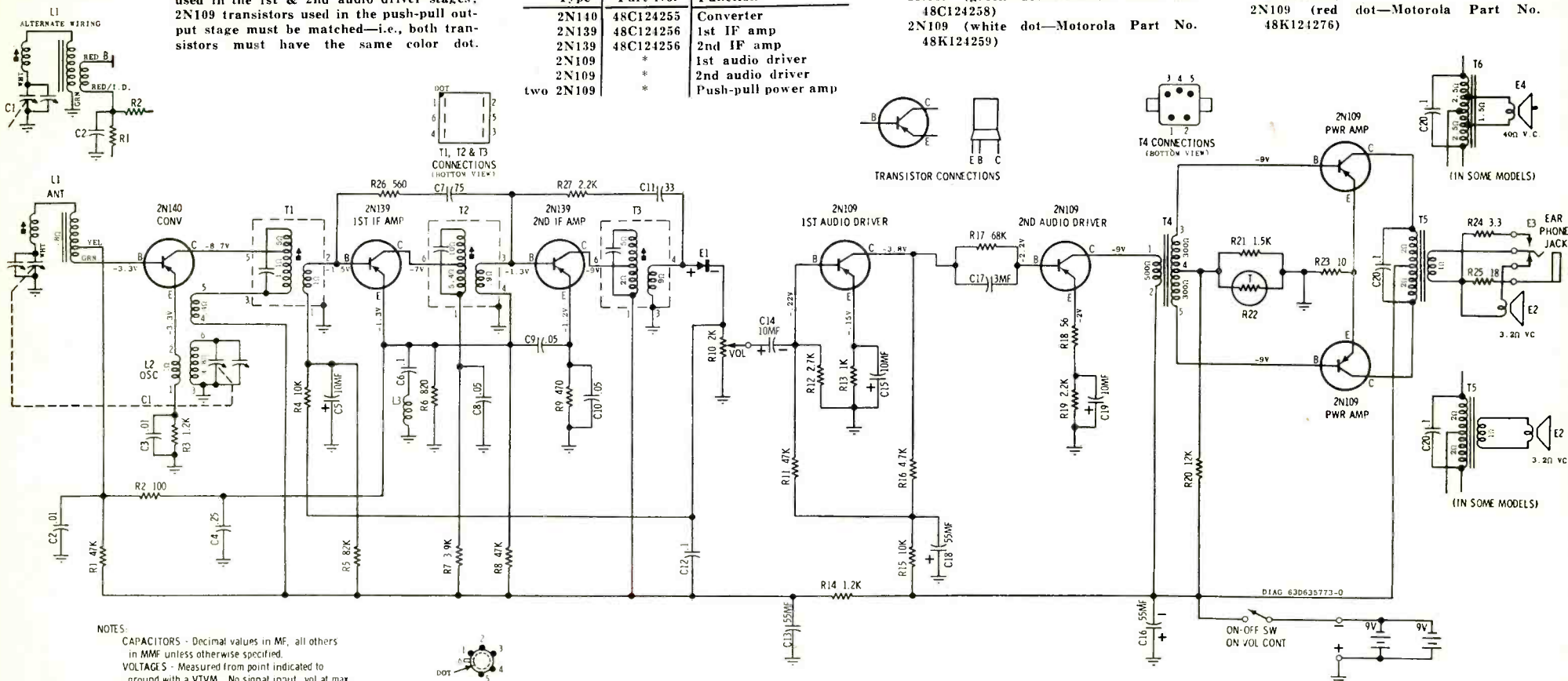
\*Any color 2N109 transistors may be used in the 1st & 2nd audio driver stages; 2N109 transistors used in the push-pull output stage must be matched—i.e., both transistors must have the same color dot.

#### TRANSISTOR COMPLEMENT

Type	Part No.	Function
2N140	48C124255	Converter
2N139	48C124256	1st IF amp
2N139	48C124256	2nd IF amp
2N109	*	1st audio driver
2N109	*	2nd audio driver
two 2N109	*	Push-pull power amp

Use the following 2N109 replacements:  
 2N109 (green dot—Motorola Part No. 48K124258)  
 2N109 (white dot—Motorola Part No. 48K124259)

2N109 (yellow dot—Motorola Part No. 48K124275)  
 2N109 (red dot—Motorola Part No. 48K124276)



TUNING RANGE - 535 to 1620 Kc IF - 455 Kc

**POWER SUPPLY** - Operates from two 9 volt batteries. Either two of the following or equivalent may be used: Eveready 276; Burgess D6.

#### CIRCUIT DESCRIPTION

1. The circuit of this chassis is conventional - there are no built-in resistors or capacitors. Leads are plated on both sides of the chassis base, thereby replacing the usual connecting wires and making wiring more uniform.

2. The metal plating extends through all the holes on the chassis, connecting circuits on the front with those on the rear.

3. Reference to the chassis photographs, schematic diagram and to chassis will permit the circuit to be traced easily.

#### SERVICING PRECAUTIONS

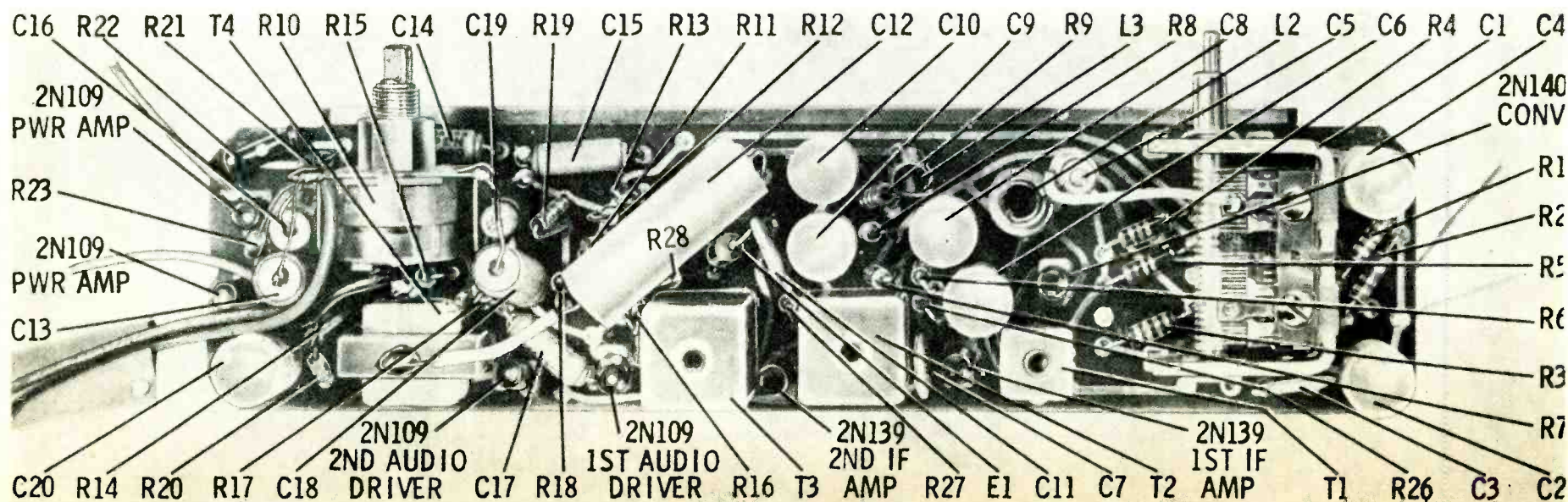
1. When servicing this radio, probing with a screwdriver (checking for spark to ground or for "clicks" from various points) must be avoided, because the transistor stages are susceptible to damage from this type of check. If the transistor BASE electrode is shorted to ground (either directly or through any path) the BASE bias will be removed, allow-

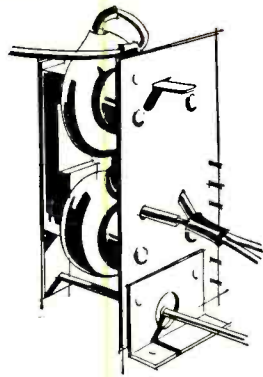
ing excessive current to flow through the transistor, causing permanent damage.

2. Do not service the chassis on a metal plate because of the possibility of a short circuit.

3. Refer to "Plated Circuit Chassis Servicing Techniques" manual (Motorola Part No. 68P636536) for recommended tools and procedures to be used when servicing Motorola plated circuit chassis.

4. When making circuit resistance checks, all transistors should be removed from circuits to avoid erroneous readings or possible damage to transistors.





HVO-66 replaces part 24K736488 in 85 Motorola models and chassis

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BC-358 sub-miniature IF input transformer for printed circuits—455KC



MDF-85 for G.E. RLD-041 & 045



HVO-62 replaces Magnavox part 360580-1, 360604-1, 360610-1



BC-359 sub-miniature IF output transformer for printed circuits—455KC



MDF-84 for G.E. RLD-025

# MERIT

MERIT COIL AND TRANSFORMER CORP.  
4427 N. Clark St., Chicago 40, Ill.

Mfr: Admiral Chassis No. 17XP3, 17SX3

Card No. AD-17XP-1

Section Affected: Pix and raster

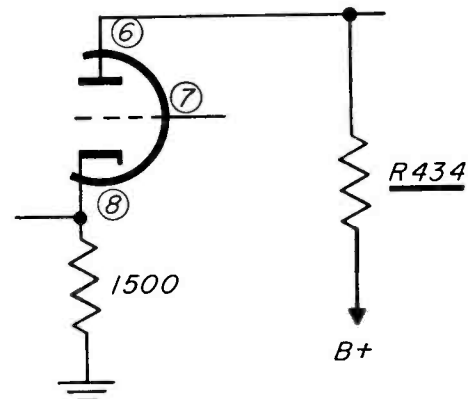
Symptoms: Drive lines show in picture

Reason for Change: To increase the drive range to horizontal output circuit.

What to Do:

Change: R434 (100K, ½ watt) to 82K, ½ watt.

V404  
7AU7  
HORIZ. OSC.



Mfr: Admiral Chassis No. 17XP3, 17SX3

Card No. AB-17XP-2

Section Affected: Pix

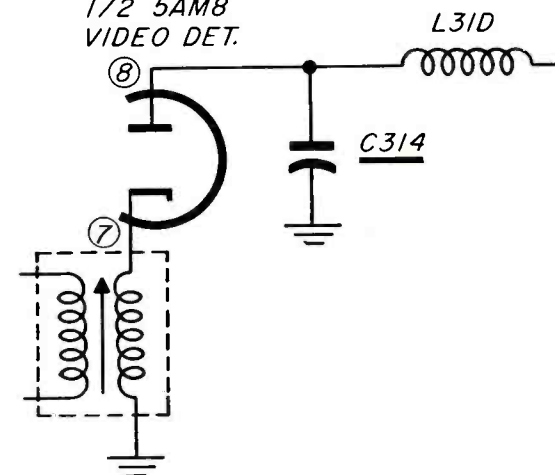
Symptoms: R-F interference pattern of rotating bars exhibited on Channel 5. The interference is caused by the 3rd harmonic if radiation. The symptoms are exhibited only at certain settings of the fine tuning control and usually under weak signal conditions.

Cause: The interference is picked up in the antenna and input circuit due to video detector radiation.

What to Do:

Add: C314 (6.8 mmf ceramic) from pin 8 of V303 to ground.

V303B  
1/2 5AM8  
VIDEO DET.



Mfr: Admiral Chassis No. 17XP3, 17SX3

Card No. AD-17XP-3

Section Affected: Pix and raster

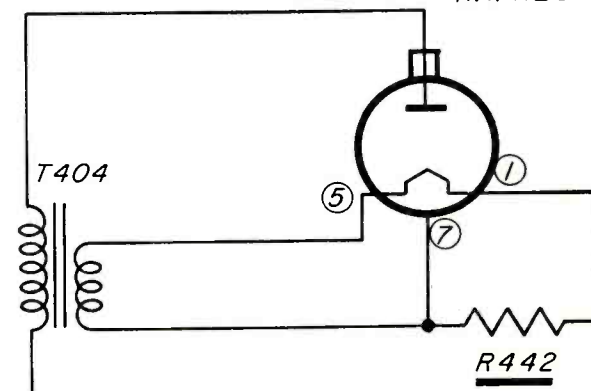
Symptoms: Blooming when brightness control is advanced.

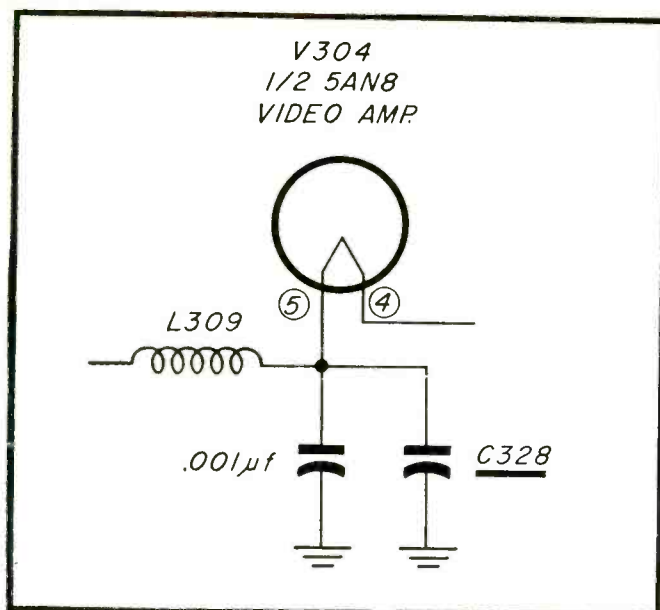
Reason for change: Circuit improvement to prevent the blooming action in picture and raster.

What to Do:

Replace: Horizontal output transformer T404 with the improved type number 79C60-5.  
Add: R442 (4.5 ohm, ½ watt).

V406  
1X2B  
H.V. RECT.





Mfr: Admiral Chassis No. 17XP3, 17SX3

Card No. AD-17XP-4

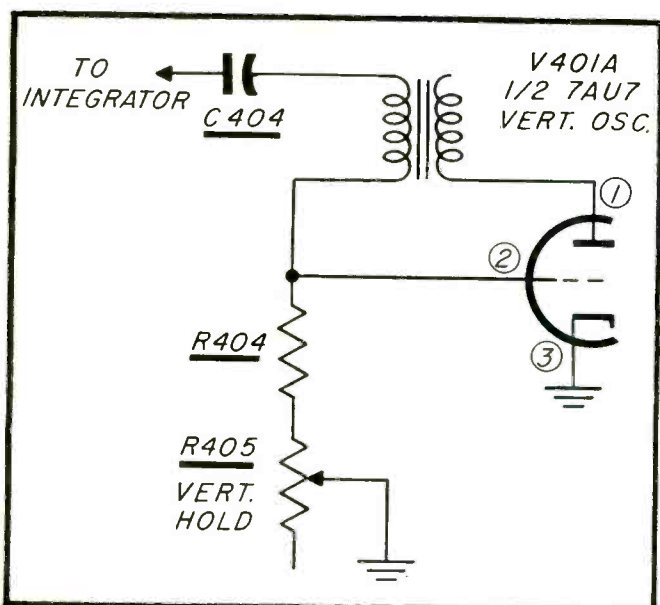
Section Affected: Pix

Symptoms: Portion of picture appears to have regenerative distortion.

Cause: Regeneration is occurring in the if circuitry. This can usually be seen by examining the overall response.

What to Do:

Add: C328 (.005 mf, 450 volt ceramic) at the junction of L309 and Pin 5 of V304 (5AN8) to chassis ground.



Mfr: Admiral Chassis No. 17XP3, 17SX3

Card No. AD-17XP-5

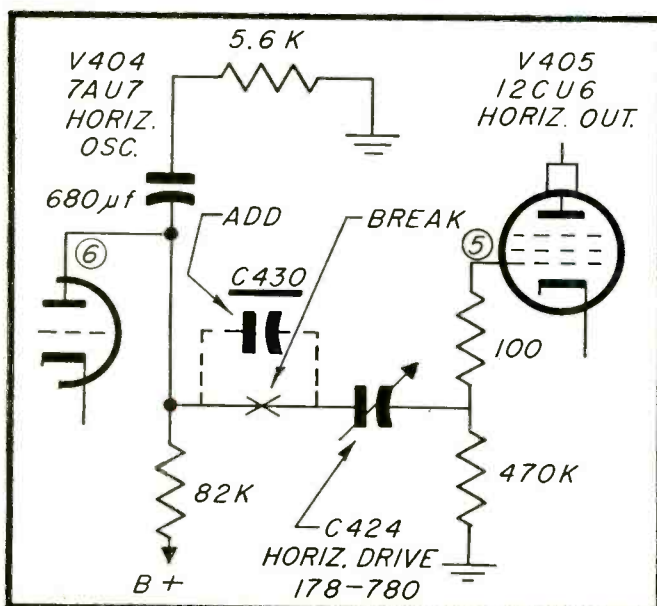
Section Affected: Pix and raster

Symptoms: Vertical non-linearity at bottom of picture.

Reason for Change: To improve the vertical oscillator circuit time constants.

What to Do:

Change: C404 (.0047 mf) to .015 mf, 600 volts. Also, R404 (820K, 1/2 watt) to 470K, 1/2 watt. Also, vertical hold control R405 (2 megohms) to 1 megohm.



Mfr: Admiral Chassis No. 17XP3, 17SX3

Card No. AD-17XP-6

Section Affected: Pix and raster

Symptoms: Frequent replacement of 12CU6 horizontal output tube (V405).

Reason for Change: To safeguard 12CU6 from accidental damage, B plus voltage is removed from one side of the horizontal drive trimmer (C424).

What to Do:

Add: C430 (.0047 mf, 600 volt) capacitor in series with drive trimmer.

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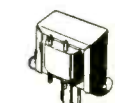
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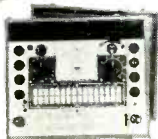
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Mfr: CBS-Columbia Chassis No. 921-93, -94

Card No. CBS-921-1

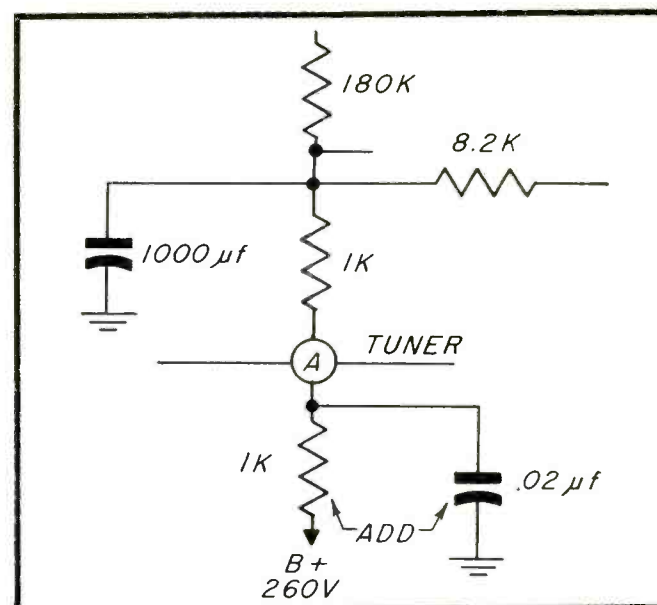
Section Affected: Pix

Symptoms: Unstable vertical and/or horizontal sync.

Cause: Sync information on B plus line (260 volts) feeding tuner is being superimposed on signal.

What to Do:

Add: 1K resistor in series with 260 volt B plus feed line. Also .02 uf, 400 volt from tuner side of resistor to ground.



Mfr: CBS-Columbia Chassis No. 921-93, -94

Card No. CBS-921-2

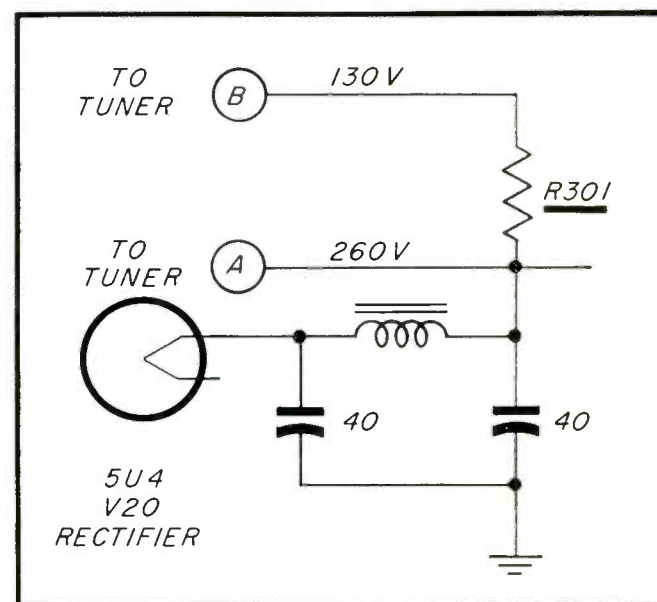
Section Affected: Pix

Symptoms: Intermittent vertical roll, critical vertical hold and poor vertical linearity.

Cause: B plus dropping resistor has increased in value supplying lower B plus to the sync stages.

What to Do:

Replace: R301 (9K, 5 watt).



Mfr: CBS-Columbia Chassis No. 921-93, -94

Card No. CBS-921-3

Section Affected: Pix

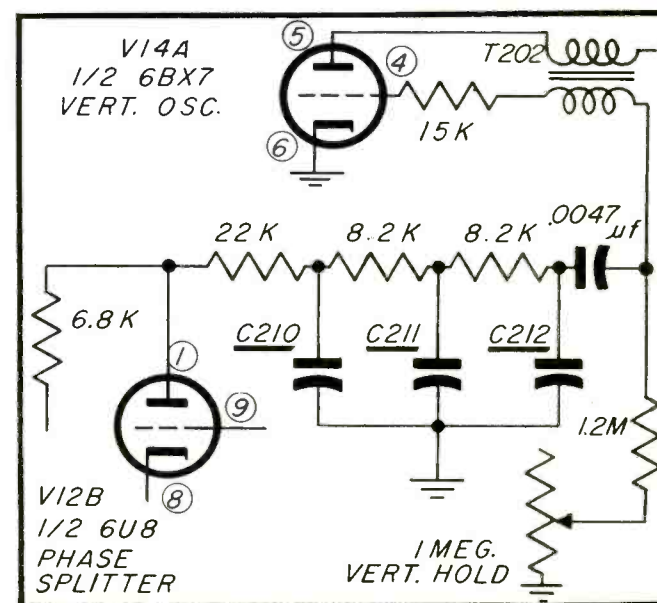
Symptoms: Vertical roll

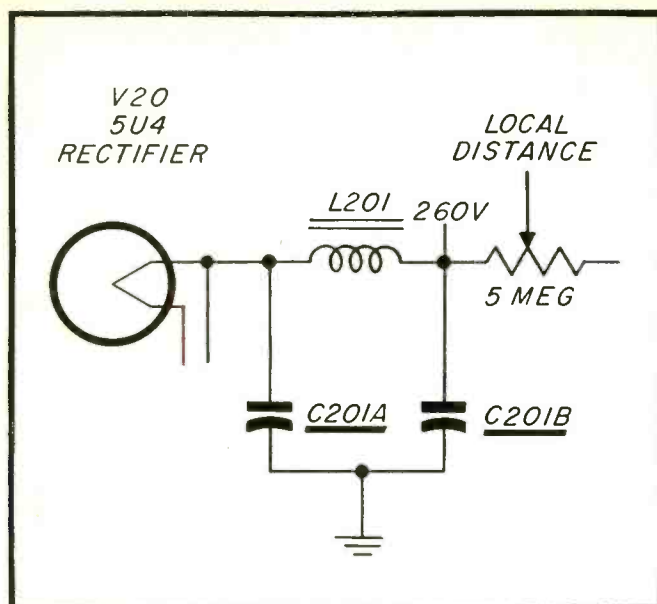
Cause: Leaky condenser in integrator network or defective V14A, 6BX7 tube.

What to Do:

Replace: V14A 6BX7 tube. Try more than one if necessary.

Check: C210 (.005 µf), C211 (.0047 µf) and C212 (.005 µf).





Mfr: CBS-Columbia Chassis No. 921-93, -94

Card No. CBS-921-4

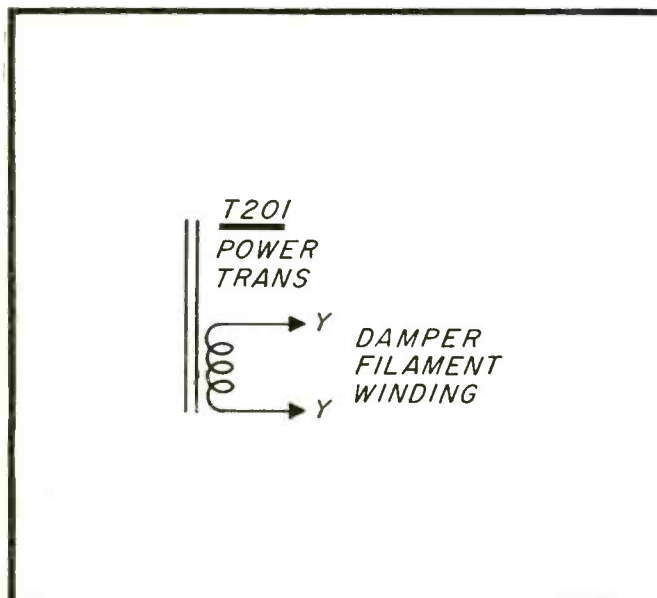
Section Affected: Pix

**Symptoms:** Variation in brightness from right to left side of picture with right side being brighter than left.

**Cause:** Power supply filter has decreased in capacitance permitting the horizontal oscillator signal to be superimposed on the video signal.

**What to Do:**

Replace: C201 (40  $\mu$ f electrolytic).



Mfr: CBS-Columbia Chassis No. 921-93, -94

Card No. CBS-921-5

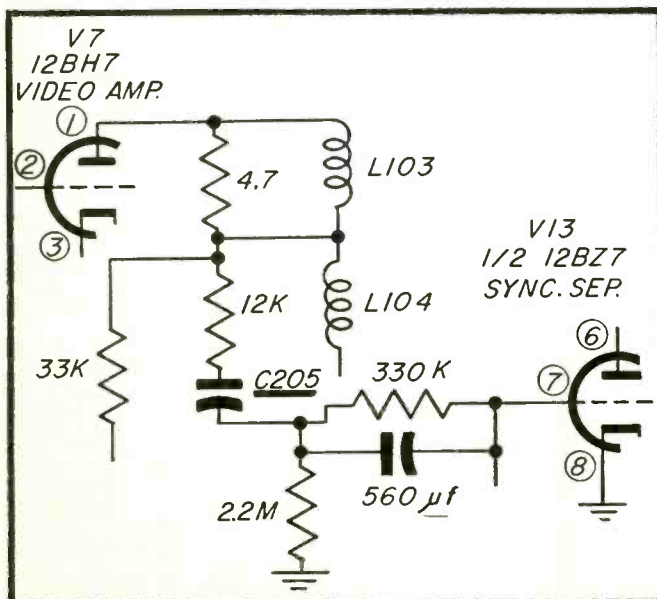
Section Affected: Pix, sound and raster

**Symptoms:** No raster, 6W4 damper and 5U4G rectifier plates glow red.

**Cause:** Damper filament winding in power transformer shorting to case.

**What to Do:**

Replace: Power transformer (T201) or substitute special transformer to supply filament voltage just for damper tube filament.



Mfr: CBS-Columbia Chassis No. 921-93, -94

Card No. CBS-921-6

Section Affected: Pix

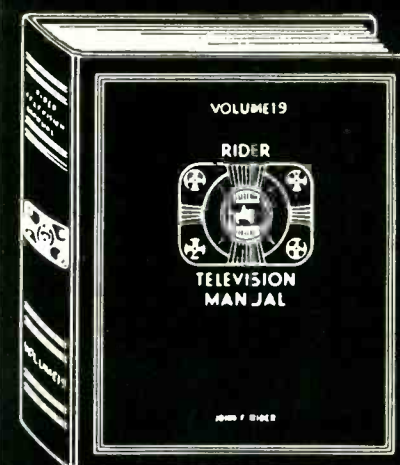
**Symptoms:** Picture information modulating the sides of the picture horizontally.

**Cause:** The sync coupling condenser feeding signal into sync separator is leaking causing incorrect bias and video information to be passed in stage.

**What to Do:**

Replace: C205 (.02  $\mu$ f, 400 volt).

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## Mohawk Midgetape Recorder

by Noel Namtrow

THE tape recorder business is getting bigger all the time. And tape recorders are getting smaller! Some short time ago the Mohawk Business Machines Corporation, introduced a compact, lightweight, self contained magnetic tape recorder. The unit is portable, and almost pocket sized. See Fig. 1.

### Specifications

Briefly, the specifications of the "Midgetape" Model BR-1 (furnished by the manufacturer) are as follows: recording time one half hour uninterrupted half-track, 1 hour total per-cartridge; frequency response, 200 to 4000 cps; wow and flutter, 0.7%; noise, 35 db below maximum recording level; high impedance input: 2000 ohms output impedance; tube complement, two CK549DX, one CK542DX; batteries, one special Mohawk pack for motor and tube filaments, one standard 30-volt B battery; dimensions, 8½" x 3⅞" x 1⅞"; weight, with batteries, 49 ounces.

### Operational Features

Operational features of particular interest to the service-dealer are: erase is *dc*; bias is high-frequency (11,000 cps) *ac*, both turned on automatically with "record" switch; single lever-switch starts and stops motor and amplifier; instant warmup; rewind with a manual crank; recording-playback elapsed-time indicator is visual and marked in 5-minute periods on case; battery life indicator is a pilot light; one volume control serves for both recording and playback, hearing aid type.

### Construction

The construction is a straight-forward application of printed circuit and miniaturization techniques quite familiar to those who have worked with hearing aid equipment. The circuitry is similar to that found in larger, *ac* powered tape recorders. However, because we are dealing with very low-power audio, the design is simplified. Two high gain pentode stages serve as the microphone preamplifier during the recording process, and as the playback head preamplifier during playback of the recorded tape. The recording and playback heads are the same unit, being switched into proper circuits as needed. The erase coil is part of the same head assembly. As with all magnetic recording equipment, the interesting aspects are in the methods used to feed audio and bias voltages to the recording head, the erase method, and the tape transport. Referring to Fig. 2, we see a rather conventional pentode low-power amplifier stage, transformer coupled to a 2000 ohm earphone. This shows the output of the unit as it is connected during playback.

When the lever-switch is thrown to record, the circuit is connected as in Fig. 3. Capacitor C13 provides feedback from secondary of the output transformer to the grid of the output tube. The combined inductance of the transformer, and the capacitance of C13 cause the tube to oscillate at 11,000 cps. This provides the bias voltage for the recording head. The same output tube also amplifies the audio signal from the

preamplifier stages and super-imposes the audio voltage on the bias voltage. The erase coil derives its voltage from the filament battery. Effectively a *dc* electromagnet, it is "hot" only when recording.

### The Cartridge

The tape cartridge consists of 300 feet of ¼" magnetic tape wound on two coaxially mounted (common center shaft) reels. The amount of tape-wind is clearly visible through a slot and thus provides an elapsed-time indicator. When the cartridge is in the machine, a crank engages the hub of the uppermost reel for the purpose of manual rewind. There should be absolutely no scraping or rubbing sounds inside the cartridge, and no drag or tension on the tape, tested by slowly pulling tape out of the cartridge. It is recommended that any attempt to adjust or repair the cartridge be left to the manufacturer, who is specially equipped to make the necessary precision adjustments.

### The Motor

The motor—truly the heart of the practicability of such a small, battery-powered recorder—is a permanent magnet device. The speed of the motor is kept fairly constant by the action of an "electro-centrifugal" governor which inserts resistance into the armature circuit when the motor runs too fast, thus tending to create a dynamic speed stability and minimize "wow." When the battery life drops to a residual operating time of 3 to 5 hours, the governor contacts remain closed, shorting out the pilot light as a warning to change the motor battery.



Fig. 1—Midgetape Recorder.

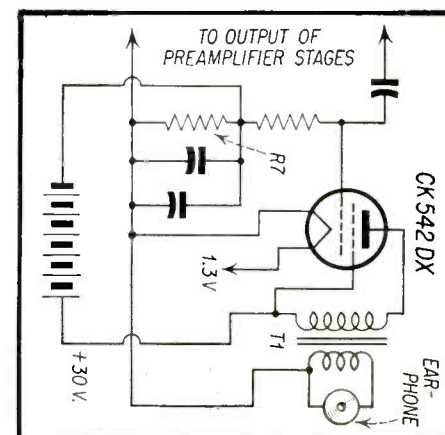


Fig. 2—Amplifier used in recorder.

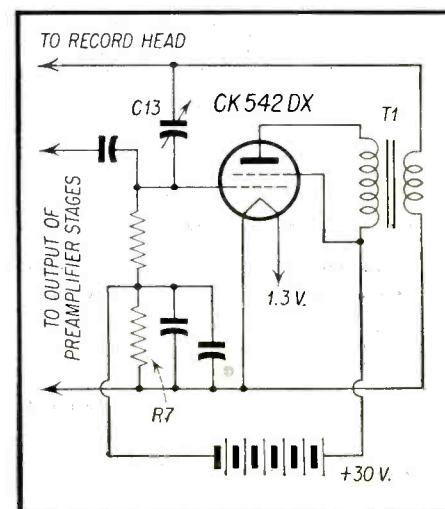
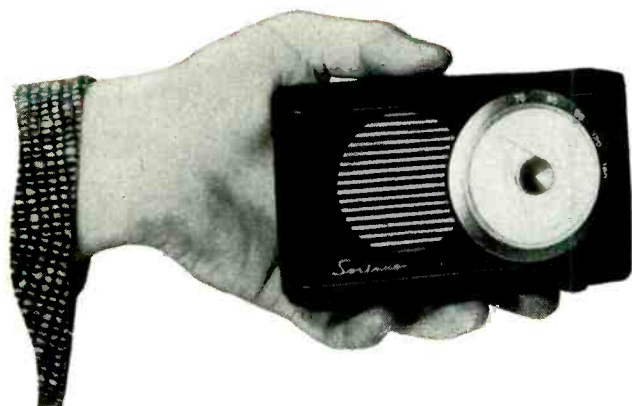


Fig. 3—Circuit in record position.

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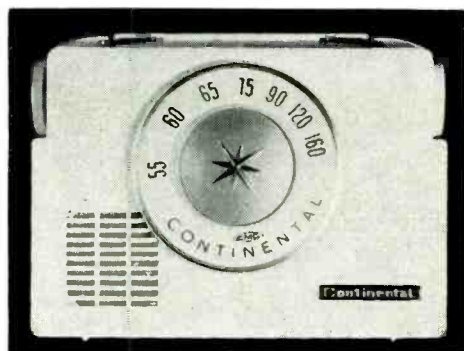
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## EXCEL XLN2

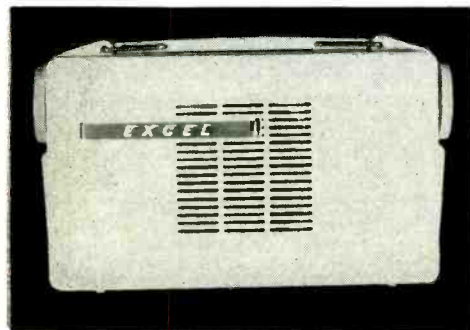
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# THE ANSWERMAN

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BY SERVICE DEALER & ELECTRONIC SERVICING TECHNICAL STAFF

Dear Answerman:

My trouble is an intermittent vertical roll on a Westinghouse V2351-204 chassis. Everything has been checked in the vertical oscillator and output circuit from the integrator circuit to the coupling condensers except the vertical output transformer. I have been wondering if the vertical output transformer could be the cause of this trouble. Portions of the picture are stretched out of the normal vertical linearity. We can't seem to be able to determine the cause of this either. Adjustments do not help.

C. K.  
Miami, Fla.

It is agreed that the vertical output transformer is probably causing your problem of vertical roll. This is quite common as far as intermittent vertical roll conditions are concerned, especially since the components in the integrating network have been tested as well as the

tubes. I suggest that a transformer tester or a sweep analyzer be employed to check the transformer for shorted turns. As can be seen from Fig. 1 the output transformer circuit supplies the feedback pulse which maintains vertical oscillations. Arcing or intermittent shorting can easily cause this problem.

Mr. Answerman:

I have a Hotpoint "MM" chassis in which there is a crowding together of the picture at the center of the screen into a broad vertical bar. Tubes have been changed and the output system checked thoroughly. The deflection waveforms are distorted throughout the receiver. I was wondering if the flyback transformer could be causing this trouble.

F. H.  
Philadelphia, Pa.

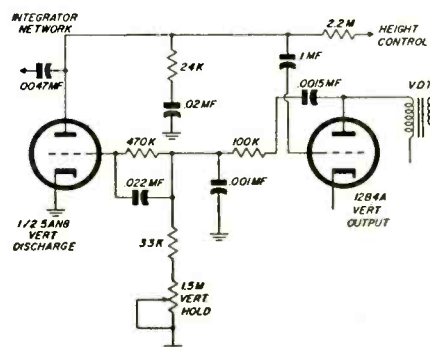


Fig. 1—Partial schematic of Westinghouse V2351-204 chassis.

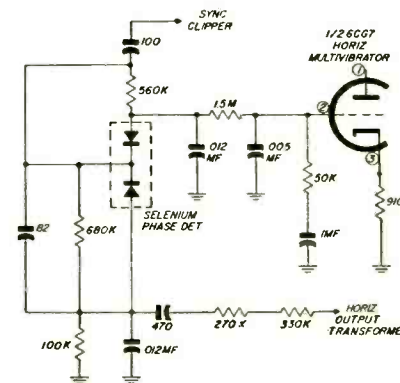


Fig. 2—Partial schematic of Hotpoint "MM" chassis—phase detector.



We are inclined to believe that your trouble is due to something associated with the horizontal multivibrator circuit. It is believed that the selenium phase detector is shorted, applying the horizontal transformer pulse to the grid of the multivibrator. This alters the output multivibrator waveform so that the shape applied to the horizontal output tube is distorted causing the squeeze in the picture. The selenium phase detector circuit is shown in Fig. 2.

Dear Sir:

In a Crosley 487 chassis I haven't been able to locate the cause of small vertical size. The B plus boost voltage is low and therefore the plate voltage of the vertical output tube is low. Normal checks have been made. There seems to be no reason for this trouble. Can you offer any suggestions?

D. L.

Los Angeles, Cal.

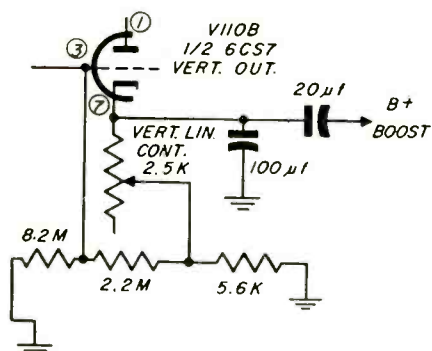


Fig. 3—Partial schematic of Crosley 487 chassis—vertical output.

If you will examine Fig. 3 you will note that the boost voltage condenser of 20  $\mu$ f feeds to the cathode of the vertical output tube where the 100  $\mu$ f condenser across the cathode resistors is supposed to provide the additional necessary capacitance to ground. Either of these condensers is probably open. In other receivers using similar circuits, when the cathode bypass condenser opens or loses capacitance the same symptoms are observed together with possible reduction in width. This effect often gives the mistaken impression that the trouble is due to a failure associated with the power supply, such as a defective selenium rectifier. As can be seen, the cathode bypass condenser is an important item in the development and filtering of the boost voltage as well as the vertical circuit. ■■

## RIDER SPEAKS

[from page 45]

who go in to buy their daily food needs. We know that there are many people who object to the growth of the supermarket because of what it is doing to the small butcher, grocer and other local merchants. But the point that is being made is that the aim of the supermarket operators is to gain the maximum income, and feel that they can best do this by diversifying the products they sell. They offer to the public, under one roof, as many different things as possible. The manufacturers of products which are in the food category but are salable through this vehicle also see the potential.

Consider the neighborhood drug store. At one time it was a pharmacy whose principal effort was the compounding of prescriptions and the sale of patent medicines. Pharmacies are now virtually extinct. It may be that economics forced the pharmacist to make a miniature department store out of his establishment, but regardless of what may have been the underlying cause, the fact does remain that diversification of product sales was necessary.

In all of these cases one thought cannot be ignored. The vendor desires to sell the maximum amount of merchandise, and so derive the greatest income from the customer who enters his store. The same situation and thinking prevail when we suggest that the servicing industry diversify its efforts.

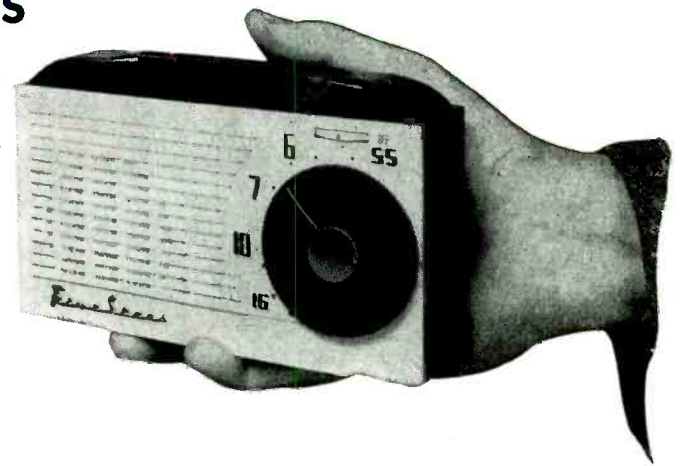
John Q. Public comes into an appliance store and sees radio receivers, television receivers, clocks, washing machines and refrigerators; he goes into a supermarket to buy food and sees many other items that may arouse the desire to buy, but the service technician gets into the home. Here he has the opportunity of selling service not only on television receivers, but on every other device of an electronics nature in that home. The single point that we are trying to make is that we feel it is not in the best interests of the servicing industry to think solely of television receiver service as the only source of income. We believe diversification of service income is vital. ■■

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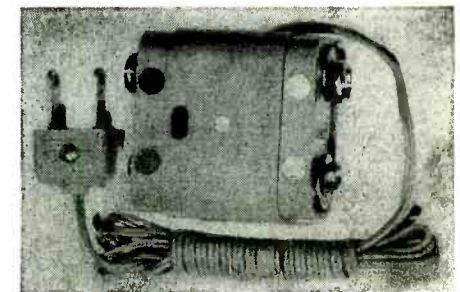


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# THE WORK BENCH

## Unusual Service Problems And Their Solutions

by **PAUL GOLDBERG**  
Service Manager

**T**HIS month's installment concerns itself with a color receiver's convergence and purity adjustment and an odd horizontal frequency problem.

### Motorola TS902A-03 Color Receiver

A new color picture tube had been ordered for this receiver as its present tricolor picture tube 19VP22 was arcing in the neck. When the new 19VP22 arrived, the defective one was removed carefully and the new one was installed. We made sure that the blue gun was facing directly down. One can tell which is the blue gun by the flat plate in the neck. (See Fig. 1).

When the blue gun is straight and perpendicular to the chassis it is directly in line with the blue convergence coil and thus the red and green convergence coil will also be in the correct position (120° apart). This flat plate is the pole piece (magnetic) of the blue gun. There are red and green gun pole pieces but they are of a different shape.

When the tricolor tube is removed the convergence coils remain in position. The purity device is then mounted in the area of the focus electrode toward the end of the gun structure. The purity device consists of magnetic rings with a tab on each ring. The blue beam

lateral correction magnet mounts on the tube neck over the pole pieces.

After the 19V22 was completely installed, the tricolor tube was adjusted for purity. The receiver was turned on and after our color pattern generator had heated up sufficiently, a dot pattern signal was applied to the receiver's antenna terminals. Because the three beam positioning magnets and the yoke had previously been set correctly on the defective tube, only the purity device and the blue beam lateral corrector magnet had to be adjusted. First, the blue and green guns were cut off by grounding their grids in the ground holes of the receiver's receptacle. The tabs of the purity device had also been previously set correctly. Therefore, the tabs were not touched but the device itself was rotated until the entire screen was a pure red. This is the first step in the purity adjustment. Next, the green gun was checked for purity by grounding the blue and red guns. Finally, the blue gun was checked in the same manner.

As a 100% purity could not be obtained we did the best we could in getting purity over all of the screen for each gun. The receiver was next set at Channel 6, a vacant channel, and the

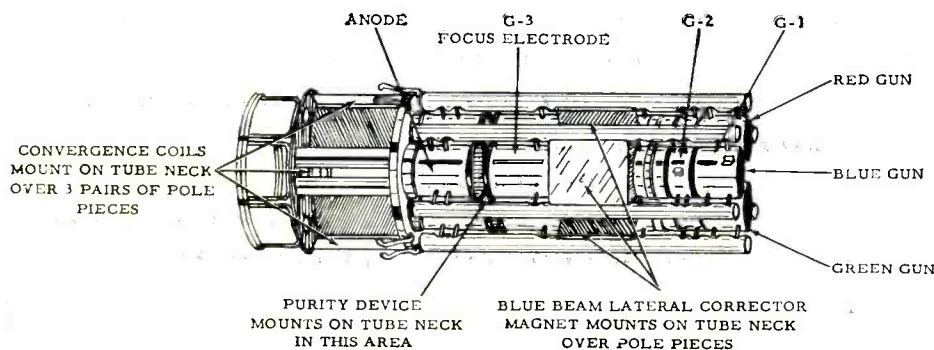


Fig. 1—Electron gun assembly of 19VP22 color picture tube.

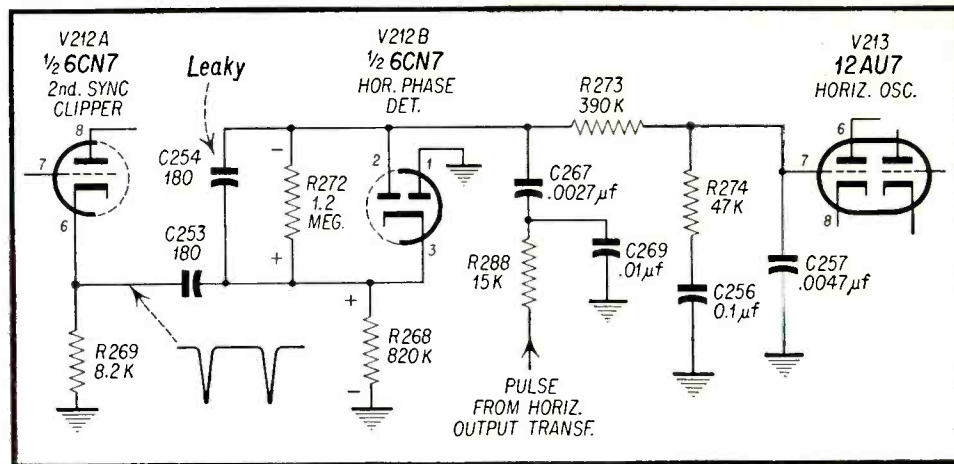


Fig. 2—Partial schematic of Du Mont RA370 chassis.

color pattern generator was also set to Channel 6. The dot pattern was examined on the tricolor tube screen and it was noted first that the blue dots were off convergence (the blue magnetic lateral corrector had not been adjusted). The blue magnetic lateral corrector was next adjusted to converge the blue dots at the center of the screen with the already converged red and green dots to form a white dot.

Next, the color pattern generator was switched to vertical bar position. The screen was then examined and it was noted that there was red fringing at the left and right sides. With the combined use of the red convergence beam positioning magnet and the horizontal dynamic amplitude control, this red fringing was eliminated.

The color pattern was then switched to horizontal bar position. The tricolor screen was next examined and blue and green fringing was observed at the top and bottom of the screen. Adjusting the blue and green vertical dynamic amplitude and tilt controls eliminated most of this fringing (one will never get perfect convergence).

The color pattern generator was next switched to cross hatch position and the tricolor screen was again observed. Here again a bit of fringing was observed here and there. The horizontal and vertical dynamic amplitude controls and vertical tilt controls were therefore touched up to give the most satisfactory cross hatch pattern. It was decided to allow a bit of blue fringing in the lower right and left-hand corners and to settle for that as the best

possible convergence. The red, green, and blue background controls were then adjusted on a normal black and white picture for the best gray, white, black, quality picture. The channel selector was switched to a channel receiving color. The receiver was adjusted with the hue and chroma controls for the best possible flesh color. The flesh color was found to be accurate, thus the receiver was functioning properly.

### Du Mont RA370

The receiver was turned on and it was observed that the horizontal frequency was far out of range. The horizontal phase detector tube, V212, 1/2 6CN7 and the horizontal oscillator, V213, 12AU7, were replaced individually but had no effect.

The diagram was then studied. This receiver uses a rather different horizontal phase detector system. It utilizes V212B, 1/2 6CN7, as its horizontal phase detector. From the cathode of V212 A, negative going horizontal sync pulses are fed to pin #3 of V212 B. The vertical sync pulses are blocked by the RC network arrangement of C253, C254, R272, and R268. The negative going horizontal sync pulses however, cause current to flow from cathode pin #3 to plate pin #2 of V212B down R272. Simultaneously, current flows from pin #3 to plate pin #1 and up through R268. Thus we have opposite voltage drops whose polarities are indicated in the diagram.

The resultant voltage (pin #2 plate to ground) is noise filtered by R273, R274, C256 and C257. In this circuit R268, and R272 are not equal in value

because they are selected to fit the particular circuit requirements. A sample of the horizontal sawtooth voltage is obtained from a takeoff winding on the horizontal output transformer. It is then applied to the plates of V212B through C267, .0027  $\mu$ f. The sawtooth voltage divides equally between the diodes.

When the sawtooth is in phase with the sync pulse, each diode conducts equally and the difference of potential across R272 and R268 is such that no change appears at the grid pin #7 of the 12AU7, horizontal oscillator. If line fluctuations cause the horizontal oscillator frequency to change, one diode will conduct more than the other and a difference voltage at the grid of the

12AU7, pin #7 will pull the oscillator back into phase.

Knowing these facts, the 6CN7, V212, was pulled out of the socket as a check. The horizontal frequency although out of horizontal and vertical sync, nevertheless came back into horizontal frequency range. It was deduced therefore that the trouble was in the V212 circuit. Next resistance checks were made of R268, and R272. Resistor R268 measured correctly at 820K but R272 measured only 10K instead of 1.2 meg. Noting that C254, 180  $\mu$ f was in parallel with R272, C254 was clipped out of the circuit and measured. It was found to measure about 10K. With the new 180  $\mu$ f condenser the receiver functioned properly. ■■

## COLOR [from page 21]

1. Connect a jumper between the control grid (pin 7) of V701-A and the junction of CR701 and R717.

2. Connect a VTVM to this lead.

3. Adjust the ACC threshold control until the VTVM reads  $-5V$  dc.

4. Remove jumper.

The action of the acc diode can be checked by connecting a *vtvm* to the oscillator side of the crystal and then to the bandpass amplifier side. The voltage at the bandpass amplifier side should be approximately double that at the oscillator side.

An excellent check on the entire section comprising the burst amplifier, 1st bandpass amplifier, 3.58 mc CW oscillator and diode rectifier is to first connect a *vtvm* at the bandpass amplifier side of the crystal. Then, with an incoming burst signal, adjust T703 for a maximum negative voltage reading.

Correct adjustment of this transformer provides a maximum negative voltage reading at the *vtvm*, the latter being an indication of the circuit response.

In some chassis, coil L710 in the screen-grid of the oscillator is adjustable. In this case it should be adjusted so that  $-6$  volts is developed on the bandpass amplifier side of the crystal under conditions of no burst. Burst can be removed temporarily by shorting out terminals B and C of T702.

## Service

It is a simple matter to check ACC action. The instrument needed is a VTVM. If the ACC circuit is operating correctly when connected to the control grid of the 1st BP amplifier the VTVM will indicate an increase or decrease in bias as the incoming chroma signal is increased or decreased. ■■

## LOUDNESS CONTROLS [from page 13]

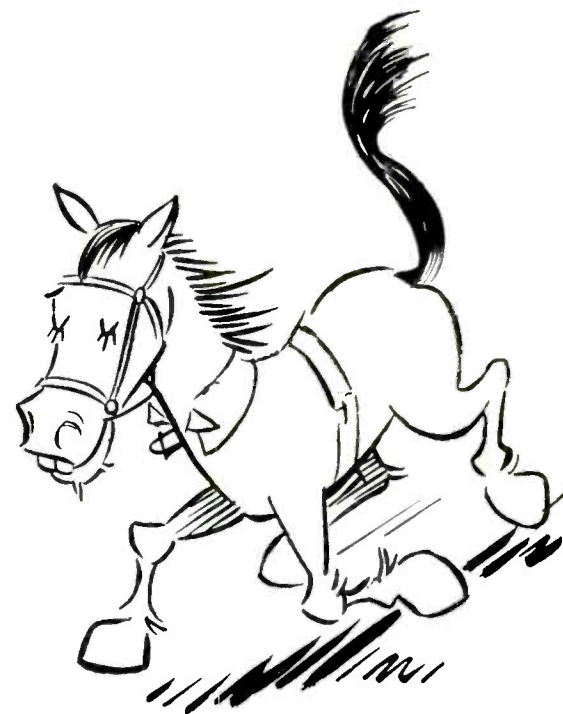
characteristic very similar to that achieved by more conventional non-automatic tone control circuits. It should be noted that, since at the top of the control, no boost was affected, and since at the tap, considerable boost was achieved, points in between will cause intermediate degrees of bass boost curvature to the overall response characteristic. The lower tap of R2 (Fig. 6) was not considered in this analysis, but its function is exactly the same as the

upper tap, but more so. That is, the bass boost curves become even steeper (more compensation) at lower and lower settings of the arm of R2.

## High Frequency Compensation

Not all loudness control circuits employ high frequency compensation as well as bass boost circuits. Examination of Fig. 1 shows clearly that the requirements for high frequency correction are far less than for the bass

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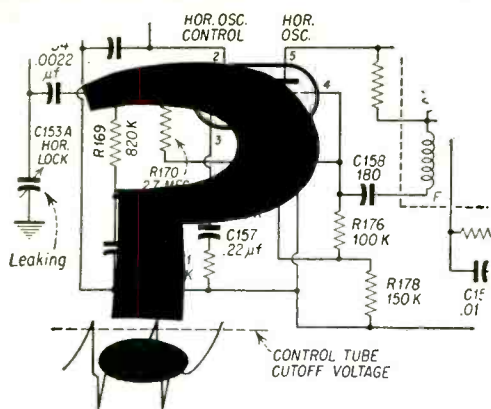
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## The Case of the Shifty Oscillator

part 2 of a series

Mike the TV expert glanced around as he entered a large suite on the 14th floor of a lavish midtown hotel. It was less than 15 minutes ago that he'd received a rush call from the manager that the tenant was furious about missing the championship fight, and was threatening to sue the hotel if his TV set were not fixed immediately.

As he turned on the set Mike noticed that the symptoms were rather common: tearing picture, normal audio. It didn't take Mike long to check the handy file of SERVICE DEALERS he always carried on service calls to find the trouble. There in bold print it read: Symptoms: tearing picture, normal audio. Check horizontal oscillator for shift in position.

Following instructions, our hero soon had the set working normally enough. That is, except for one strange thing. The oscillator refused to stay in position for more than a few minutes at a time. This was a real problem. An oscillator that refused to stay put. Mike was beginning to get angry.

Rolling up his sleeves, Mike tried everything to pin the stubborn oscillator in place, masking tape, adhesive tape, wire staples, even iron glue. It just made no difference. The oscillator eventually twisted back to a position about 45° from normal.

Last we heard, Mike was still trying to get the oscillator to stay in place. If any readers are interested in further information about this tricky problem, visiting hours are 1:00 to 4:00 P.M., Monday through Saturday. No children allowed.

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tones. Some manufacturers feel that the additional circuitry is not worthwhile for the few db of correction thought necessary at the treble end. The method of correction sometimes employed is shown in simplified form in Fig. 7C and 7D, again based on the schematic of Fig. 6. In the case of Fig. 7C, middle and low frequencies undergo no shunting effect from capacitor C1 and these frequencies are again passed on in a ratio of about 2/3 of total signal applied to R2 when the arm is at the upper tap. High frequencies, however, see a finite impedance across the 380K section of the potentiometer. The parallel impedance is therefore less than 380K and the portion of signal seen at the arm of R2 is therefore greater than 2/3. In other words, a small amount of treble boost is automatically accomplished as the arm of the loudness control is progressively lowered or rotated counterclockwise. Again, the action is variable depending upon the setting of the arm of R2.

### How to Set Up a Loudness Control

In setting up this type of loudness control to work properly, one point should be emphasized. Not all people have exactly the same hearing response. In fact, the Fletcher-Munson curves are really the average result of hearing tests given to hundreds of people who took part in the tests. Therefore, the instructions to follow are, at best, an approximation and slight variations are to be expected. Start by rotating the loudness control fully clockwise (to maximum). The other "level" or "volume" control should then be rotated gradually, causing the music to sound louder and louder until it is as loud as the live music it represents. (This is generally a lot louder than you might at first suspect. Think back to the last live concert you heard!) Reduce the sound to comfortable living room listening level by means of the loudness control, leaving the secondary level or volume control permanently set. Now, regardless of how high or low you set the loudness control, the correct amount of tonal compensation will take place automatically. If less compensation is desired, reduce the setting of the volume control and in-

crease the setting of the loudness control. For more compensation, increase the setting of the volume control and reduce the setting of the loudness control. Some readjustment may be necessary for different types of program material to get the most pleasing results.

### Installing a Loudness Control

Before analyzing the minor variations present in the other two types of loudness controls, this would be a good time to suggest the installation of a loudness control in older equipment not already containing this device. For that matter, even conventional radios and phonographs can be made to sound a lot better by the addition of this circuit. Fortunately, at least two ready-made circuits are available for just this purpose. One is manufactured by Centralab and includes, in addition to the correct potentiometer (500K or 1 Meg, with or without a power on-off switch), a printed circuit plate already wired to the potentiometer and incorporating the other components (C1, C2, C3, C4, R3 and R4 of Fig. 6) necessary in the circuit. Installation, then, becomes simply a matter of unsoldering the connections to the terminals of the present volume control in the system and resoldering the leads to the corresponding terminals on this replacement unit, trade named the "Compentrol." The shaft length is oversized and should be trimmed to the length of the previous volume control. Full instructions covering every

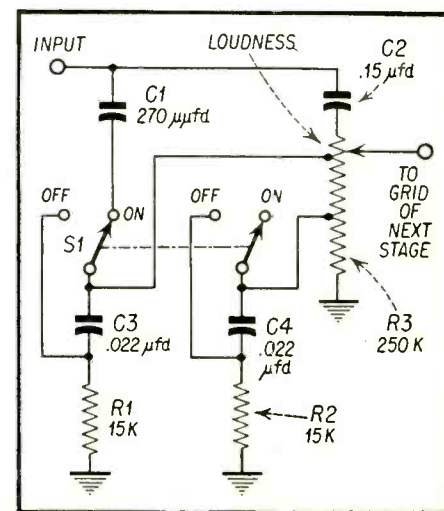


Fig. 8—Partial schematic of G.E. Pre-amp and Control Unit A1-200.

possible application are included with this replacement control. The results of such a conversion are immediately apparent by a simple listening test and there's nothing in the world that pleases an audio customer more than something which enables him to "hear the difference".

### Loudness Control Variations

Another method of engineering a loudness control into high-fidelity equipment is illustrated in the partial schematic of Fig. 8. The circuit is part of General Electric Preamplifier and Control Unit Model A1-200. Here too, a two-tap potentiometer,  $R3$ , serves as loudness control. In this design, however, switch  $S-1$  is included for the anti-loudness-control segment of the population. It can be seen that if  $S-1$  is thrown to the *off* position, both  $C3$  and  $C4$  are shorted out and no compensation will occur regardless of the setting of the arm of  $R3$ . The control then becomes a regular volume control. With  $S-1$  in the *on* position, we have a circuit very similar to that described in connection with Fig. 6, with  $C3$ ,  $R1$ ,  $C4$  and  $R2$  accomplishing the low frequency compensation and  $C1$  taking care of the small amount of treble emphasis required, as explained above.

### Contour Control

Some manufacturers feel that the use of separate volume and loudness controls may be confusing to the customer and is apt to cause more harm

than good because of improper set-up. For this reason, they have made only one control continuously variable, while the other controlling element uses a multi-position switch. Typical of these circuits is that used by Harman-Kardon in the Model C-100 Amplifier and Preamplifier. A partial schematic is shown in Fig. 9. The switch,  $S-1$ , is shown in the position of maximum compensation and under these circumstances the circuit is exactly identical to those previously discussed. As the switch  $S-1$  is successively moved to the lower positions, smaller values of resistance ( $R4$  through  $R7$  and  $R8$  through  $R11$ ) are shunted across  $C1$  and  $C2$  preventing them from becoming infinite impedance as shown in Fig. 7B and thus limiting the amount of automatic bass compensation possible. In actual use, this type of control is somewhat simpler to set up. The user simply adjusts the potentiometer  $R1$  to suit his volume requirements and then selects the "contour" of compensation best suited to his ear by means of  $S-1$ . Of course, the circuit loses some of its automatic features because of the absence of an additional level set control elsewhere in the system, but since this whole matter of loudness compensation is entirely subjective, the user has as much flexibility with this circuit as with those previously discussed.

In the next installment of this series we shall analyze the use of cathode follower circuits as applied to high fidelity, and show why these circuits have had widespread use in hi-fi components. ■ ■

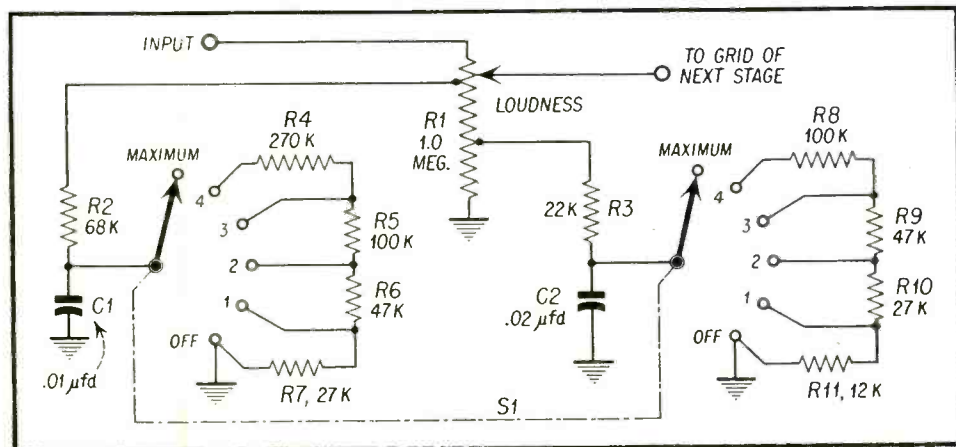
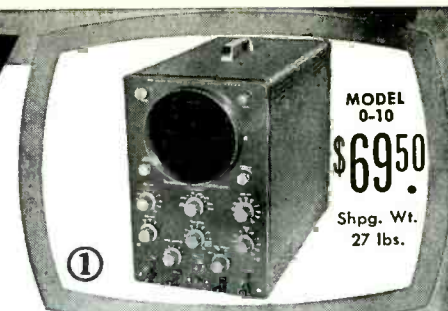


Fig. 9—Partial schematic of Harman-Kardon Model C-100 showing loud-control using fixed taps instead of continuous variation.

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## TRADE LITERATURE

[from page 23]

guide is available from electronic parts distributors throughout the United States.

A highly detailed, comprehensive guide showing the electrical and mechanical interchangeability of capacitors has been released by the *Pyramid Electric Company*. The two-color booklet contains 24 pages of valuable information on the interchangeability of single, dual, triple and quadruple capacitor units. For a copy of *TM-1-1*, contact a *Pyramid distributor* or representative or write directly to the *Pyramid Electric Company, 1445 Hudson Boulevard, North Bergen, New Jersey*.

An illustrated *catalog sheet* describing a two-range DC power supply for servicing transistor auto radios is available from the *Electro Products Laboratories*. The described model D612T power supply offering power ranges of 8 and 16 volts is especially designed to operate, test and service all auto radios, including those using transistors from AC lines. The *catalog sheet* spells out the unique features and uses of the D612T and lists complete specifications. Write *Electro Products Laboratories, 4500 Ravenswood Ave., Chicago 40, Ill.*, for a copy of the sheet.

The new statistical "*Fact Book*" on the electronics industry prepared by the RETMA Statistical Department contains information on radio and television receivers, including production and sales figures; picture and receiving tube statistics; and special chapters devoted to military and industrial electronics, tubes and parts, and export data on the industry. Copies of the "*Fact Book*" are available to non-RETMA members and the general public for 50 cents a copy from *RETMA headquarters, 777 14th Street, N. W., Washington 5, D. C.*

Publication of an illustrated reference book on the set-up and servicing of the new RCA Victor 700 series 1946 color television receivers was announced by *RCA Service Company, Inc.*

The new book, "*The 700 Series Color Television Receivers*," is illustrated with 148 photographs and diagrams. It is designed principally for on-the-job reference use by dealer and independent servicemen. Completely indexed for quick reference, the book contains a circuit-by-circuit description of the two types of chassis in the 700 series receivers, an illustrated description of set-up procedure and a section stressing step-by-step practical methods to enable the service technician quickly to analyze, localize and easily correct any malfunction that may occur. Copies may be obtained from *Commercial Service, RCA Service Company, Inc., Camden 8, N. J.*

Centralab, a division of Globe Union Inc., announces the availability of their *Pocket Control Guide No. 4*. This handy control cross reference guide is published semi-annually to make the latest and most up-to-date replacement control information available to everyone. This guide will fit neatly into the pocket or repair kit. Priced at 20 cents it will be available at all *Centralab distributors* or by writing direct to *Centralab, 900 E. Keefe Avenue, Milwaukee 1, Wisconsin*.

The release of a new fully illustrated 14 page *General Microphone Catalog* has been announced by The Astatic Corporation of Conneaut, Ohio now being mailed to all Astatic distributors and representatives. The new catalog, numbered *S-442* and printed in four colors, includes the complete line of Astatic professional, general purpose, and amateur microphones and microphone accessories. An entire section is devoted to the brilliant new "Futura" series of dynamic microphones, their specifications, features, performance, accessories plus architect's and engineer's specifications. The new catalog may be obtained from Astatic representatives and distributors, or by writing direct to *The Astatic Corporation, Conneaut, Ohio*.

## CADILLAC AUTO RADIO

[from page 9]

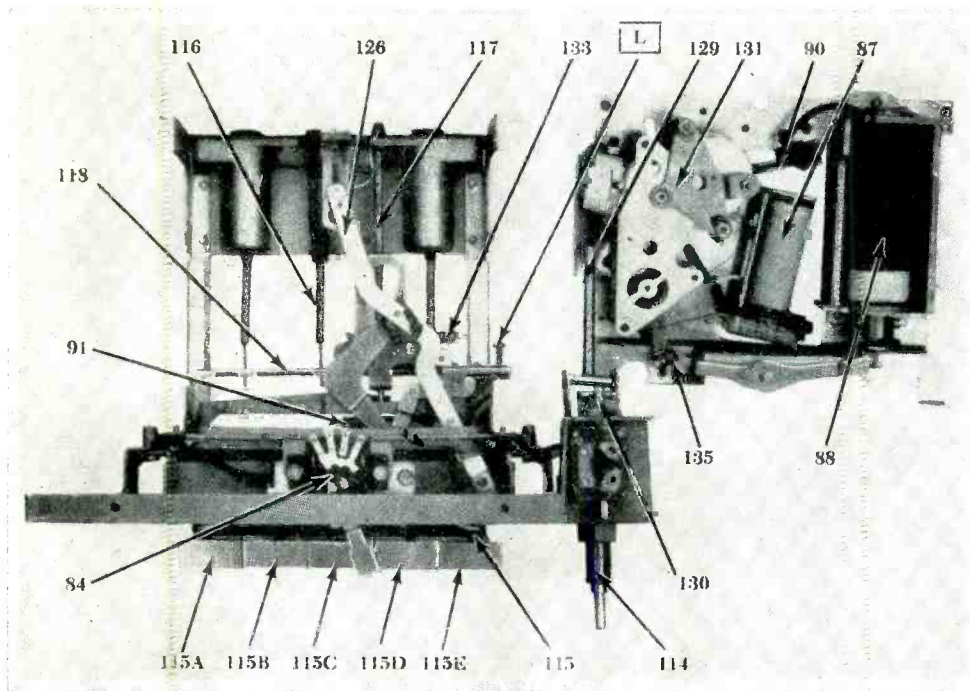


Fig. 3—Tuner open.

tab by depressing the corresponding station selector button. If the correct station is not tuned in, re-adjust the selector tab.

### Service Hints

The commonest complaint with any electronic tuning is that the tuner rolls without stopping on stations. Before removal for service, checks should be made in the car.

First and always, check the setting of the sensitivity switch lever, Fig. 3, item 84. Many owners do not understand the use of this switch and may need education as to its use. When left in the minimum sensitivity position the tuner will almost always roll without stopping. For checking purposes, it should be left full on to the right.

If the tuner still rolls without stopping, check the antenna and the antenna trimmer adjustment. These are available at the bottom right of the set. Antennas should be checked for intermittent operation by whipping the rod at various lengths and by moving the lead-in cable around, especially at the junction with the antenna. The trimmer must be adjusted at all times with a minimum of aerial extended and on a

weak station around 1000 kc.

If the antenna circuit is not the answer, remove the bottom cover and check the tubes by substitution; the 12AU7 first. When the complaint is of the tuner not rolling, always check the 12AU7 since it is the trigger tube which should set the train reaction that causes the tuner to roll.

As in all previous models of signal-seeking radios, the greatest sources of trouble have been in the "contact" devices, namely the switches and relays. Most common is the case when the pointer moves to 1600 kc and stops. The reversing switch contacts, Fig. 3, item 90, may be burnished and adjusted for proper throwing action. In the majority of cases, however, the switch must be replaced.

Where a microphonic tuner seems the case, try insulating the selector switch contacts, Fig. 4, item 90, with a piece of paper. If this solves the microphonics, replace the switch assembly. Sometimes increasing the spacing of the contact arms may be the solution. When there is not enough spring tension, a sharp bounce will momentarily close contacts, grounding the audio grid.

In cases where the tuner will roll

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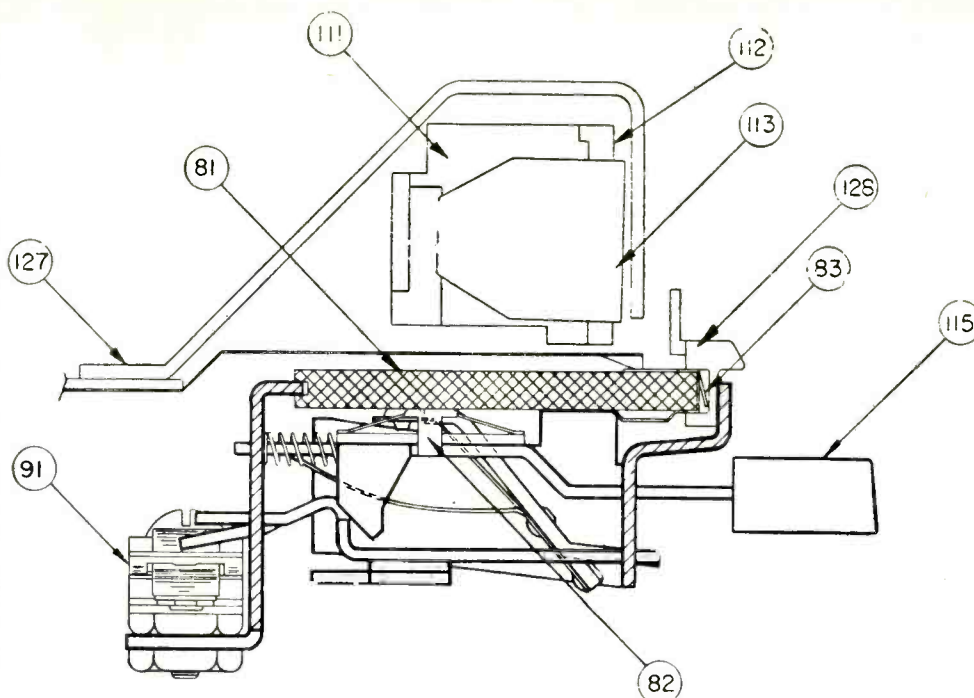


Fig. 4—Tuner button mechanism—cross section.

without touching the selector bar or will roll as soon as the set is turned on, check to see whether the chassis shows signs of water. Many cases in the past have been due to leaky insulation in the selector switch assembly, Fig. 4, item 90. This allows a high resistance leakage to ground, causing the plate relay to actuate, releasing the tuner. This can be checked quickly by removing the plate resistor lead from the switch. If the tuner stops, replace the switch assembly.

When mechanical operation of a tuner is faulty, the gear train assembly, Fig. 3, item 131, must be removed. Typical complaints are: hesitation, crawling, jamming, machine gunning and slippage of manual tuning. Removal of the gear assembly is fairly easy when done with proper care. Proceed as follows:

1. Remove the screws holding the coil assembly to the frame.
2. Remove the nut holding the slide bar, Fig. 3, item 117, to the coil frame.
3. Slide the coil assembly off the cores and lay aside.
4. Remove the clips and springs connecting the core and slide assembly, Fig. 3, item 118, and remove the assembly.
5. After loosening the manual shaft setscrew, remove the clips, Fig. 3, item 135, and the three nuts holding the gear train assembly.

To check the train, hold the large part with the manual worm gear in one hand and close the planetary gear section. The planetary gear section should roll out smoothly to the other stop when released. Always observe the action of the nylon paddle wheel; there should be no hesitation.

When a "machine gun" action is obtained, the tuner hits 1600 kc, bounces back but not all the way and keeps repeating. The planetary gear assembly may be at fault. This can be changed very easily by loosening its mounting plate nuts, Fig. 3, item 131, and sliding the shaft out of its bearing holes.

Where the planetary gear is suspected, check by trying to turn one section against the other. There should be a very tight clutch action between the halves. If the planetary gear assembly checks, look carefully at the gears in the train. Machine gunning can also occur when a dual gear comes loose; where the two gears on the same shaft turn independently instead of being fast to each other. In this case, the whole gear train assembly must be replaced.

Another case of faulty planetary gears is where the manual tuning slips or does not operate at all. Slippage in the gear assembly will cause many variations of these problems. In any case, do not attempt to repair this assembly; replace it.

There have been many instances

where corrosion of the plate relay contacts, Fig. 3, item 87, will cause the tuner to roll and not stop on stations. Careful handling and burnishing of the contacts can solve this situation or where very bad contact action is encountered, replace the relay. Contacts should be spaced very closely to make very quickly.

Similar faulty action of the push buttons, Fig. 4, is attributable to corroded contacts. Always put a film of lubriplate on the contact fingers, Fig. 4, item 83, and on the pointer contact arm. In severe cases of improper operation of push buttons, it is necessary to check the slide contacts, Fig. 4, item 82. Move the gear train assembly to the 550 kc end to clear the dial pointer as much as possible from the dial scale as the scale assembly is removed. These pointers snap very easily. Place the set with the tuner on top. Remove the two end screws which hold the printed contact board, Fig. 5. Note the position of each red button indicator, Fig. 4, item 128, since they are all different and must be replaced in the same order. Carefully slide the board forward away from the tuner and let it hang to the side by its contact wires. Now the slide contacts, Fig. 4, item 82, and underpanel printed wiring, Fig. 5, can be cleaned and lubriplated. It is necessary to be cautious so that the slide contacts remain in place with their insulation and push button arms. When replacing the contact board, push it evenly back into the notch without disturbing the contact slides. Just before seating the front, the red indicators, Fig. 4, item 128, must be replaced on its edge. Each indicator must fit flush on its own contact finger or the board will not fit flush. It is always advisable when lubriplating, to include the sensitivity switch contacts.

When these sets get older, the return from 1600 kc to 550 kc may get sluggish or too weak. The weakened solenoid action can be assisted by stretching the

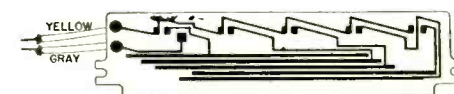


Fig. 5—Tab rail board showing underpanel printed wiring. Slide contacts in this unit can be cleaned and lubricated. However, care must be exercised in this operation.



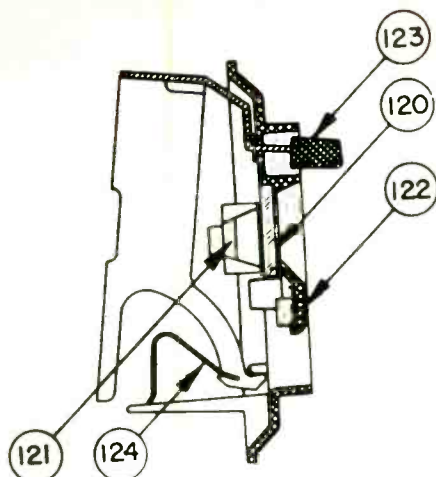


Fig. 6—Escutcheon—cross section.

tuner power spring, Fig. 3, item 133, about 2 or 3 turns spacing. This may slow the tuner rolling action but not to any noticeable extent.

There have been cases of selector bar binding, Fig. 6, item 123. Since the escutcheon is easily removable, correct by bending the arms slightly.

Dial glasses, Fig. 6, item 120, are held in place by end clips, Fig. 6, item 121, that are notched into the escutcheon walls.

## TRANSISTOR RECEIVERS

[from page 3]

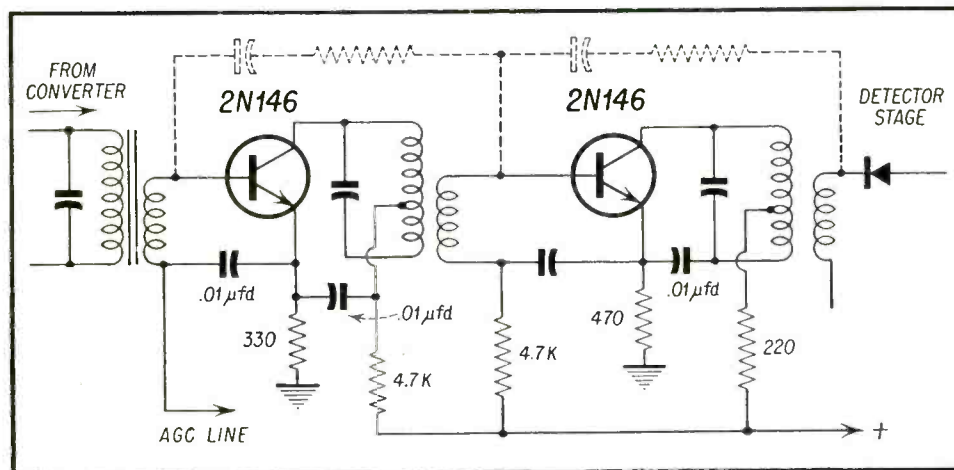


Fig. 4—Partial schematic—I.F. amplifier of Emerson Model 842.

though the familiar diode detector provides the simplest and cheapest method of detection, the class B power detector is also popular.

The Class B is capable of good detection and about 10 db of audio amplification. This same detector may be used with vacuum tubes but the transistor offers the advantages of less distortion due to the very straight line from Y to Z, Fig. 5. In fact, this detector as used with the transistor is more linear than the diode detector.

Figure 6 shows the Class B detector as used in the CBS-Columbia TR250 receiver. The 3300 and 330 ohm resistors are used to fix the bias point of the transistor at point Y on the curve (Fig.

5) for Class B operation as described. AVC voltage is obtained from the collector and filtered by the 10,000 ohm resistor and 8 μf capacitor. The .05 μf capacitor filters out unwanted rf.

The circuit for the diode detector of the Regency Model TR1 is shown in Fig. 7, as representative of most. It is quite common to see large values of capacitance utilized due to the low impedances involved.

### Audio Output Stage

Audio output stages fall into two classifications; single ended outputs delivering about 60 milliwatts and push-pull Class B output stages giving as much as ¼ watt (250 mw). It is com-

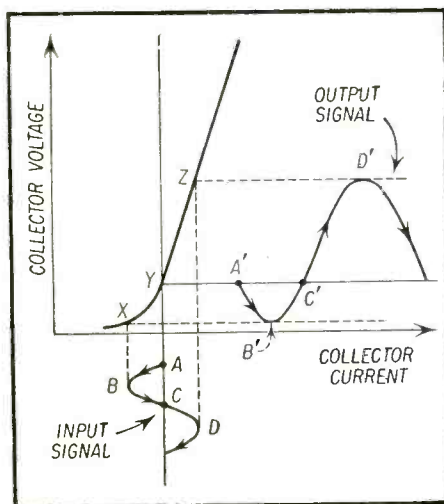


Fig. 5—Class B power detector operation. Shown above are the transfer curves.

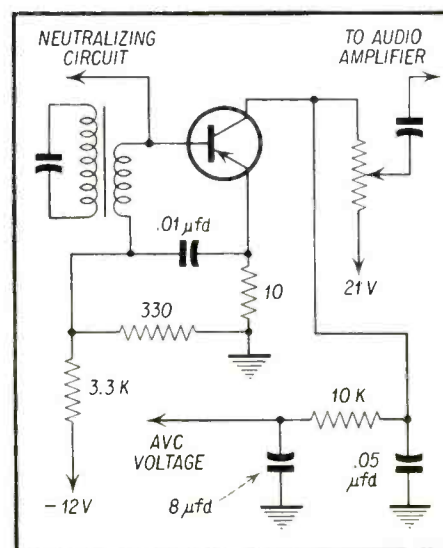


Fig. 6—Class B detector used in CBS Columbia Model 7R 250.

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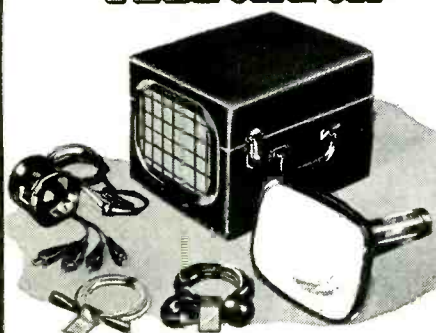
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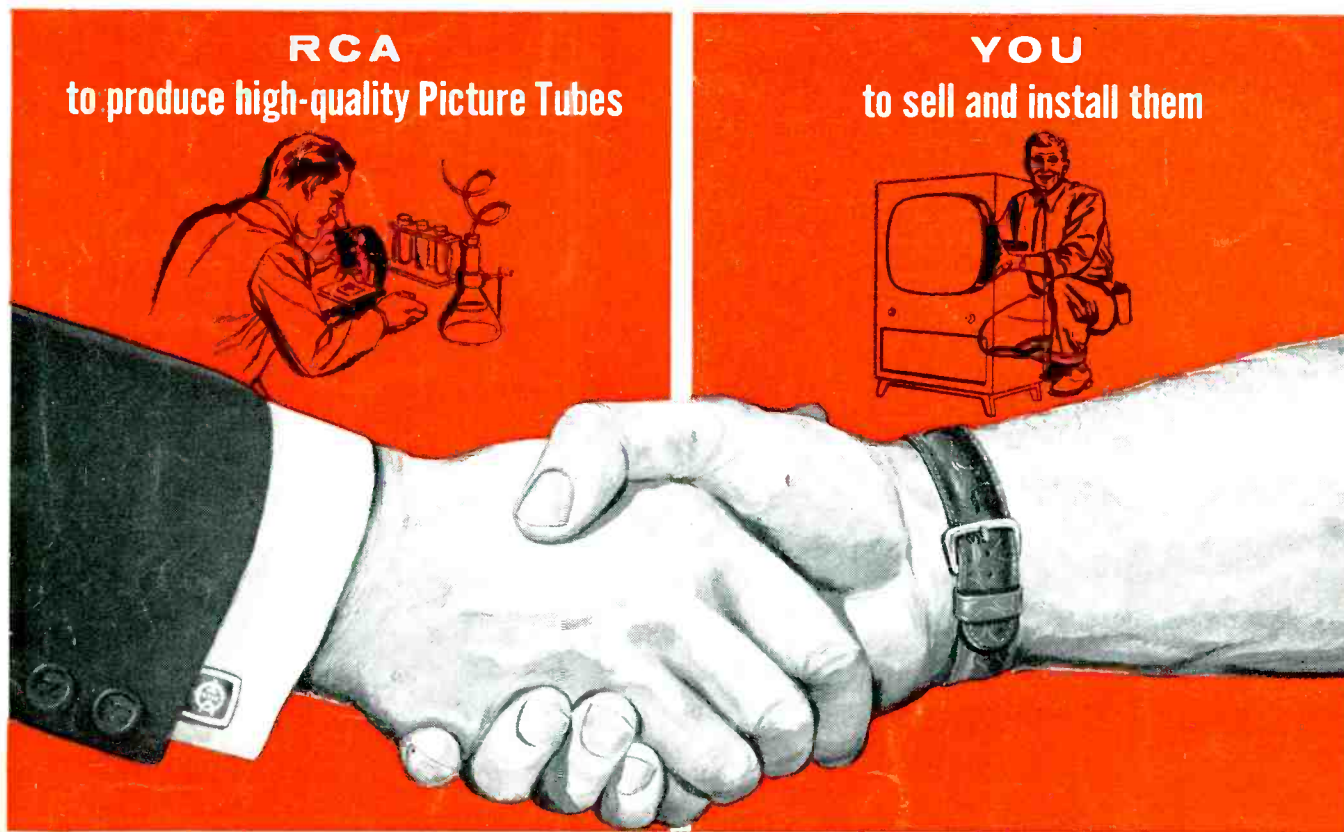
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