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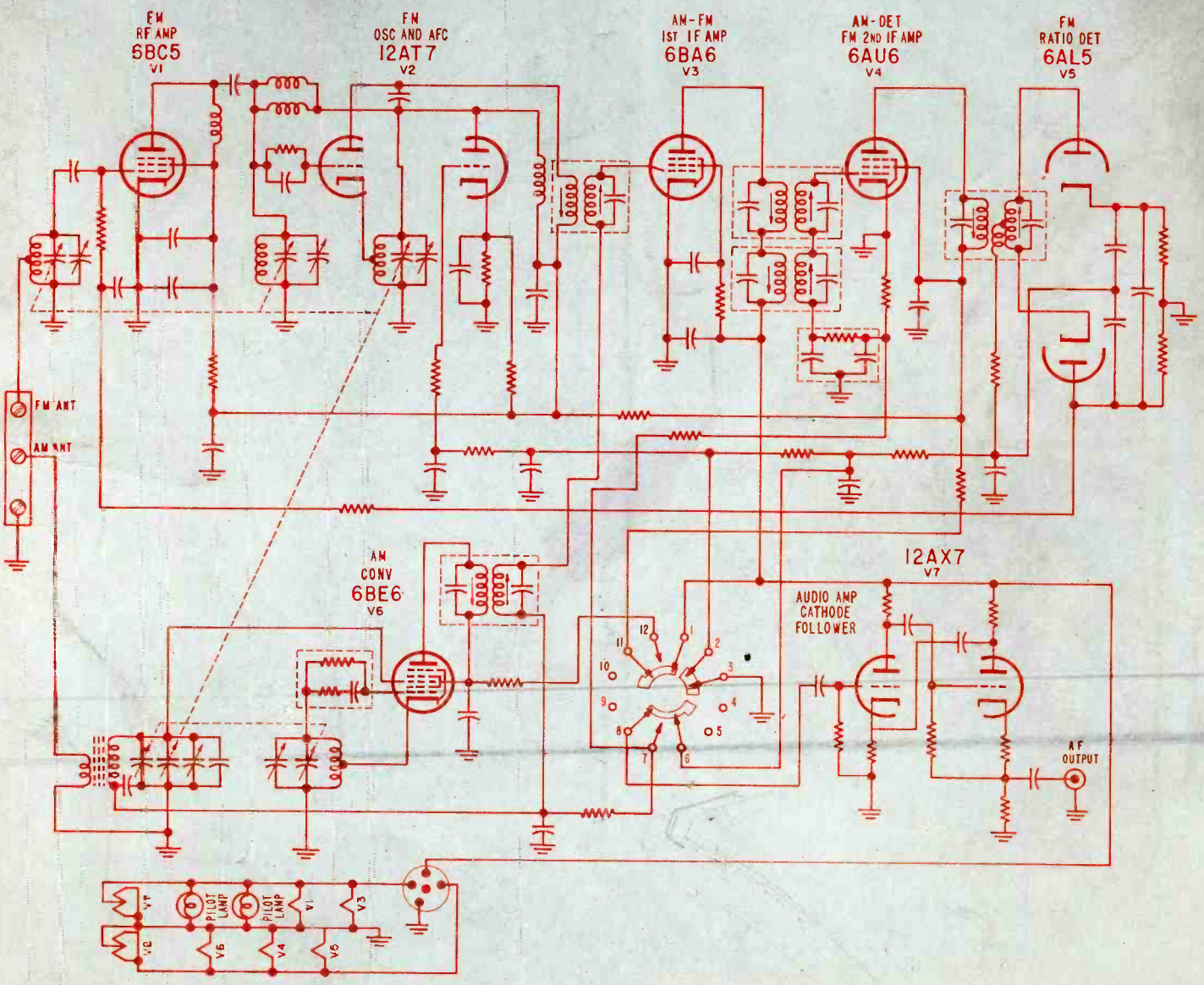
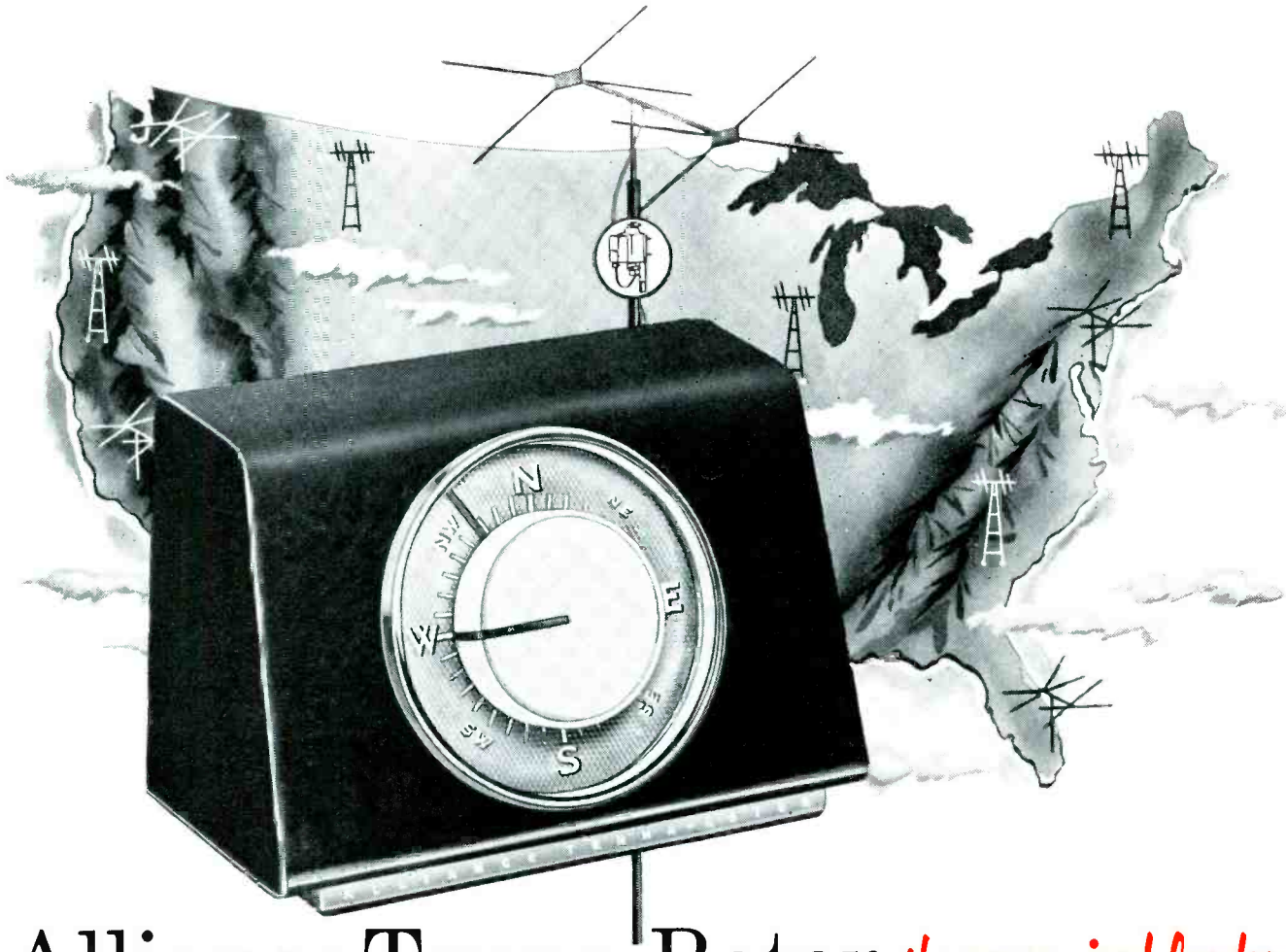
SERVICE

THE TECHNICAL JOURNAL OF THE TELEVISION-RADIO TRADE



AM-FM tuner designed for remote-control 3-speaker radio-phono consolette.

See circuit analysis, this issue



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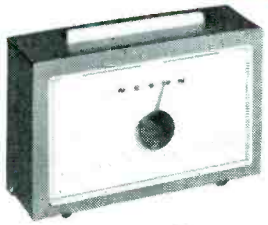

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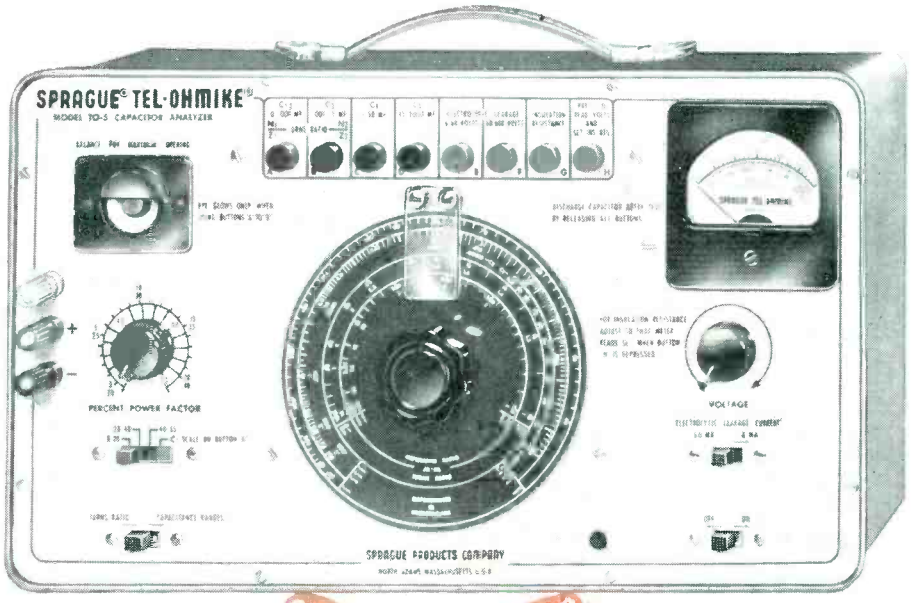

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Vol. 27 No. 1 JANUARY, 1958

27th YEAR OF CONTINUOUS PUBLICATION

SERVICE

THE TECHNICAL JOURNAL OF THE TELEVISION-RADIO TRADE
Including RADIO MERCHANDISING and TELEVISION MERCHANDISING
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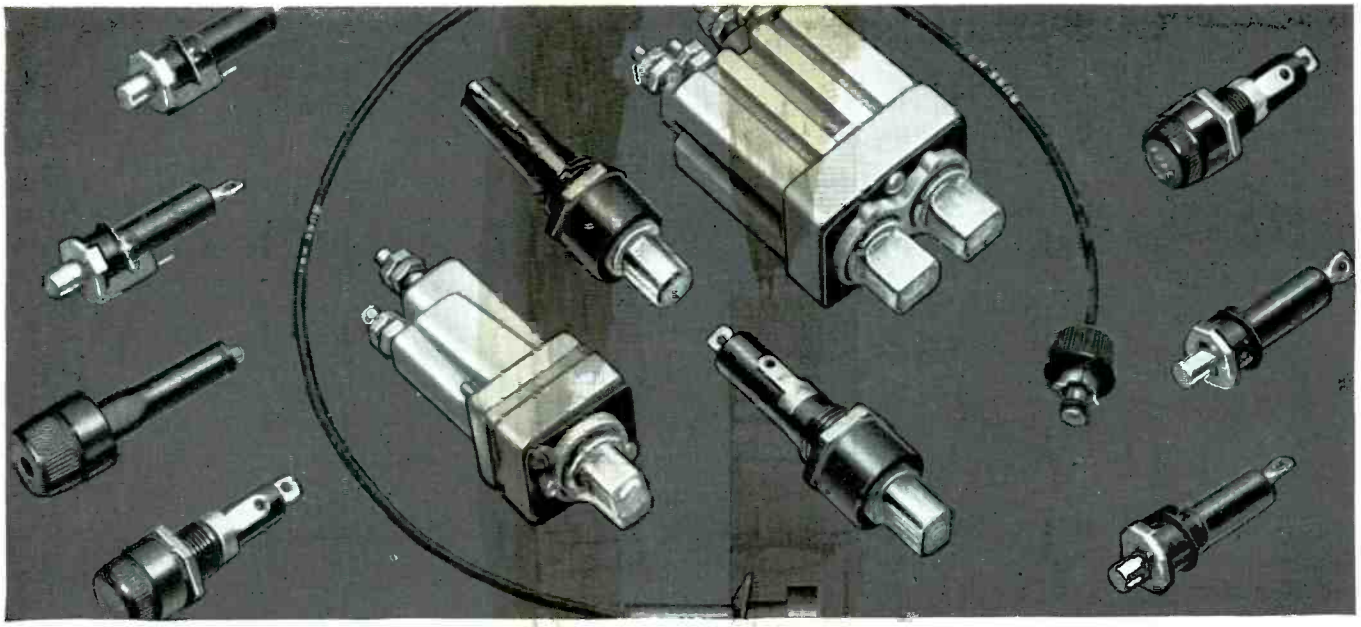

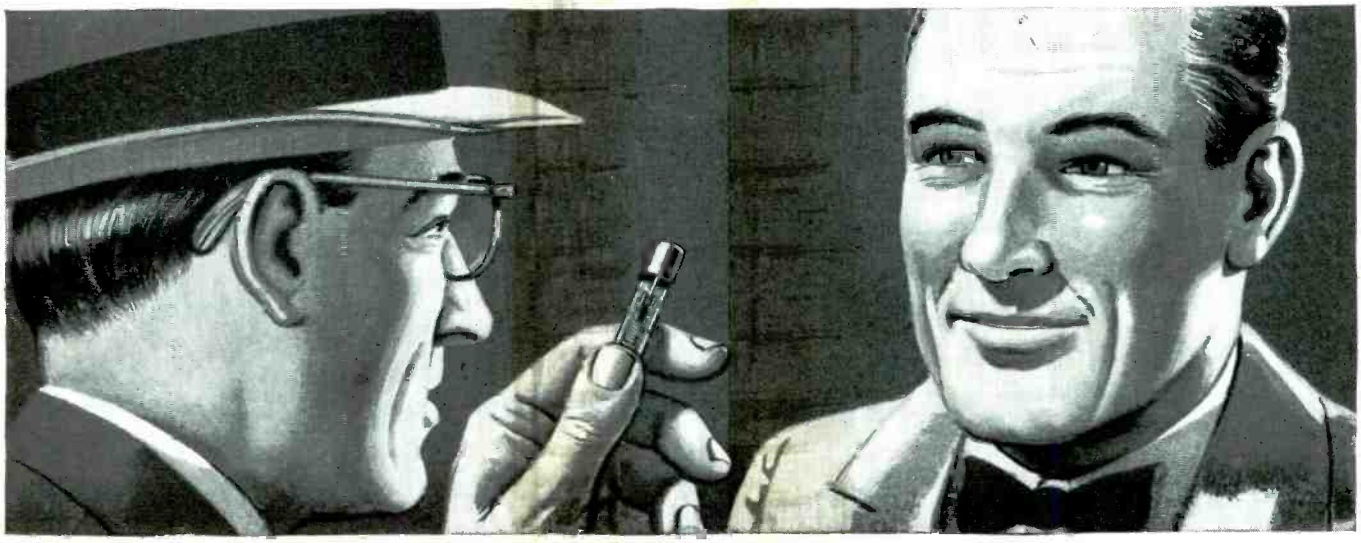

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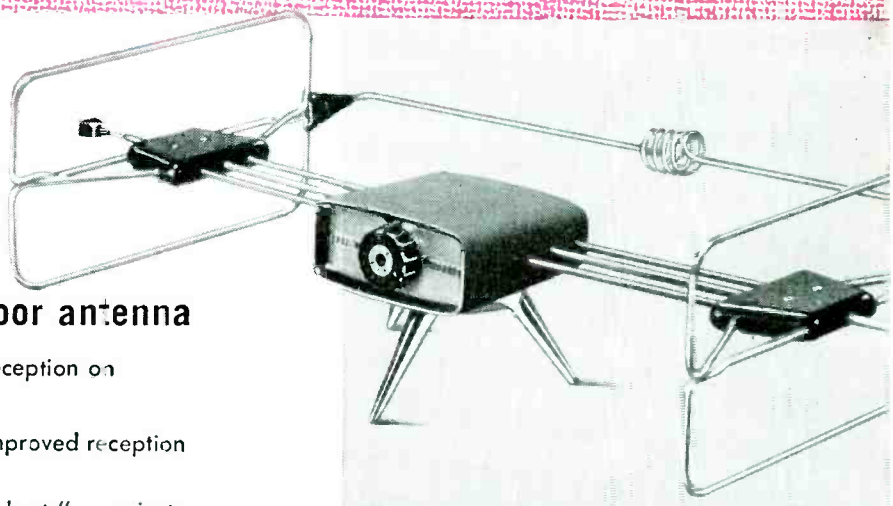

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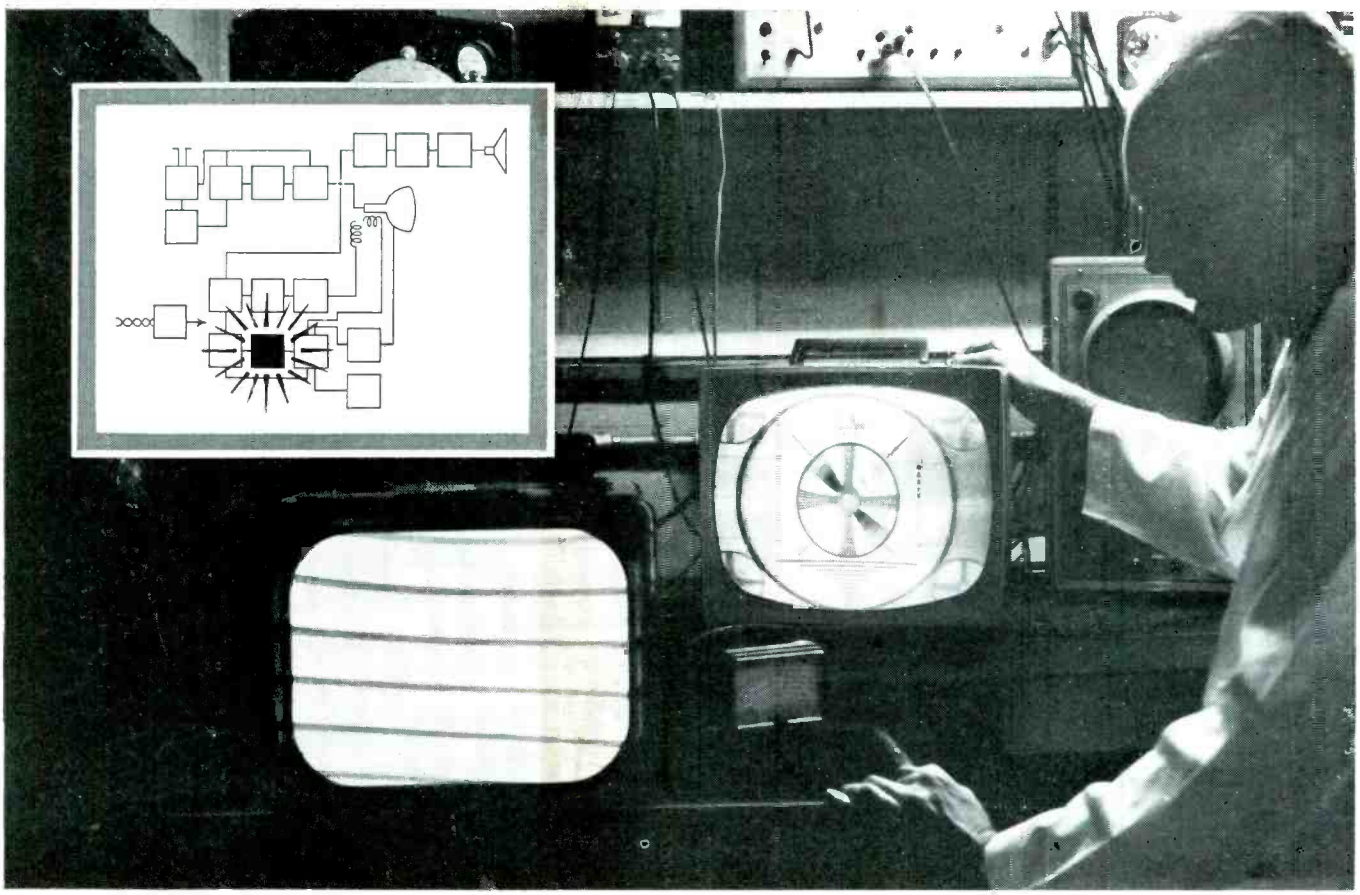

Here General Electric Application Engineer C. L. Taylor shows what can happen when an old-style horizontal-oscillator tube is used in two different TV sets. Image at left is completely out of sync. To avoid this hazard, the cut-off and other electrical characteristics of General Electric tubes are held within limits that bring satisfactory operation in all television circuits.

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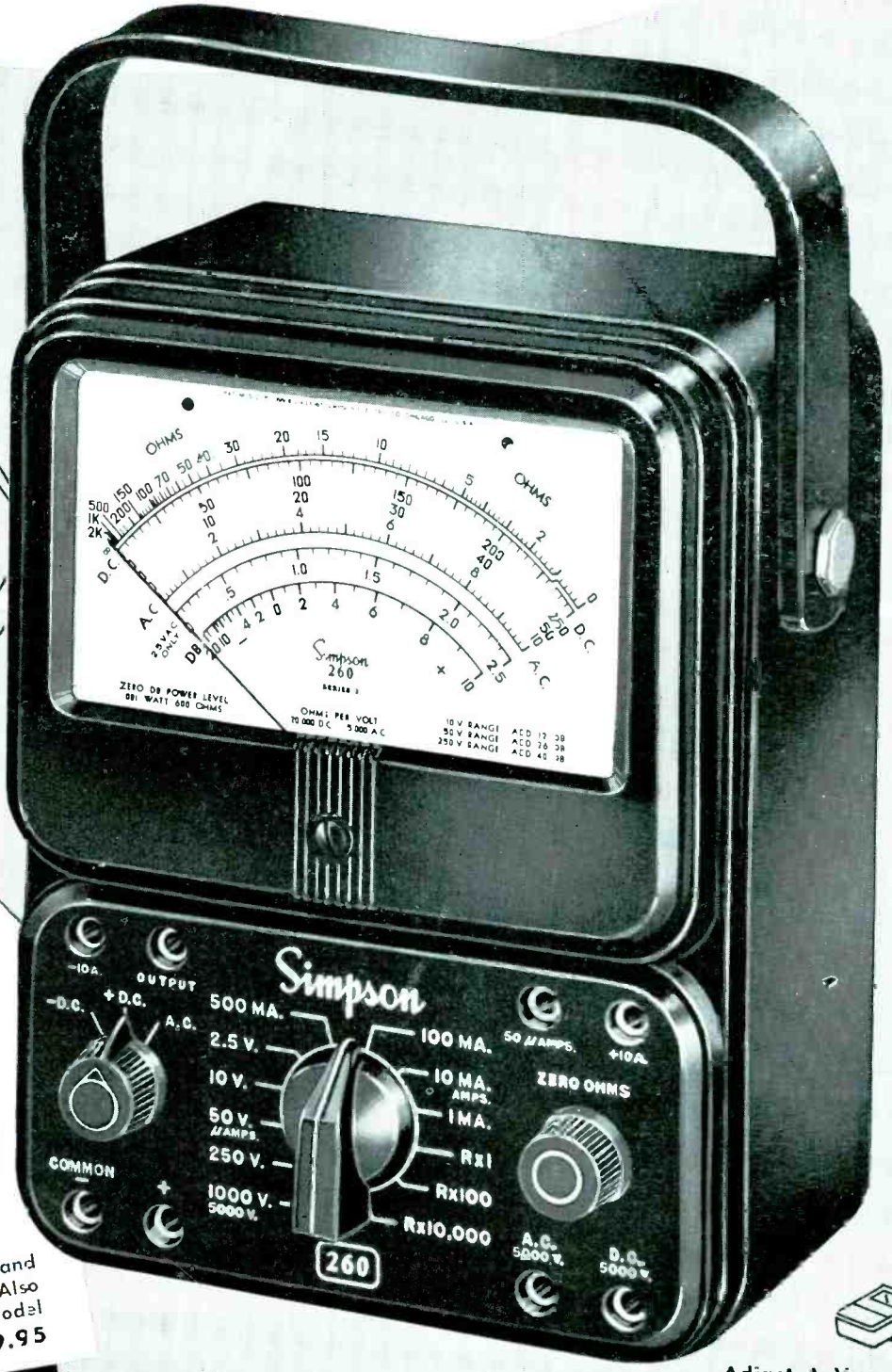

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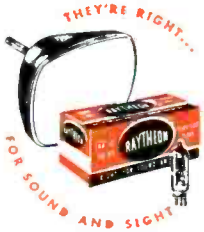

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SERVICE

THE TECHNICAL JOURNAL OF THE TELEVISION-RADIO TRADE

New Horizons in Service

THE GROWING NUMBER of technical improvements now being included in an ever-increasing variety of products for audio, radio, TV and electronic use has created a need for a new family of techniques in installation, maintenance and repair.

The advent of the transistor and its complement of semiconductors has completely changed circuit design and service concepts, not only in radio, but in TV. No longer can we use the garden-variety of test and service practices developed for tube equipment. The nature of the transistor is such that we cannot employ standard instruments, like the ohmmeter, for troubleshooting when the transistor is in the circuit; the terminal voltage across the ohmmeter leads can cause conduction within the transistors and develop erroneous readings. Also, excessive ohmeter terminal voltages across a transistor can cause permanent damage to the transistor. To resolve the problem, the transistor must be removed, or if it cannot be taken out because of in-circuit soldering, special in-circuit testers must be used, such as a low-voltage-ma type of power supply.

TV chassis now feature use of semiconductors—dual selenium rectifiers as phase detectors and silicon power rectifiers—and both require a new approach in testing. Silicon rectifiers which short cause the B+ current-limiting fuse resistor to open. In the past, open fuse resistors have been shorted to permit spot checking of trouble. Now, however, if the fuse resistor is shorted, the silicon rectifier will short too, causing direct *ac* line voltage to be applied across the B+ filter which can become very hot and possibly explode.

THE STARTLING RECOVERY of the phono and the evolution of packaged and assembled hi-fi systems has also altered the servicing scene. Today, one must know how to handle multiple-speaker phasing problems, crossover network conditions, and rumble and scratch filters. We must also be familiar with an assortment of needles, pickups and tone arms, enclosures, amplifiers and changers available as replacements.

THE RETURN OF FM—because of the audio boom—has also introduced many new field problems. WHEREAS IN THE PAST FM interest was purely local, it has now become a fringe-area item and the host of pecularities common to *vhf* reception have appeared. In veryhigh TV these problems, which include adjacent and co-channel interference, airplane flutter, fading and snow, can be detected on the screen. The FM listener has all these, but snow, for instance, is called noise. Although the same remedies which help the TV viewer can help the FM listener, in TV the remedies are more efficient, since in FM the listener cannot distinguish a ghost or phase shift caused by multipath reception, except in extreme cases. Antenna systems, heretofore rarely considered for FM, are now musts for those in weak-signal areas; such setups involve not only high-gain yagi-type antennas, but good leadins and particularly, mast-mounted preamplifiers.

COLOR-TV has also become an active partner in industry because of many improvements in both circuitry and components. Today's receiver is not only capable of delivering an excellent color picture, but black and white reproduction comparable to that obtainable from b-w sets. But the maintenance of such performance rests upon the Service Man.

There are three factors which contribute to solid b-w detail on color chassis: The uniformity or purity of the red, green and blue fields, the registration or convergence of the red, green and blue rasters, and the uniformity of the color temperature or tone of the picture from dark gray to white. The first factor—purity—is determined by the different angles at which the three beams approach the shadow mask of the picture tube. The second factor—convergence—is determined by the angles at which the three beams approach each other. And the third factor—color temperature uniformity—is the result of the proper adjustments of the screen grid and bias voltages of the electron guns in the tube, and the video signal applied.

THE SWIFTLY-CHANGING technological scene has fashioned new patterns in circuitry, components and testing—new horizons that can spell more business for the resourceful Service Man.

Progress Report on Improved B-W Picture

An Analysis of New Color-TV Chassis Developments Which Afford Black and

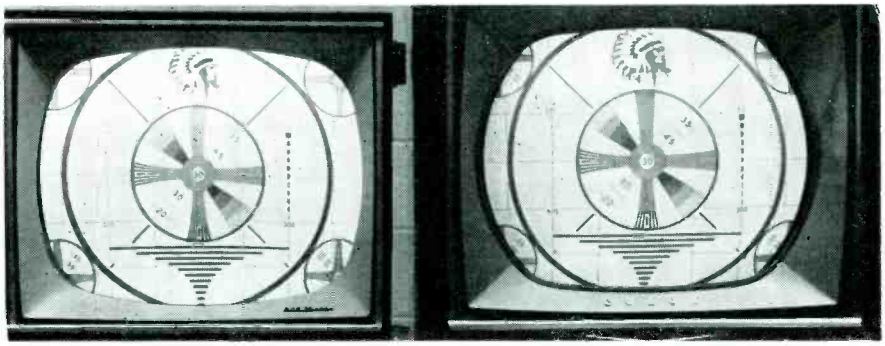


FIG. 1: UNRETOUCHED PHOTOS of a TV pattern on black and white (left) and color-TV (right) models.

GOOD REPRODUCTION of black and white-TV broadcasts on color-TV receivers depends to a large extent on three factors: The uniformity or purity of the red, green and blue fields, the registration or convergence of the red, green and blue rasters, and the uniformity of the color temperature or tone of the picture from dark gray to white. A modern color-TV receiver, which is in proper operating condition and which has been carefully adjusted for the three factors listed, will give excellent reproduction of black and white pictures.

In Fig. 1 appear unretouched photos of a TV signal pattern on a black and white receiver[1] and color model[2]; *off-the-air* as would be received in the home. The only adjustments made on these sets were on the tuning controls, identical to those a customer would normally make. Unfortunately, the photos do not show minute detail, but in closeup study of the faces of the picture tubes observers have been unable to indicate which is the color or the black and white receiver. With the receivers covered to show only a 12" area of the picture tube, and the safety glass removed, even members of our staff were in disagreement as to the identity of the models. In this instance, no adjustments were made on the receivers and it is questionable whether extensive readjustments of any kind would have resulted in observable improvement one way or the other.

It is true, however, that we have seen receivers that did not always demonstrate their full capability as shown here—occasioned either by changes in shipping, mishandling, improper tuning, local interferences, or other circumstances.

Technical Aspects of Picture Quality

The first factor in picture quality—purity—is determined by the different angles at which the three beams approach the shadow mask of the picture tube. The beams pass through their center of deflection at the yoke and travel in a line from there to the phosphor screen. The shadow mask is aligned so that each beam can strike only its corresponding phosphor dot. The purity magnet makes possible an adjustment of the position of the beams in the neck of the picture tube so that the beams pass through their respective centers.

The yoke is moved back and forth on the neck of the picture tube to place the center of deflection at the correct distance from the shadow mask. This adjustment makes each electron beam strike its corresponding phosphor dot array at any section of the screen.

Correction is built into the picture tube for the vertical component of

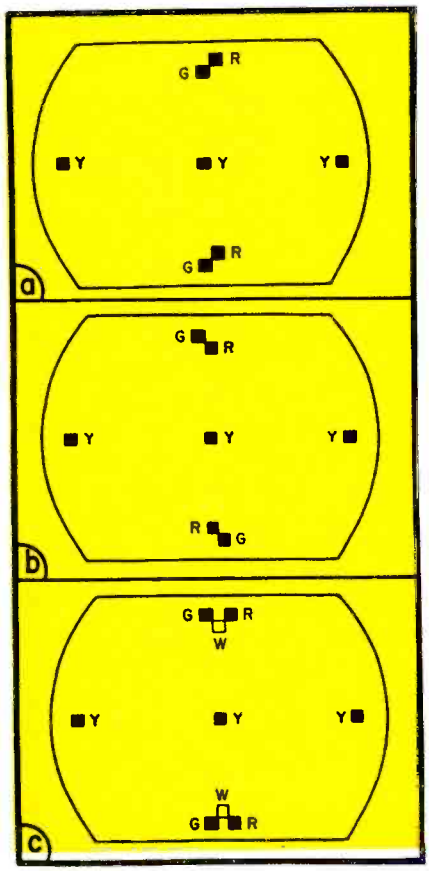


FIG. 2: COLOR-TV convergence conditions where (a) red vertical amp is off, (b) green vertical tilt is off, and (c) green and red vertical tilt is off; red and green cross.

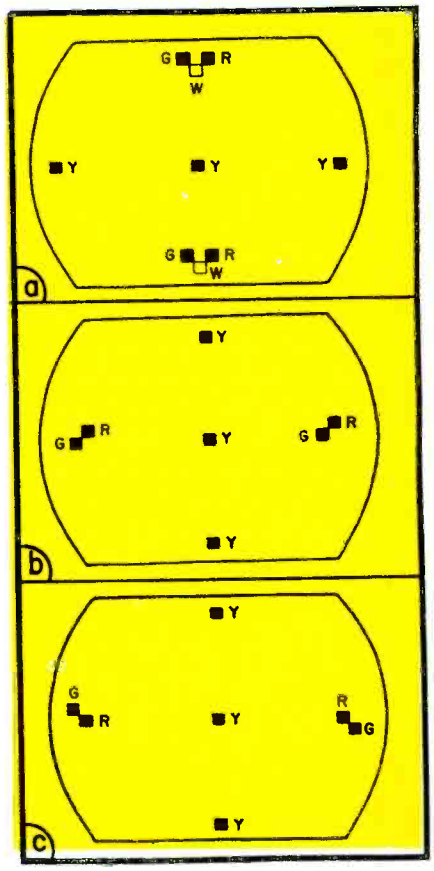


FIG. 3: CONVERGENCE RESULTS when (a) the green and red vertical amplifier is off (red and green are not crossed), (b) red horizontal amp is off and (c) green horizontal tilt is off.

[1]RCA 21RT8202. [2]RCA 21CD8725.

Performance Available on Color-TV Sets

White Detail Comparable to That Available from B-W Models

by E. R. KLINGEMAN, Engineering Staff, RCA Service Company

the earth's magnetic field, and this requires that the picture tube be mounted with the blue gun and base pin-12 uppermost. External magnetic fields and picture-tube manufacturing tolerances may produce localized areas of impurity near the edge of the tube. To minimize the effect of magnetized metal fields and tube-manufacturing tolerances, the equalizing magnets (which may be located around the rim, or around the bell of the tube) are adjusted.

For proper purity and convergence, a white dot or cross-hatch signal must be applied to the receiver and the pattern converged in the center of the screen. After some practice, it is possible to converge the center area of the screen using *off-the-air* program material.

The second factor, convergence, is determined by the angles at which the three beams approach each other. These angles are adjusted by the convergence pole-piece assembly to make the three beams come together at the shadow mask and pass through the correct hole.

The electron guns are assembled to provide approximate center screen convergence. Pole pieces are attached to each gun and external electromagnets or permanent magnets are attached to the neck of the picture tube, positioned so as to provide the proper magnetic coupling to the internal pole pieces. Some receiver designs provide for an adjustable direct current passing through the electromagnets. Others use permanent magnets to provide a magnetic field for each gun, which makes the beams meet at the shadow mask in the center area of the screen.

Because the distance the beams travel to reach the shadow mask is greater at the edge of the screen than at the center, it is necessary to change the value of the fields which produce center screen convergence, as the beams scan from the center to the edges of the picture tube screen. To do this, currents with parabolic waveforms—one at horizontal and one at vertical scanning frequencies—are passed through the convergence electromagnets.

These currents are individually adjusted for each electron gun, both in amplitude and shape, and are polarized so that the magnetic fields they produce subtract from the magnetic fields that provide center screen convergence.

Considering these facts, it is easily seen that good convergence is more difficult to attain than purity. There are also other factors which can affect convergence. For example, the deflection yoke can produce raster distortion if not precisely wound to exacting dimensions. However, with proper adjustment techniques, the black and white picture, at normal viewing distances, should look perfectly converged to the viewer; that is, there should not be any red, green or blue fringing apparent at the edges of the picture detail.

Since this fringing cannot be entirely eliminated at extremely close viewing distances, it must be decided what color can be tolerated as a fringe color.

From color theories and practical tests, it has been found that the color blue is the least visible as the viewing distance increases, whereas red and green remain visible at greater distances. Therefore, it is reasonable to assume that blue should be the fringe color if it is necessary to make a compromise convergence adjustment.

This tends to confuse the usual convergence procedure because the blue raster is an ideal reference to

(*Continued on page* 39)

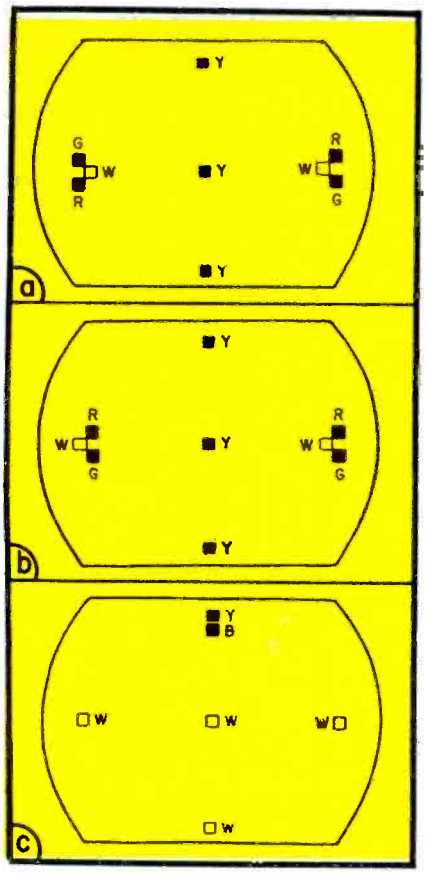


FIG. 4: AN ADDITIONAL set of convergence conditions. In (a) the green and red horizontal tilt is off and the red and green cross; (b) green and red horizontal amplifier is off and red and green are not crossed; and (c) blue vertical tilt is off.

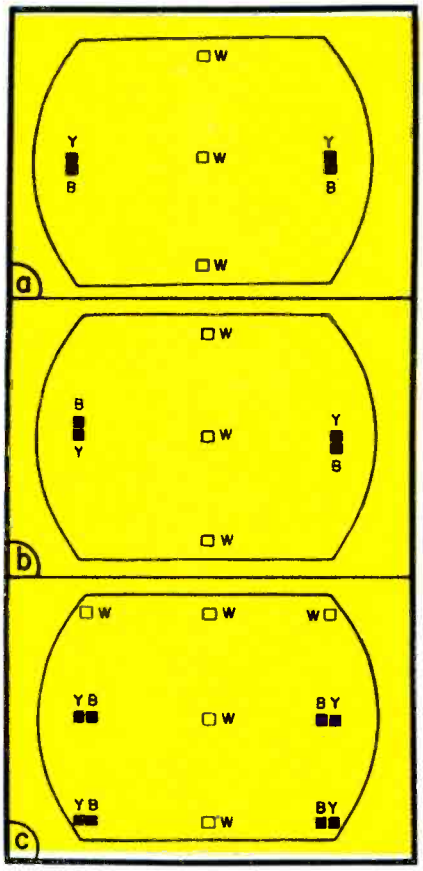


FIG. 5: THREE MORE CONVERGENCE setups: In (a) the blue horizontal amp is off, blue horizontal tilt is off in (b), and (c) shows a trapezoidal blue raster. In Figs. 2, 3, 4 and 5 colors are referred to by W (white), G (green), R (red), Y (yellow) and B (blue).

A 3-Speaker AM-FM Radio-Phono With

by RUDOLPH T. PLEMICH

THE GROWING TREND for customer convenience in TV and particularly phonos has prompted the development of many novel facilities in audio systems.

In the modern phono, as exemplified by the model[1] shown in Fig. 1, one finds remote control, recording output and an auxiliary input which may be switched in and out.

Other Features

Also, there is a 4-speed record changer which operates through a physically separate, but electrically matched preamplifier and power amplifier (Fig. 2), with the latter functioning into a properly phased three-speaker 8-ohm system. Directly feeding from a cathode follower to the preamplifier is an AM-FM tuner; see *cover* and Fig. 3.

Individual Controls

In addition, there are individual bass, treble, and volume controls which feature a compensation network.

Using two 12AX7 dual-triodes in the preamplifier, with all of the cathodes unbypassed, the noise level can be kept very low and overloading can be prevented. One section of the 12AX7 (V_{1A}) not only serves as a phono and auxiliary input, but provides a cathode-follower recording output when either of these inputs are used.

In the output-input circuits of the 12AX7 (V_{1A} and V_{1B}) are Fletcher-Munson-type bass and treble controls. One section of the second 12AX7 (V_{2A}) feeds a phase-splitter output at the grid; V_{2B}.

Split-phase output is developed at a 100,000-ohm cathode resistor and at the plate of the second portion of the 12AX7 (V_{2B}).

Power-Amplifier Chassis

Featured in the output amplifier is an *ac* and *dc* balanced cathode circuit. The *dc* path is common to both cathodes through a resistor-capacitor network involving a 270-ohm and 40-mfd combination. Actually, this is an *ac* feedback winding to each of the cathodes.

A mating socket-plug connects the preamplifier split-phase output filament and $B+$.

AM-FM Tuner

The AM-FM tuner has two front panel controls; function switch and tuning. The switch has three positions; FM, FM-AFC and AM.

Antenna Provision

A built-in ferrite loopstick has been built in for AM reception, while a 300-ohm twin-lead dipole has been included for FM reception.

Tuned RF Amplifiers

The input and output of the FM *rf* amplifier stage are tuned. A dual triode (12AT7) functions both as the

[1] *Webcor Overture-Coronet.*

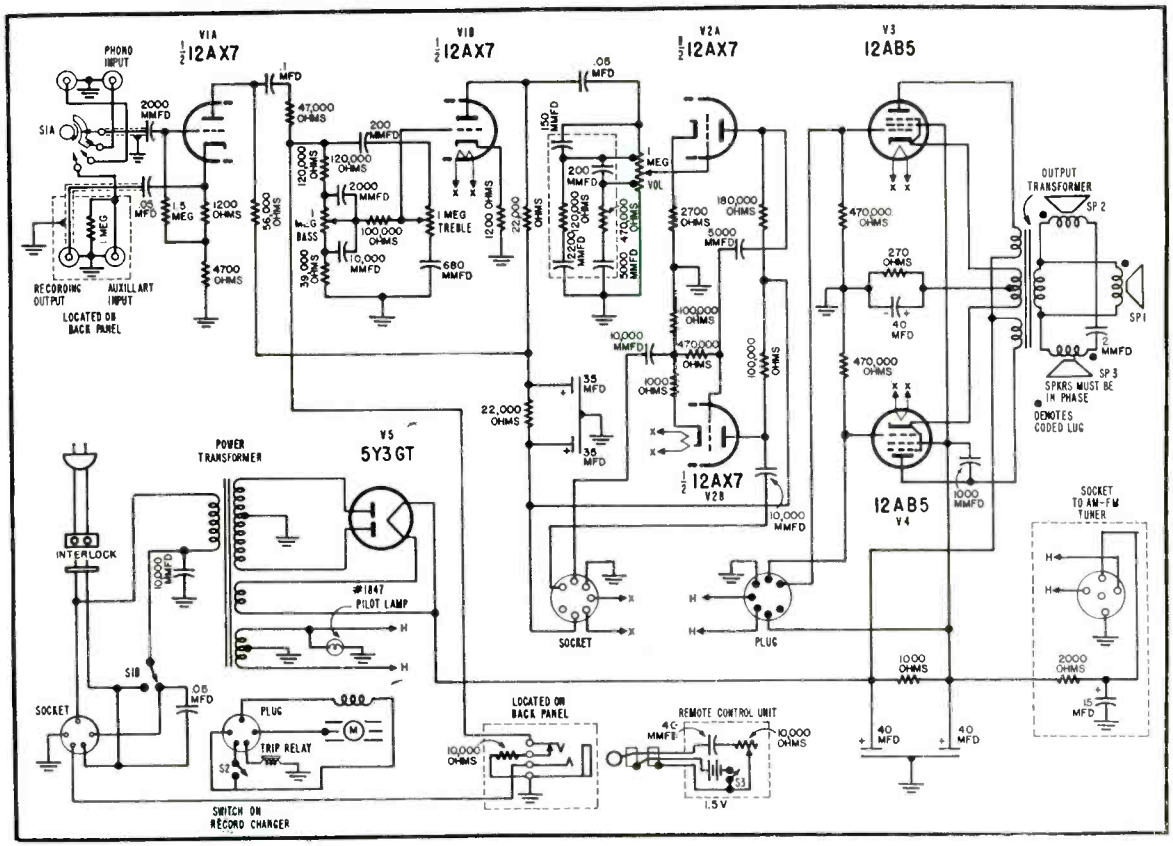


FIG. 2: SCHEMATIC of Webcor 14X264-2 preamplifier and 14X266-3 power amplifier.

Remote Control

[See Front Cover]

FM oscillator (pins 1, 2, and 3) and *afc* (pins 6, 7, 8), the oscillator being of the series Hartley type.

AM-FM IF Stages

A 6BA6 and 6AU6 serve as the first and second FM *if* amplifiers; the 6BA6 is also the AM *if*. The FM and AM *if* transformers are connected in series; an FM *if* of 10.7 mc is used. At this frequency, the capacitors across the AM *if* transformers have a low shunting capacitive reactance, effectively shorting the transformers.

Ratio Detector Circuit

A ratio detector (6AL5) converts a frequency-modulated signal into an output voltage whose amplitude depends upon the degree of deviation from the *if*. Since the *if* mirrors the frequency-modulated signal of the *rf* which changes according to audio modulation, the ratio-detector output is this audio signal; in this instance, at the junction of a 68,000-ohm resistor and .001-mfd capacitor.

Limiter Action

Limiter action is provided by the filter action of an 8-mfd capacitor, since it is effectively across the secondary of the ratio-detector transformer through two diode sections of the 6AL5 and tends to hold the *if* signal at its average level. As a result, limiting action is effective on weak as well as strong signals.

An interesting design feature is that of *avc* from the plate (pin 2) of the ratio detector to the *rf* amplifier.

Automatic-Frequency Control

The 12AT7 also serves to provide *afc* and its reactance is varied by a *dc* voltage from the output of the ratio detector which is applied to the grid. If the oscillator deviates from its tuned frequency, this action will return it to its original value.

FIG. 1: WEBCOR Overture-Coronet radio-phono consolette.

Audio Amp—Cathode Follower

A 12AX7, used as an audio amplifier and cathode follower (pins 1, 2, 3), feeds the cathode-follower section which delivers the output to the input of the preamplifier.

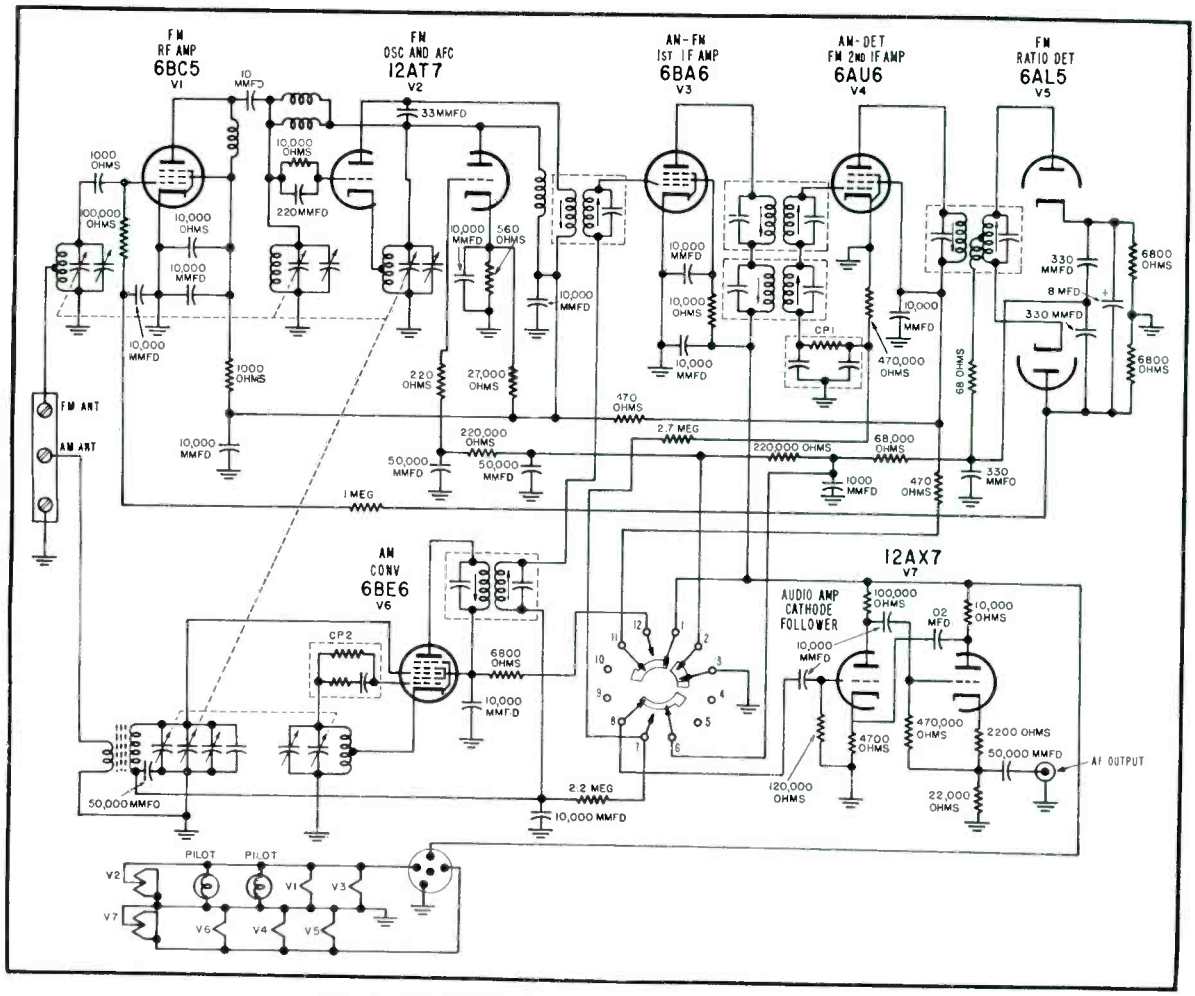


FIG. 3: DIAGRAM of Webcor 73X013-1 AM-FM tuner.

THIS MONTH IN SERVICE

ETHICS OF SERVICE MEN PRAISED BY EIA--In a statement defending the nation's radio and TV Service Men against charges of unethical practices, the Electronic Industries Association declared recently that the . . . "vast majority of these people are sound, ethical businessmen and technically competent." . . . EIA said that it deplored the type of publicity which places emphasis on the . . . "comparatively rare but sensational examples of unethical practice . . ." instead of . . . "praising the less newsworthy but large number who are competent and honest." . . . Actual impartial polls show, it was noted, that over 90 per cent of the public is satisfied with its TV and radio service.

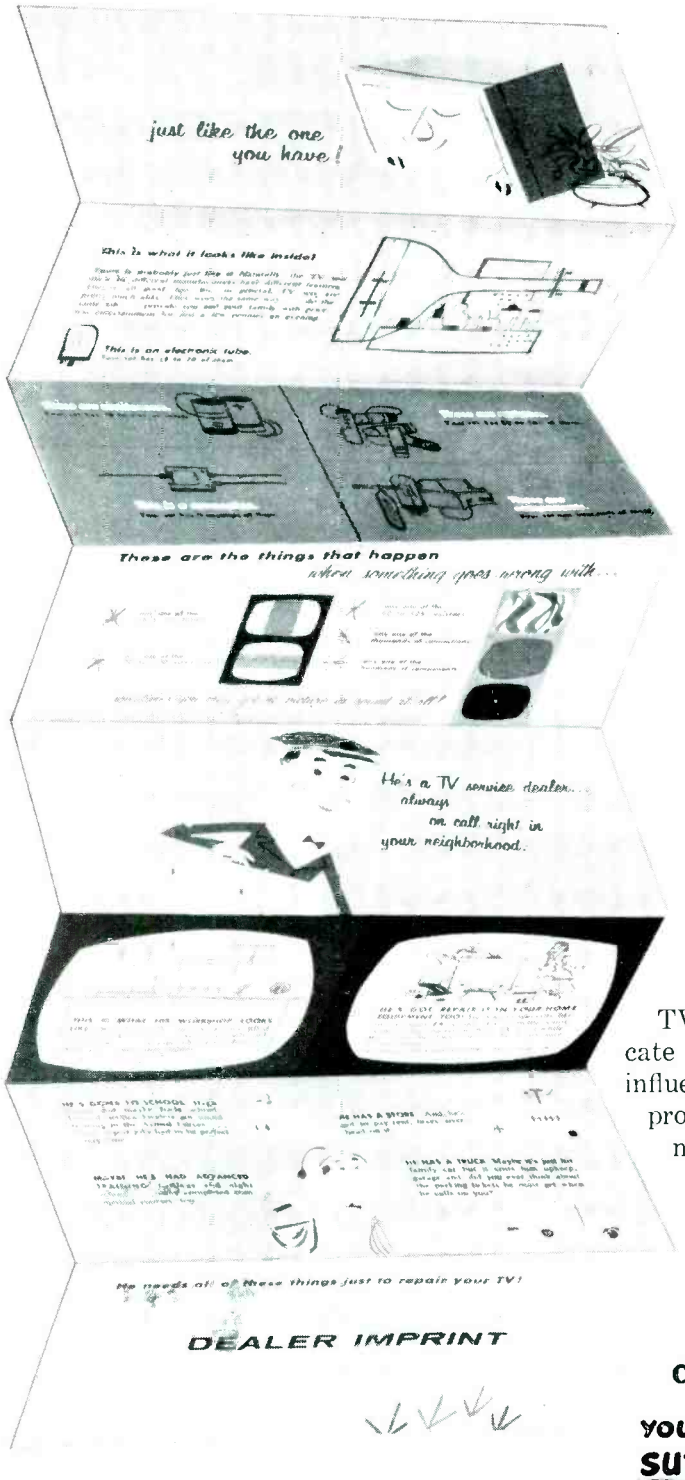
FIRST TRANSISTORIZED-TV PORTABLE MAKES DEBUT--The first truly portable-TV set--a 31-transistor battery-operated model--was unveiled recently by Motorola in Chicago. . . . A full 14-inch overall diagonal chassis, the receiver is driven by a pair of nickel-cadmium batteries, 5" x 5" x 5", consuming only 12 watts per hour, in contrast to the minimum of 105 watts consumed by the smallest tube-type TV portable now available. . . . According to the designers of this chassis, six hours of play can be had from one charging of the batteries. . . . Release of the set to the general market, it was said, was related to the availability of the variety of new types of transistors required. Estimates at this time indicate that these transistors will be produced in quantity in about two years, and transistorized TV portables should be available then.

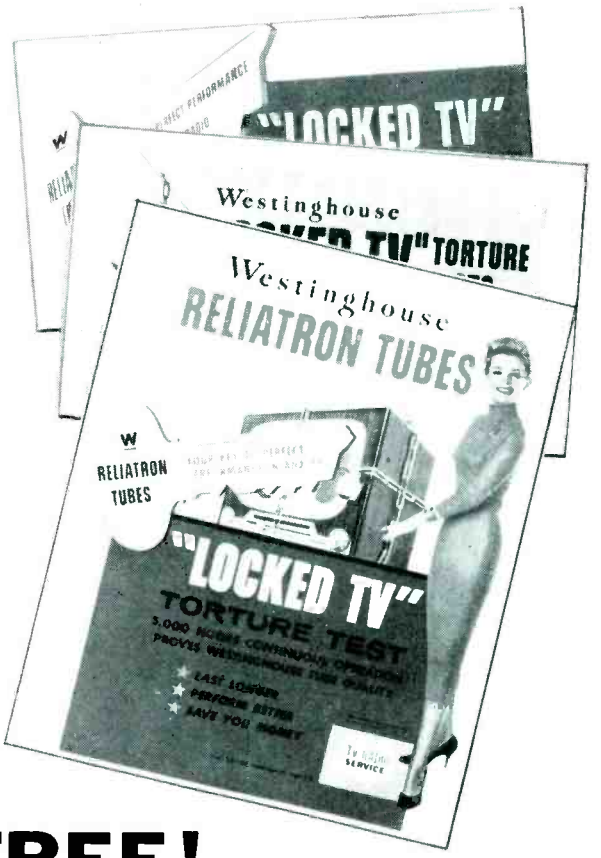
TRANSISTOR-POWERED 2-WAY MOBILE EQUIPMENT DEVELOPED--The communications products department of General Electric announced recently that it has designed transistor-powered 30 and 60-watt mobile radios for the low band (25-40 mc), 25 and 50-watt models for the high band (144-174 mc) and 15-watt equipment for the citizens' band (450-470 mc). . . . The transistorized power units can be used with either positive or negative ground 12-volt dc systems. . . . Mounted externally on the front of the mobile combination is a grille-like heat-sink for fast heat dissipation to provide maximum protection for the transistors.

ELECTRONIC VEHICLE CONTROL DESIGNED FOR HIGHWAYS--An electronic system, that provides automatic control of vehicles on the highway, has been developed by RCA. . . . The system, tested recently in Lincoln, Nebraska, consists basically of a series of electronic detector units buried in and along the highway, and a guidance cable buried in the center of a traffic lane along the length of the road. The detector units, in which signals are generated by the passages of cars, are used to activate various systems of warning lights and can eventually be combined with simple receivers and automatic equipment in vehicles to control speed and braking. The guidance cable radiates a constant signal which is employed in conjunction with a car receiver and automatic steering equipment to keep a vehicle centered in its traffic lane. . . . Scientists, who developed the system, disclosed that the network includes provision for radio tail-warning that extends any desired distance behind each passing car to warn or control following cars equipped with receivers, or to operate warning lights along the roadside.

OVER 800 TO EXHIBIT AT '58 IRE NATIONAL CONVENTION IN NEW YORK CITY--The annual IRE Radio Engineering Show, which this year will be held March 24-27 at the New York Coliseum and the Waldorf-Astoria Hotel, will feature displays of over 800 exhibitors and technical talks by over 275 specialists at 55 sessions. . . . Subjects to be covered include semiconductors, mobile radio, stereophonic developments and miniature components. . . . High point of the program will be two special symposia on electronics in space and electronic systems in industry, which will be held Tuesday evening, March 25. . . . SERVICE will be at the show, in booth 4416, on the fourth floor at the Coliseum.

WESTINGHOUSE HELPS TV SERVICEMEN "GET A FAIR SHAKE!"





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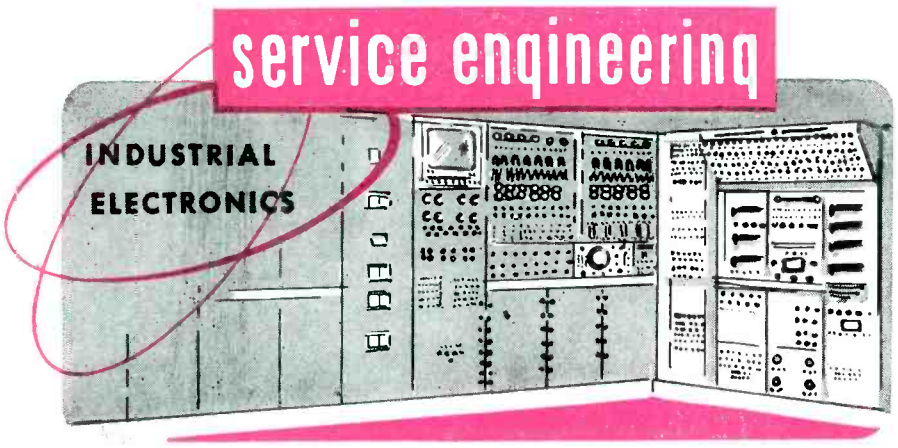
Latest Developments In Marine 2-Way Radio



by LEO SANDS

WELL OVER one-billion dollars was spent during '57 on pleasure boating. Estimated '57 sales of marine electronic equipment was over the $16,000,000 mark and a sharp increase is anticipated in 1958.

Many of the manufacturers of radiotelephones and other electronic gear for marine applications will be displaying their wares at the string of boat shows early this year starting with the New York Boat Show in January.

New models have not changed drastically from a technical viewpoint since functional requirements remain essentially the same. Instead, emphasis is on new styling. Manufacturers are dressing up their equipment so it will harmonize with cabin interiors, getting away from the boxy radio look. Women are having more to say about the appearance of the radio to be purchased for the family boat.

The marine radiotelephone is very similar functionally to two-way equipment used in land communications. It differs in operating frequency and employs AM exclusively, whereas both AM and FM are used in land mobile systems. While most mobile radio units can be used on one or two, and sometimes as many as four different frequencies, marine radiotelephones are provided with five to nine crystal-controlled operating frequencies, selected by a switch on the front panel. Some marine two-way units are provided with a built-in AM broadcast band tuner, while others make use of an optional remote broadcast tuner. Thus, the radiotelephone can be both functional as well as a source of entertainment.

Marine radiotelephone transmitters for pleasure craft are available in various power ratings running from 20 to 100 watts *rf* output. All are amplitude modulated and necessarily crystal controlled to comply with FCC regulations. Receivers are built into the same cabinet with the transmitter and both receiver and transmitter frequency are switched simultaneously when changing from one operating channel to another. Receivers are also crystal controlled so that the user need not go through a complicated tuning procedure.

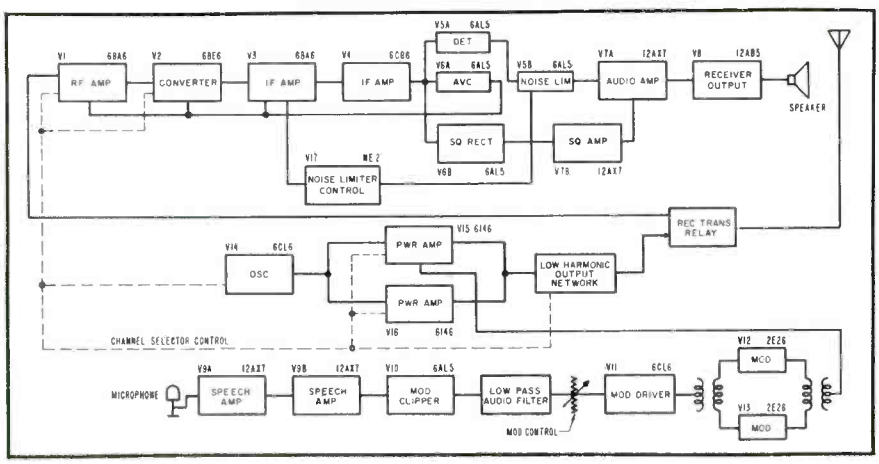
Medium power radiotelephones—the most popular for both pleasure boats and commercial vessels—are normally desgined for bulkhead mounting, but the new models[1] can also be mounted on a table or other horizontal, flat surface by means of a tubular mounting stand. Access to the chassis is achieved by removal of an ornamental hood from the top of the unit. The front panel tilts forward exposing the chassis and inside adjustments. Front panel controls include a squelch threshold control, channel selector switch, volume control, and *on* switch. A push-to-talk button on the microphone turns the transmitter on and off.

Both receiver and transmitter[1] can be operated on any of six crystal-controlled channels between 1.6 to 5 *mc*. Optionally, the sets are available for operation over an extended frequency range, 1.6 to 6.5 mc.

Transmitters have a rated power output of 50 to 60 watts, depending upon operating frequency, and the final *rf* amplifier can be loaded to

(*Continued on page* 36)

[1]*Such as Kaar 242A.*



BLOCK DIAGRAM of the Kaar 242A marine radiotelephone. In this model both transmitter and receiver frequency are changed simultaneously by a single control.

VHF TWO-WAY RADIO installed in a boat yard to communicate directly with service vessels as well as land vehicles in the low power industrial radio service band.

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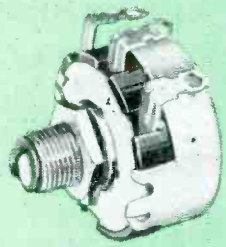

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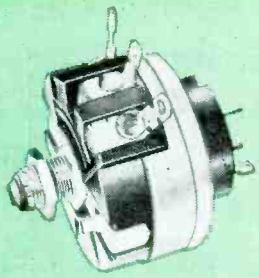

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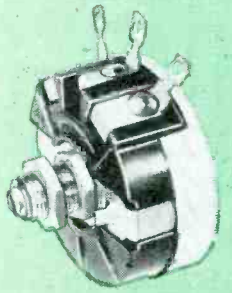

SERIES A58

3-watt, 1⅜" diameter, available in resistance values from 1 ohm to 50K ohms. Also with factory-attached switch.

SERIES 39

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*Modifications to Prevent Incorrect 12" Record Indexing— Removing Microphonic Howl — Moving-Coil Pickup Stylus Replacement — Adjustment of Level-Balance Controls‡ . . . Tape Equipment Maintenance and Repair**

INSTANCES HAVE BEEN found in RCA RP-205 phonos where the stylus will land approximately ¼" outside of the landing area for 12" records. This condition has been corrected by increasing the offset of the right-angled tab on the index lever. This change decreases the rise of the landing selector lever during cycle and prevents it from contacting the small projection on the stepped pickup arm return lever.

The 45 centerpost now supplied with 4-speed record changers of the RCA RP-205 Series has a die-cast metal body; earlier production centerpost assemblies used a plastic body.[1]

[1]The die-cast metal body is available as stock No. 105501. The complete centerpost assembly using the metal body is available as stock No. 79096E.

Microphonic Howl Cures

To prevent microphonic howl in any record playing instrument, it is essential to minimize acoustic vibration feedback from the speaker to the pickup.

In model RCA 9-EM-21 acoustic insulation is provided in two places:

(1) The motor and turntable assembly are mounted on rubber grommets.

(2) The pickup arm is mounted in a loose fitting rubber grommet fixture.

If there is any direct contact between the motor assembly (including speed shift arm) and the motorboard or between the pickup arm and the motorboard, there will be excessive acoustic feedback and howl will result. Howl will also result if these grommets are compressed.

The pickup arm mounting does not have a fixed stop and it is possible to compress the rubber grommet in which it is mounted. If howl is noticeable, the pickup arm mounting should be closely checked and the mounting nut loosened if necessary. A drop of speaker cement should be used to cement the nut to the threads if the nut is loose fitting.

One must not permit cement to contact the grommet or the howl may be worse after the cement has hardened.

There have been a few cases of howl caused by a microphonic 25L6GT.

Moving Coil Pickup Stylus Replacement

The pickups used in RCA 100566, 100793, 102955 and 102956 models have a very low mass in the stylus assembly. This low mass enables a wide range linear response to be obtained. To attain low mass, the stylus holder must be omitted and the stylus connected direct to the moving element of the pickup.

Adjustment of Level Balance Control

An adjustable control (R_{89}) is provided on RCA RC-1180 tuner/amplifier chassis to enable the audio output of the two speaker systems to be equalized. This control is a screwdriver adjustment on the top of the chassis (in front of the variable gang capacitor).

The control may be adjusted either while listening or while measuring audio output. For measured equalization, an audio signal should be injected and the two audio outputs measured. This audio signal may be a modulated *rf* or *if* signal, a frequency record or an audio signal injected first at channel 1 then at channel 2 tape input. The level balance control adjustment affects the output of channel 1 only.

This level balance control affects the audio output on all functions and should not be confused with the equalization control on the tape

(*Continued on page 43*)

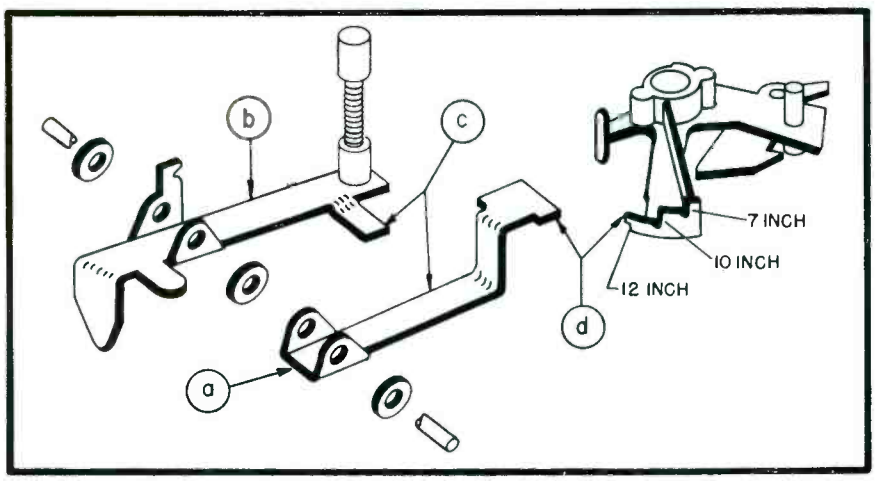

FIG. 1: LEVER REPAIR in RCA RP-205 phonos to avoid incorrect indexing of 12" records. Altered parts are landing selector lever (a) and index lever (b) which must not cause excessive rise of the landing lever. The landing lever should not rest on the end of the projection of the pickup arm return lever (d).

‡Based on field notes prepared by RCA Service Company. °From Presto service notes.

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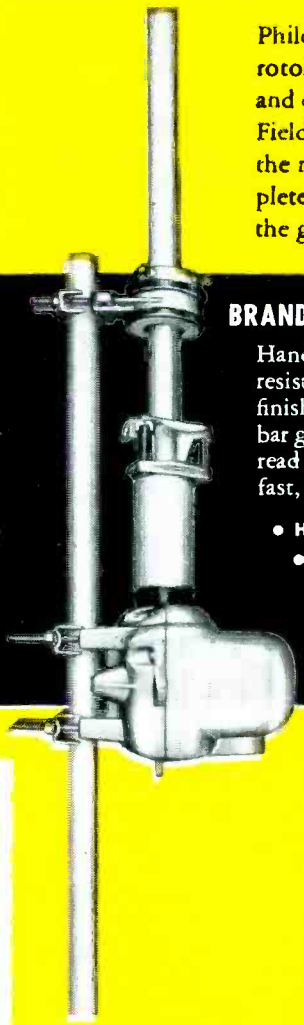

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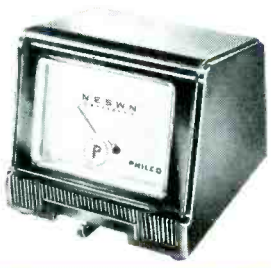

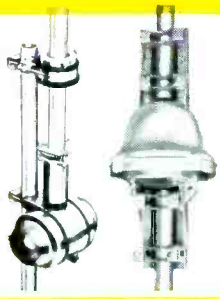

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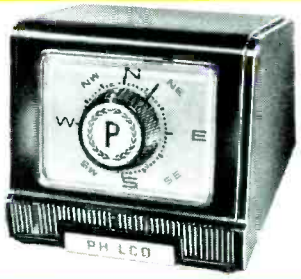

P11	P4A
AP1	AP22
ROTOR	ROTOR

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

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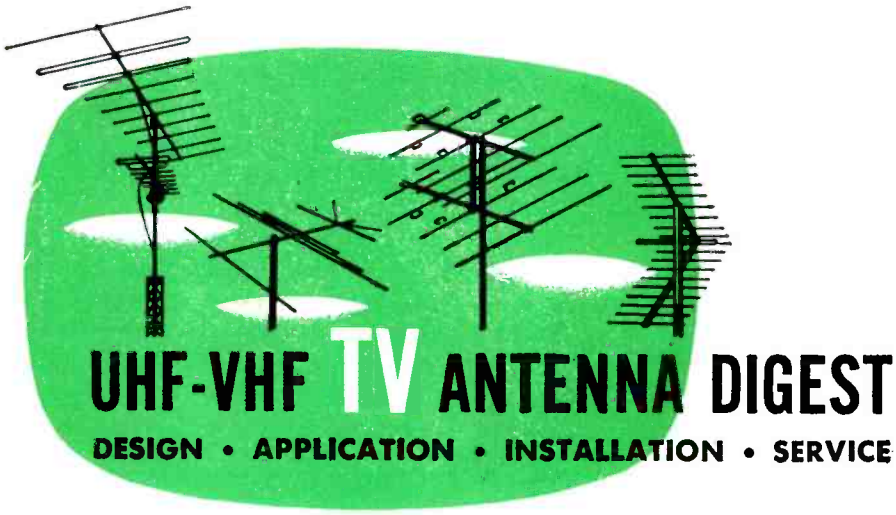
S158

How To Select and Install Proper TV-FM Antenna, Leadin and Preamp and



by JACK BEEVER, Systems Design Engineer, Jerrold Electronics Corp.

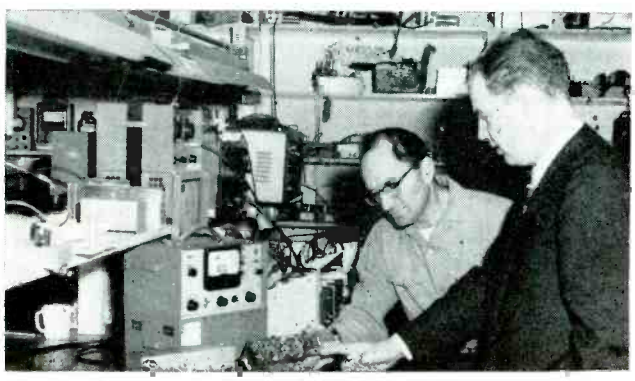
THE ACCELERATED INTEREST in FM reception has developed a number of problems for the Service Man, particularly in remote areas where reception is often difficult, as in TV.

In TV, however, the problems—which include adjacent channel and co-channel interference, airplane flutter, fading and *snow*—can be detected on the screen. The FM listener has all these, but here snow is called *noise*. The same remedies which help the TV viewer help the FM listener, but in TV the remedies are more efficient, since in FM the listener cannot distinguish a *ghost* or phase shift caused by multipath reception, except in extreme cases.

All the troubles mentioned have one thing in common—they are best attacked at the antenna or antennas. With the exception of noise, and this is a dubious exception, all of these troubles are due to signal-path conditions; conditions existing between the transmitter and the input terminals of the FM tuner.

FM signal paths, at least home-radio FM, fall in the spectrum bounded by 88 and 108 mc. This is the region immediately above channel 6 of the low *vhf* television band. We can expect propagation characteristics of these signals to be quite similar to TV, and indeed they are. FM sets, however, because of their much narrower bandwidth requirements, and the nature of FM reception, operate on much lower signal levels. FM sets generally require two things to produce satisfactory sound. They must have a signal at the input terminals which has a satisfactory ratio to the noise generated in the tuner's input circuit, and this signal must be high enough to drive the limiters in the tuner to their proper operating levels.

If these conditions are not met, the resulting sound output will have *hash* in it, resulting from the reproduction of the random noise of the tuner, which is AM in nature. It is not commonly realized that the intelligibility and fidelity of FM reception is only better that AM when the signal-to-noise ratio is over a certain threshold. Below this threshold, which is a function of both signal and design, the FM set is worse than an AM set.



(Left) **VICTOR NICHOLSON (seated), chief of the Jerrold test and evaluation department, and Jack Beever in the lab with the recently developed FM-antenna preamplifier.**

Weak Signals

Since the condition of *hash* or weak signals is the most common complaint, we can attack this first. From the preceding analysis, it is evident that a tuner producing such noise is starving for signal. The only cure is more signal, and this means the erection of an antenna, or a better antenna, or more antennas. Sometimes it means an antenna in a better place, or an antenna preamplifier.

The FM Yagi

High gain yagis are being manufactured to cover the FM bands. Choice of such antennas is usually a compromise between gain and price. To choose the antenna it is best to review the methods used to rate antennas. Briefly, a half-wave dipole is the common standard, and is called a *0-db antenna*. Other antennas are rated in terms of gain in db over such an antenna, usually in voltage gain. For those not familiar with the decibel, a few common values and their equivalent ratios are tabulated in table 1 below. The equivalent figures are used to multiply the output of a dipole to give the expected output of an antenna whose gain (or loss) is the number of db greater (or lesser).

The commonly-used *omnidirectional* FM antenna, consisting of a pair of crossed dipoles or a curved folded dipole has a gain of – 3 db; 3 db down. It will deliver about 70% of the voltage of a straight dipole which is properly oriented. Its advantage is that it receives equally well from all directions. In a fringe area though we cannot afford the luxury of omnidirectional reception. A good yagi at FM will develop 9 db gain, which is 12 db higher than the usual FM antenna; 12 db means that the yagi will develop four times the voltage. However, high gain always means high directivity. The yagi will deliver this voltage only when

Db (voltage)	*Gain*	*Loss*
3 db	1.4 X	.7 X
6 db	2 X	.5 X
9 db	2.8 X	.36 X
12 db	4 X	.25 X

TABLE 1: DB values and equivalent gain and loss ratios.

properly *oriented*. If the distant stations desired are all in the same city—40 miles or more away—the yagi's pattern will be broad enough to cover these stations. In this case, the yagi can be oriented properly by turning it while watching the indicator needle or tuning eye of the FM tuner.

Multidirection Reception

If the desired stations are located in different directions, the yagi will develop poor signals on those to which it does not point. If this problem obtains, a TV antenna rotator should be installed; then the listener can orient for the desired stations. The tuning indicator can be used to orient, just as is done when erecting a fixed antenna.

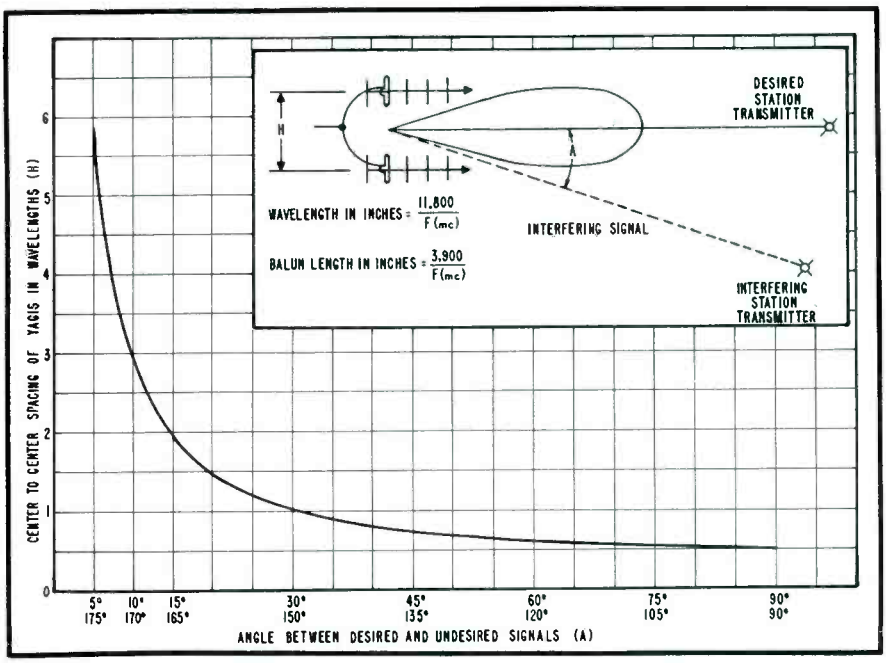
Estimating Required Antenna Gain

Sometimes the yagi antenna is not enough to develop useful signals at the tuner. It other signals are available which do produce proper limiting, the deficiency factor in the desired weak signal can be obtained if the tuner uses a meter. To obtain this information the good signal should be reduced until it sounds just about as *hashy* by disconnecting the antenna and using loose coupling of some kind, such as holding the lead in the palm of the hand and touching the tuner terminals with the fingers. The coupling should be increased until the signal clears up and the difference in meter reading noted between this signal and the weak signal. This difference can be converted to db by the use of the table 1 chart. It it is less than 12 db, we have a chance to correct it, if the tuner is a very good one. If an average or mediocre tuner is used we can correct up to 24 db, which is a ratio of 16 times.

Leadin Losses

It is extremely important that one important thing be realized. The signal that our tuner sees is not the signal developed by the antenna. It is less due to leadin loss. It behooves us to find out how much loss.

Ordinary flat twinlead is rated at a nominal loss of 1.1 db per hundred feet at 100 mc. The tubular types, air filled or polyfoam filled, show larger losses, but are more stable under adverse conditions. But these losses are nominal losses, measured

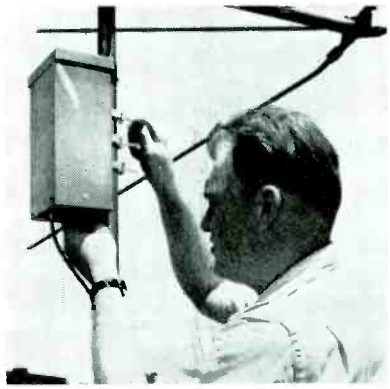


HORIZONTAL SPACING of yagis in wavelengths (H) versus angle (A) formed by desired and undesired signals. Wavelength in inches = 11,800/f (mc); balun length in inches = 3,900/f (mc).

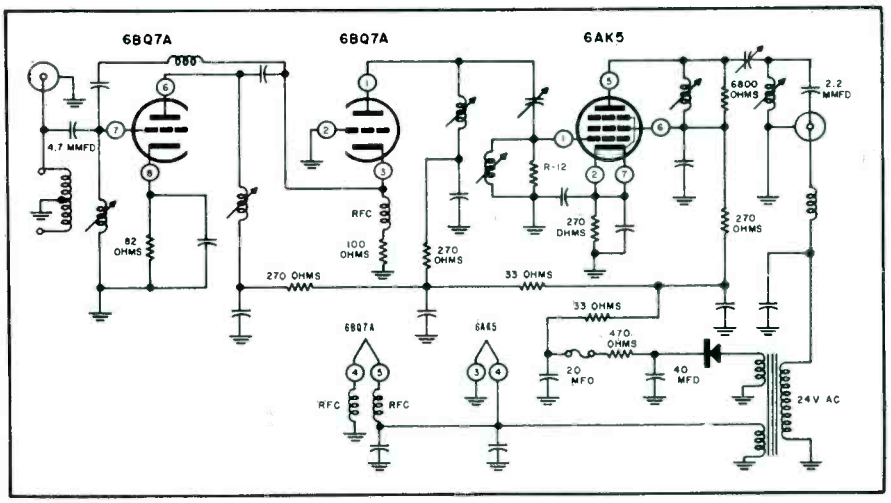
under free space conditions with perfectly matched sources and loads. We never have these conditions in a real installation. Actual twin lead losses measured in typical installations have been found to be as high as 9 db in 70'. This is due to the fact that twin lead must be mounted, and must penetrate walls and go along floors and baseboards. This type of transmission line propagates energy by means of external fields and any material interfering with these fields increases the loss in the line.

We need either a no-loss transmis-

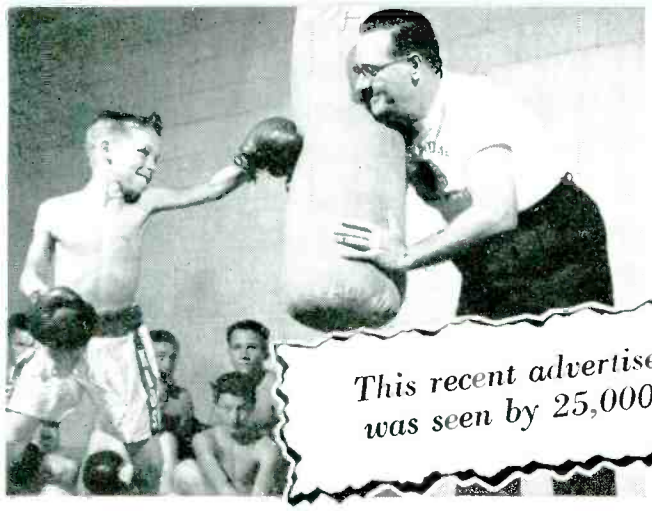
(*Continued on page* 46)



INSTALLING a mast-mounted preamplifier.



CIRCUIT of FM antenna preamplifier.



This recent advertisement in **LIFE** *was seen by 25,000,000 people...*

GOOD SPORTSMANSHIP is developed by Marcus E. Denham at Whitaker State Orphans' Home, Pryor, Oklahoma, where he assists in recreational activities. He is also prominent in many local community service groups. His work is typical of the many public service contributions of TV technicians everywhere.

BOY SCOUT WORK and assistance to Charlotte, Michigan, youth groups make Bart Rypstra, Jr., another "All-American". He is a member of the Charlotte city council, active in civil defense communications, and belongs to many community service clubs. When time permits, Bart devotes his technical talents to servicing sound equipment, movie projectors and record players at city schools.

JUDGES SELECTED 13 WINNERS to receive this trophy, $500 for use in community improvement, and luncheon with Under Secretary of Commerce Walter Williams at Washington, D.C.

"ALL-AMERICAN" TV TECHNICIANS WIN GENERAL ELECTRIC AWARDS FOR PUBLIC SERVICE

AMERICANS everywhere responded to General Electric's invitation to nominate candidates for "All-American" Awards, honoring television technicians who have distinguished themselves in public service.

The winners, whose pictures appear on these pages, were selected by a panel of judges composed of *Wendell Barnes*, Administrator, Small Business Administration; *Wendell Ford*, 1956-57 President, United States Junior Chamber of Commerce; *Herman Hickman*, Sports Authority; and *Ed Sullivan*, Columnist and TV Personality.

General Electric has established these awards as another step in its program to recognize the public service contributions made by independent businessmen everywhere.

The accomplishments of these television technicians should serve as an inspiration to all Americans. *General Electric Company, Receiving Tube Department, Owensboro, Kentucky.*

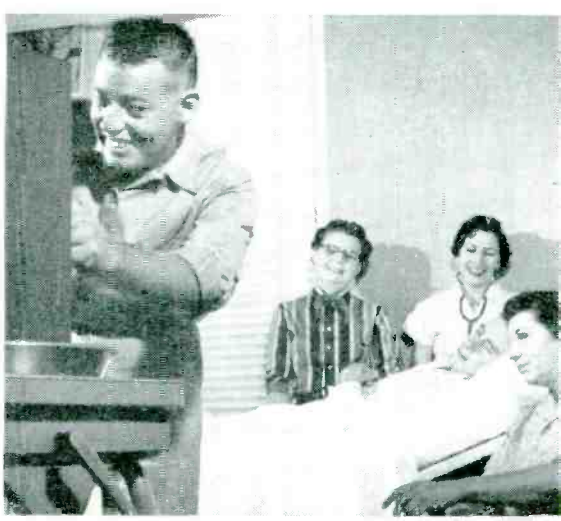
Progress Is Our Most Important Product

GENERAL ELECTRIC

11-11-107

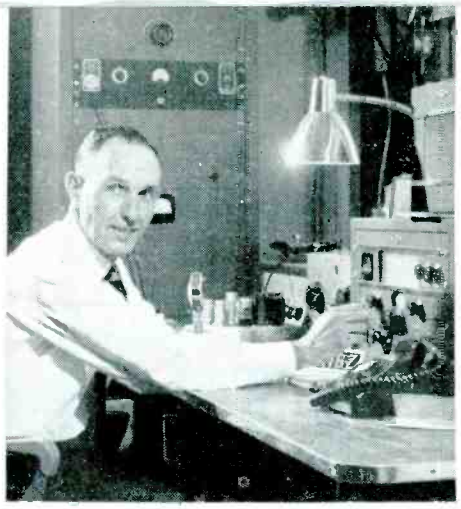
VOLUNTEER FIREMAN and Instructor John R. O'Brien, Evanston, Wyoming, teaches first aid at neighboring fire companies and schools. He is active in communications during civic emergencies, and lends and installs sound equipment for town functions. Many community service groups benefit from his time and skills.

MANY WERE SAVED by Scott Witcher, Jr., during Lampasas, Texas, disaster. Here he shows height of water in raging flood which swept his area. Scott saved lives and helped restore communications to the community. He is active in the National Guard, in civic and youth organizations.



TV FOR THE SICK is provided by Billy Joe Jenkins of Paducah, Texas. By installing antenna cable and servicing sets without charge, Billy Joe has made it possible for patients in Richards Memorial Hospital to enjoy TV. He helps community improvement drives, teaches electronics to Boy Scouts.

GIRLS' DRILL TEAM at St. Joseph's Parish is supported by Remo De Nicola, Quincy, Mass., as one of his many community services. He also gives free television service to a school for retarded children and is always ready to lend sound equipment for charitable affairs.



CIVIL DEFENSE LEADER Richard G. Wells, Jr., Pikeville, Ky., installed television cables from a community antenna to Pikeville College, high school, fire department, Scout building and Methodist Hospital. He is working to give the high school a closed-circuit TV system.

FIVE PUBLIC SERVICE CITATIONS plus a civilian Navy award were given Frank J. Hatler, Roselle, N. J., for his communications work in community emergencies. As local civil defense head, Frank organized communications networks, helped many to get radio licenses.

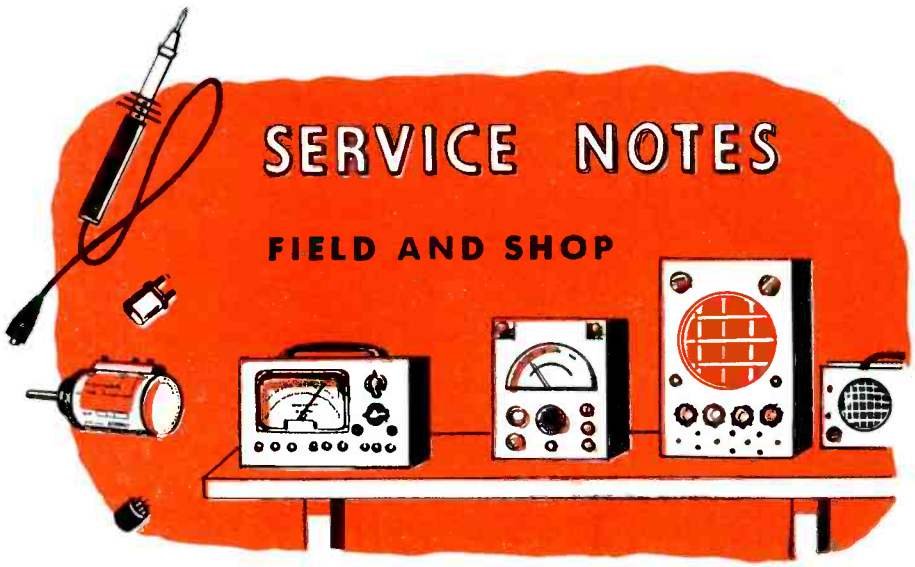
BLIND CAN SKATE because Philip G. Rehkopf, Jr., Louisville, Kentucky, installed a record player and placed loud speakers around the walls of the gymnasium at the Kentucky Home for the Blind. He developed an electronic device to give scores to blind basketball fans, and tape records text books for blind students.

WHEEL CHAIR is no handicap for Mortimer Libowitz of Brooklyn, New York. Though disabled all of his life, Morty has devoted his time to helping others in his community. With a crew of student volunteers, he maintains the radio station at Thomas Jefferson High School, Brooklyn. He also services a Red Cross radio station and is active in civil defense communications. Morty has trained many youths in radio, developing some into amateur operators and skilled television technicians.

ELECTRONICS LABORATORY at Long Beach City College, California, was established with help from Harry E. Ward. Harry serves as chairman of the Business and Technology Advisory Committee and for fifteen years has devoted his time to finding work for students, graduates and others.

STUDENT BENEFACTOR Philip T. Di Pace, of Albany, N. Y., contributes used radio and television chassis and parts to Siena College students who are interested in electronics. Phil now heads a project to finance an athletic field and playground for 75 neighborhood children.

BASIC ELECTRONICS is taught to neighborhood boys by John H. Stefanski, Pontiac, Michigan. He has organized a scientific library for the boys and is now planning a new Pontiac Boy's Club. John has served as chairman of the Business Ethics Board of the Pontiac area Chamber of Commerce. Television sets in the Oakland County Sanatorium are serviced without charge through his efforts.



Troubleshooting Transistor Radios: Safety Precautions — Battery Replacements . . . Repairing TV Chassis With Dual-Selenium Phase Detectors and Silicon Power Rectifiers

THE LATEST TYPE TRANSISTOR-radio models have been so designed that a variety of transistor types can be used throughout.

In the Sentinel and Spartan CR-279 chassis, which use 6 transistors, either of two types of transistors can be used in the converters; the 2N172 or 2N253.

As first *if* amplifiers, the choice is among the 2N145, 2N146 and 2N253. For the second *if* stage, one can use a 2N146, 2N147 or 2N254.

In the detector and as audio amplifiers, however, the selection is usually restricted. A 1N295 diode usually serves as the detector and the 2N185s are used in the amplifiers. This practice is followed in the Sentinel and Spartan sets.

In 6-transistor radios, of the Spartan and Sentinel type, the antenna is a ferrite rod type inductively coupled to the base terminal of the converter stage by means of a low impedance secondary winding. The antenna is tuned by a section of a 2-gang variable capacitor.

Collector to emitter feedback is accomplished by means of an oscillator coil which consists of two windings and provides for the oscillator function of the converter stage. The top winding of the oscillator coil is the feedback winding. The bottom winding is tuned by a section of the tuning gang to establish the frequency of oscillation. The oscillator emitter current establishes oscillator bias by means of an emitter-coupling capacitor and an emitter-return resistor.

The function of the converter stage is threefold in that it acts as an amplifier for the antenna signal, an oscillator and a superhet mixer which converts the antenna signal to an *if* frequency of 455 kc.

The *if* signal is taken from the converter collector terminal and coupled to the base terminal of the first *if* stage by means of an *if* transformer. The primary of this transformer is slug tuned; the untuned secondary is a low impedance link which couples the high-impedance primary to the relatively low impedance base to the emitter circuit of the first *if* transistor. A similar transformer couples the output (collector) of the first *if* stage to the input (base) of the second *if* stage. The second *if* stage drives a crystal diode detector by means of a bifilar transformer which is single tuned by a powdered iron core.

The first and second *if* transistors operate in a manner similar to triode *rf* amplifiers and therefor require neutralization to prevent possible self oscillation. Neutralization is accomplished by feeding a portion of a properly-phased output signal back to the input. A capacitor in series with a 1000-ohm resistor furnishes the feedback for the first stage; a 22-mmfd capacitor in series with a 5600-ohm resistor furnishes the required feedback for the second stage. Since interelectrode capacitances and gain factors vary between transistor types, it is essential that the *if* transistors be replaced with exact replacements. If this is not done, circuit oscillation or a loss of gain might be incurred.

A negative *avc* voltage is fed back from the diode detector to the base connection of the first *if* stage to control its gain with changes in signal level. The total negative *avc* voltage appears across a volume control. This negative voltage is used to buck the positive voltage developed across the first *if* base resistor which is returned to a positive bias. The *avc* voltage thus reduces the amount of positive bias to the base connection of the first *if* stage and reduces the gain of the stage as required.

The audio voltage selected by the volume control is coupled to the base connection of the audio driver stage by a 10-mfd electrolytic capacitor. This high value of coupling is made necessary by the relatively low input impedance of the driver stage. Since this capacitor is an electrolytic partic-

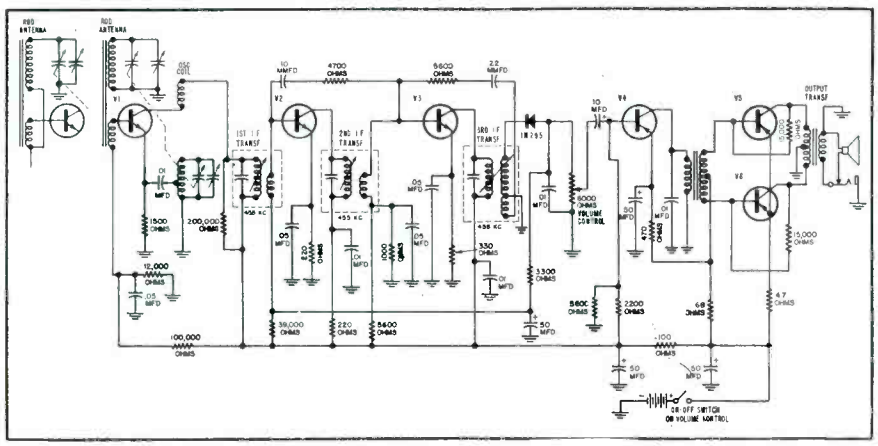


FIG. 1: CIRCUIT of Sentinel and Spartan CR-279 transistor radios.

ular attention should be given to its polarity should replacement become necessary.

The output of the driver stage is coupled to the push-pull output stage by means of a driver transformer having a center-tapped secondary. The output stage employs a pair of push-pull transistors, operated in class *B*. When operated in this manner, the output transistors are biased to cutoff and their inputs driven 180° out of phase. When one transistor is driven in a positive direction, the other is driven negative such that only one of the output transistors conducts at a time and when no audio signal is applied, neither transistor conducts. This provides for good battery economy; however, the total current in the output stage increases with audio signal level so that total battery life will be conserved if the volume control is maintained at lowest useable setting.

Chassis Troubleshooting

When servicing transistor radios one should always replace with original type transistors as indicated earlier.

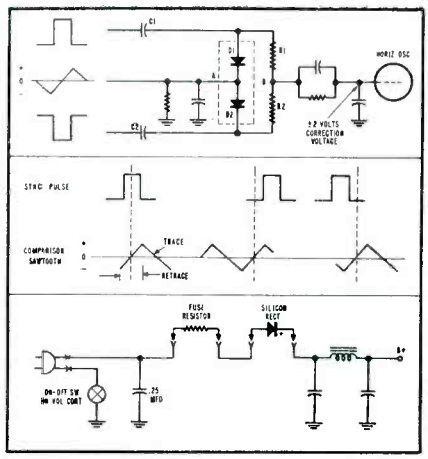
Resistance measurements of chassis circuits should be made with the transistors removed from their sockets, since the terminal voltage across ohmmeter leads can cause conduction within the transistors causing erroneous readings. Also, excessive ohmmeter terminal voltages across a transistor can cause permanent damage to the transistor.

One should always be careful not to short across the terminals of a transistor while the receiver is operating. Such practice may also cause permanent damage to a transistor.

When soldering to a transistor socket, the transistor should be removed first since excessive heat from the soldering iron can destroy the transistor.

When a battery reaches the end of its useful life its internal resistance rises rapidly. For this reason, the terminal voltage of a battery should always be checked under load with receiver operating. If the battery voltage under load measures lower than 2.7 the battery should be replaced.

Weakness, distortion or no output may be caused by a damaged transistor. If it is believed that a transistor is defective, replacement with a new transistor, known to be good, is the surest servicing check. Again, one should not check transistors with an ohmmeter as damage to the transistor may result. An ohmmeter check measures the ability of a transistor to conduct current in one direction, and to resist current flow in the opposite direction. The resistance is low in the conduction direction in relation to the resistance in the non-conducting direction. Such a check is at best a crude one and is not recommended since the front-to-back resistance ratios differ widely among transistor types.



FIGS. 2, 3 and 4: Fig. 2 (top) illustrates a dual selenium phase detector circuit used in Motorola TS-425 models. Fig. 3 shows voltage comparison of sawtooth and sync pulses in phase-detector circuits. Fig. 4 details the silicon rectifier-fuse resistor circuitry used in Motorola TS-425 chassis.

Should any of the miniature electrolytic capacitors open, the receiver will exhibit oscillation, a loss of gain or both. The simplest means of checking for this condition is to bridge the suspected capacitor with another electrolytic while the receiver is turned on. This will indicate whether or not the suspected capacitor is defective.

The total current drain from the battery when the Spartan-Sentinel sets are operating with volume control set to zero is about 7 milliamperes, with a good battery. This current can be measured by placing the power switch in the *off* position and placing the milliammeter leads across the switch terminals. The total current will rise as the audio output is increased. At maximum volume the total current drain will increase to over 25 milliamperes. From this it can be seen that battery life can be extended by maintaining conservative settings of the volume control.

An old or exhausted battery can damage the chassis if not removed from the instrument at the end of its useful life. If the radio is to stand unused for a long period, the battery should be removed to prevent possible damage to the instrument.

12BV7-12BY7 Replacements

THE 12BV7 is an especially selected 12BY7 with respect to cutoff characteristics. Generally, either tube will work, but there may be some conditions under which sync buzz will be noted if a 12BY7 is used to replace a 12BV7.

Dual Selenium Phase Detectors

THE PHASE DETECTOR circuit in Motorola's 14P10 and 14P11 TV models utilizes a dual selenium rectifier. The function of the horizontal phase detector circuit is to compare the horizontal frequency of the station with the horizontal frequency of the TV set. If a difference in frequency exists, the circuit develops a correction voltage which changes the set's horizontal frequency to bring it into the same frequency as the station.

Discounting the horizontal sawtooth voltage at point-*A* (in Fig. 2) and considering point *A* to be at ground potential, the action of diode-1 is as follows: The positive sync pulse will cause the diode to conduct and develop a negative charge or voltage on C_1, which is a function of the amplitude of the pulse and circuit time constants.

The action of diode-2 would be similar with opposite polarities. The negative sync pulse causes diode-2 to conduct and develop a positive charge or voltage on C_2, which is a function of pulse amplitude and circuit time constants.

The circuit is balanced so the net result of the negative charge on C_1 and positive charge on C_2 are equal and the voltage developed at point-*B* is zero volts.

If the voltage at point-*A* (previously considered to be a zero voltage) varies, the resultant voltage at point-*B* will vary.

If point-*A* were slightly positive at the time of the sync pulses, doide-2 would conduct more than diode-1, causing the positive voltage developed on C_2 to be greater than the negative voltage developed on C_1. The voltage at point-*B* would than be a positive voltage.

Conversely, if the voltage at point-*A* were slightly negative, diode-1 would conduct more than diode-2, causing the negative voltage developed on C_1 to be greater than the positive voltage developed on C_2. The voltage at point-*B* would then be a negative voltage.

The voltage at point-*B* is *dc* coupled to the grid of the horizontal oscillator. The horizontal oscillator is designed to operate at 15,750 cps with zero volts on the input grid. A positive voltage will decrease this

(*Continued on page* 34)

ESDA, Western Pennsylvania

THE ELECTRONIC SERVICE DEALERS Association of Western Pennsylvania, recently announced publication of a monthly journal, the *ESDA Scanner*.

B. A. Bregenzer is serving as editor of the magazine. Others on the staff include *John Gonsowski*, assistant editor; *Charles Barofsky*, business manager; *Joseph S. Doyle*, production manager; *Charles Colerich*, ad manager; *Harry Danko* and *Harry Schaup*, assistant ad managers, and *Thomas Ulrich*, photographer.

The issues will feature industry reports, comments on local and national association activities and a service-tip department.

ASSOCIATIONS

RTASCV, Santa Clara, Calif.

A PROGRESS REPORT on the use of tape for color-TV was delivered recently by *Harold G. Hummell* of the video section of Ampex during a meeting of the Radio and TV Association of Santa Clara Valley.

Highlights of a group insurance program for association members were also presented during the session. At present, the policy includes a $1,000 life insurance and accidental death and dismemberment plan with double indemnity for accidental death.

RTASCV, Calif.

ACCORDING TO *RTA* magazine, journal of the Santa Clara Radio and TV Association, a group of association members participated recently in a newspaper advertisement censuring do-it-yourself repairs.

"It's safe for your health and for your budget to use a skilled Service Man," the ad cautioned.

The ad featured the association's seal of confidence and listed all of the shops who bought space in the cooperative campaign.

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TSA, Detroit, Mich.

THE TELEVISION SERVICE ASSOCIATION, Detroit, Michigan, has established a consumer-credit reporting service for its members.

The program, known as the TSA Comprehensive Credit Assurance System, will enable members to check up on earlier credit and service experiences among set owners.

Provisions have been made for past due unpaid bills to be combined with the service charges due upon delivery of a chassis owned by the same customer, which may now be held or is being serviced in another TSA member's shop, whenever possible. It will also be possible to combine accounts for legal action.

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RTTG, Miami, Florida

THE RADIO AND TV TECHNICIANS GUILD NEWS, published monthly and edited by *Shan Desjardins*, has been expanded and now includes not only technical tips on servicing, but reports on association activities in the county, state and elsewhere throughout the country, as well as editorials by association heads and industry specialists.

All-American Award Winner

HARRY WARD, one of thirteen who received a G.E. All-American award for public service. . . . Ward has served four years on the advisory committee of the Long Beach City College Technology Division . . . has assisted in the selection of teachers to obtain highest standards . . . introduced an ability test to select only those who would be able to accept the training and become good Service Men, and now is public relations chairman of the Long Beach Radio-Television Technicians Association, Inc., which he was instrumental in organizing in 1938.
[SERVICE]

TRT, Kansas City, Mo.

L. A. BETROS and *F. D. Burkitt* have been elected to serve 3-year terms on the executive committee of the Television Radio Technicians Association of Kansas City, Missouri.

Others named to the committee were *J. W. Allen* and *R. C. Reynolds*, who will serve 1-year terms.

° ° °

LCSA, Wilkes Barre, Pa.

AT THE ANNUAL election of the Luzerne County Servicemen's Association, Wilkes Barre, Pa., all of the officers were re-elected for a second term: *Adam Deets*, president; *Al Spunar*, vice president; *Milan Krupa*, secretary; and *Joe Czapracki*, treasurer.

° ° °

NTSDA, Philadelphia, Pa.

THE NORTHEAST TELEVISION SERVICE Dealers Association was recently incorporated, according to a note from *Byron C. Frank*, association publicity director.

TEN YEARS AGO IN SERVICE

A PROPOSED N. Y. CITY licensing bill prompted the formation of an association —the Associated Radio Service Men of New York, Inc.—with a membership of 300. . . . An excellent enrollment-exam-code program was set up by the group; 50 questions covering all aspects of servicing were prepared by a board of experts who also supervised the tests. . . . A consumer complaint investigating committee was also set up and publicized on local radio stations. . . . *Max Liebowitz* was named president of the association; *Harry Anis*, corresponding secretary; *Norman Jacobson*, vice president; and *Jack Edel*, recording secretary and treasurer. . . . *Robert E. White*, general manager, and *Arthur C. Schofield*, advertising manager, of radio station KYW were awarded honorary memberships in the Philadelphia Radio Service Men's Association for their cooperation in a public-relations program to publicize PRSMA. *Dave Krantz*, PRSMA president, presented the tokens of appreciation . . . Other PRSMA officers who participated in the award ceremony were *Richard D. Devaney*, vice president; *Stanley W. Myers*, treasurer and *F. B. Guthrie*, recording secretary. . . . The Delaware Valley Service Men's Association changed its name to Radio Service Men's Association of Trenton, N. J. . . . *Frank W. Mansfield*, director of sales research for Sylvania Electric Products, Inc., predicted auto radio servicing would be a large factor in 1948. He noted that 84% of the '47 cars were radio equipped and production of auto units had hit a new high of approximately 2,860,000. . . . Admiral Corp. announced a nation-wide TV training course for its distributors. *Ray Petersen*, field service engineer, was named director of the course. Other staff members were *Max Schinke*, national service manager; *Joseph Marty*, assistant to the vice president in charge of the radio division; and *Ed Steinberg* and *Paul D'Arco*, both of the service division.

INDUSTRY NEWS

TRAINING FACILITIES EXPANDED

THE PHILCO TECHREP Division has announced that training facilities of the Philco Technological Center, 22nd and Lehigh Ave., Philadelphia, Pa., have been opened to all.

Among the technical services available are specialized correspondence courses designed for the experienced engineer and Service Man engaged in design, manufacture, installation or maintenance of electronic devices and systems.

NATIONAL HIGH FIDELITY MONTH

THE U. S. CHAMBER OF COMMERCE has officially recognized National High Fidelity Month, to be observed during October.

Announcement of the recognition was made by *Robert Walcutt*, president of Walco Products and chairman of the program to have observance established.

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ANTENNA PROMOTION PROGRAM

A 10-WEEK DISTRIBUTOR and Service Man seminar program was recently conducted in the midwest and western states by *Dan Rosenman*, distributor sales manager of Brach Manufacturing Corp., 200 Central Ave., Newark 3, N. J.

Program featured talks on Brach's *Speedmount* auto-antenna line.

COMPONENTS

COLD-PROCESS COMPOSITION RESISTORS

HIGH-STABILITY fixed composition resistors, *Coldite 70+*, have been developed by the Electronic Components Division of Stackpole Carbon Co., St. Marys, Pa.

Units are made by a cold-mold process and are available in ½-*w* (RC-20), short 1-*w* (RC-32) and 2-*w* (RC-42) ratings. Tolerances of 5%, 10% and 20% can be furnished in all EIA preferred resistance values. [SERVICE]

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SURGE CURRENT PROTECTOR

A SURGE CURRENT protector, *Surgistor* 4000, has been announced by Wuerth Tube-Saver Corp., 9125 Livernois Ave., Detroit 4, Mich.

Unit combines functions of a resistor and a relay and is connected directly into power line circuits. B+ voltages are said to be temporarily held down to prevent cathode *stripping*. [SERVICE]

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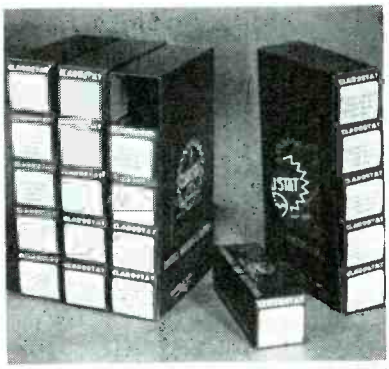
TV TRANSFORMER REPLACEMENTS

THREE FLYBACK transformers (HO-276, HO-277 and HO-278) for replacing Philco 32-8624/1, 32-8465-2, 32-8509/-2, 32-8484-2 and 32-8695/-1 units used in 22 chassis and 130 model numbers, have been introduced by Chicago Standard Transformer Corp., 3501 W. Addison St., Chicago 18, Ill.

Also available are two deflection yokes, DY-24A and DY-25A, for replacing RCA 103114, 972913 and Emerson 708288; a flyback replacement, HO-279, for Magnavox 360632-1; and three vertical output transformers, VO-103, VO-106 and VO-107, for RCA chassis. [SERVICE]

Control Packaging Sleeve



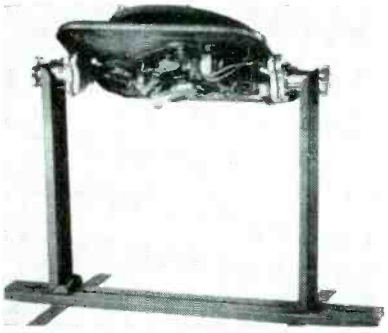
PACKAGING SLEEVE designed to keep stock orderly for jobber and Service Man. Vertical sleeve takes five cartons containing Clarostat series A47 or A43 controls. Sleeve features a tab-and-slot locking design, enabling several sleeves to be combined in a multi-pack unit from which any one of the several cartons can be removed. [SERVICE]

BENCH-FIELD TOOLS

CHASSIS CRADLE

A CHASSIS CRADLE, 5212, that rotates equipment 360° has been announced by General Cement Manufacturing Co., 400 S. Wyman St., Rockford, Ill.

Has speed clamps allowing chassis to be mounted or removed quickly. [SERVICE]



DRILL ACCESSORIES KIT

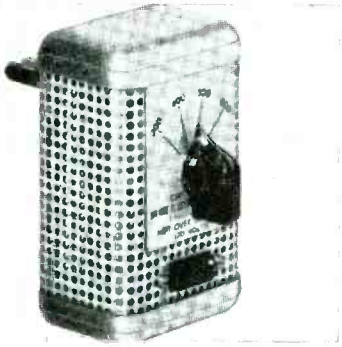
AN ELECTRIC-DRILL accessories kit, *Toter* 80K35, has been introduced by Wen Products, Inc., 5808 Northwest Highway, Chicago 31, Ill.

Measures 18"x16"x8" and contains a paint mixer, 3" wire brush, 3" x ¾" grinding wheel with ¼" shaft, 3" buffing wheel, 9 twist drills of various sizes in plastic case, 15 5" sandpaper discs, a 5" rubber pad, a 5½" lambswool polishing bonnet with 1" nap, 3 adapter sets and a speed stand. [SERVICE]

SOLDERING-IRON TEMPERATURE CONTROL

A SOLDERING-IRON temperature control, 40 (for 40-*w* irons) and 60 (for 60-*w* irons), for printed-circuit soldering, has been introduced by Drake Electric Works, Inc., 3654-56 Lincoln Ave., Chicago 13, Ill.

Heat is variable from 300° to 600°. Model 40 is for use with Drake 350, 360 and 365 irons; model 60 for Drake 400 iron. [SERVICE]



TEST INSTRUMENTS

RF SIGNAL GENERATOR

An RF SIGNAL GENERATOR, WR-49B, for applications requiring continuous wave or modulated *rf* signal of sine-wave form from 85 *kc* to 30 *mc*, has been announced by RCA, Harrison, N. J.

Rf output from unit may be modulated internally by a 400-cps audio oscillator or externally by an audio signal fed into a connector on the front panel. Internal 400-cps modulating signal is also available separately as a front panel connector. [SERVICE]

° ° °

FUSE CIRCUIT TESTER

A FUSE and fuse-resistor circuit tester, FS3, for checking either *ac* or *dc* or a combination of both, has been developed by Service Instruments Corp., 171 Official Rd., Addison, Ill.

Unit is connected in place of a fuse, fuse resistor or circuit breaker by test leads and automatically indicates whether or not it is safe to make a replacement. Separate scales are provided for each value fuse resistor. Each scale is green up to the maximum current used by TV manufacturers; red beyond that point. Also provides line current and power readings by plugging receiver into tester and tester into power receptacle. A 0-10 *amp* range is provided for these checks. Tester reads up to 1100 *w* at 115 *v*. A 5-ohm, 10-*w* resistor is wired in series with meter on fuse-resistor checks to prevent circuit damage and to simulate operating conditions. [SERVICE]

° ° °

TV/FM SWEEP GENERATOR

A TV/FM SWEEP generator, WR-69A, for sweep-frequency alignment of color and b-w TV and FM receivers, has been introduced by RCA, Harrison, N. J.

When used in conjunction with a 'scope, unit will provide a continuous trace display of bandpass characteristics of the receiver being tested. Provides *rf*, *if*, and video frequency output, permitting alignment of *vhf* tuners, picture-and-sound-*if* amplifiers, video amplifiers and chrominance circuitry in color-TV receivers. *Rf* output is provided for each of the 12 *vhf*-TV channels. Individual channel output is selected by a switch. Output at the intermediate and video frequencies is continuously tunable from 50 *kc* to 50 *mc*. Sweep width for FM-receiver alignment is continuously adjustable in the range from 88 to 108 *mc*. Maximum output voltage on all frequencies is at least .1 *v* rms. [SERVICE]

° ° °

SHOCK HAZARD DETECTOR PROBE

A TESTER, *Safe-T-Probe*, said to detect shock hazards in electronic equipment, has been announced by K-G Electronics Corp., 2738 N. Sheffield Ave., Chicago, Ill.

Unit checks for shorts and leakage current between exposed metal surfaces of equipment and both sides of *ac* line simultaneously; it is not necessary to remove plug from socket during test. [SERVICE]

CATALOGS—BOOKS

CLETRON INC., 1974 E. 61st Street, Cleveland 3, Ohio, has issued an 8-page illustrated folder with descriptions and specifications of coax speakers and systems with built-in crossovers, woofers, tweeters, and wide-range units featured in the *Cathedral* series. [SERVICE]

° ° °

HOWARD W. SAMS AND CO., INC., 2207 E. 46th St., Indianapolis 5, Ind., has issued *Auto Radio Removal—1956* and *Auto Radio Removal—1957* manuals with step-by-step instructions for removing radios, power supply units and speakers for '56 and '57 model cars. For each unit covered there is a list of tools required, phantom view of dash panel with radio in place and rear-seat speaker data. Each volume contains a brief summary on preliminary servicing procedures that can be used to determine if set must be removed for repair. Books contain 104 pages each and are priced at $2.95 per volume. [SERVICE]

° ° °

ALLIED RADIO CORP., 100 N. Western Ave., Chicago 80, Ill., has released catalog supplement 172 illustrating and describing hi-fi components and packaged units, radio receivers, test equipment, TV and FM antennas, amateur radio equipment, power tools, public address systems and tape recording equipment. [SERVICE]

° ° °

B&K MANUFACTURING CO., 3726 N. Southport Ave., Chicago 13, Ill., has released an illustrated 4-page bulletin, AP10, with specifications on portable video and audio generators, tube and tube-transistor testers, picture tube rejuvenators, test equipment calibrators and shorted-turns indicators. [SERVICE]

° ° °

JOHN F. RIDER PUBLISHER, INC., 116 W. 14th St., New York 11, N. Y., has released two volumes in the publisher's basic science series, *Heat* and *Sound*. *Alexander Efron* authored both books. . . . *Heat* covers basic theory, concepts of basic thermodynamics and their applications to heat engines such as turboprops, ramjets and rockets. *Sound* covers the physical nature of sound and characteristics of hearing, along with acoustics, musical instruments and the human voice. [SERVICE]

° ° °

GENERAL CEMENT MANUFACTURING CO., 400 S. Wyman St., Rockford, Ill., has released an illustrated 28-page technical book, *Electronic Chemicals*, with technical specifications and application information on oxide cleaners, cements, resin sprays, varnishes, lubricants, metal finishes and others. Priced at $1. [SERVICE]

° ° °

UNIVERSITY LOUDSPEAKERS, INC., 80 South Kensico Ave., White Plains, N. Y., has issued a 4-page brochure covering high-fidelity speaker systems and factory assembled enclosures. Illustrates how advanced principles of acoustics design are blended with cabinet styling. [SERVICE]

Service Notes

(*Continued from page 27*)

frequency of operation, while a negative voltage will increase the frequency of operation.

A sawtooth voltage derived from the horizontal output is applied at the point-*A*. This voltage or frequency is compared to the frequency of the station sync pulses.

Fig. 3 (p. 27) shows the comparisons which can exist; *a* shows the two voltages at the same frequency, while *b* shows the horizontal oscillator running faster than the station and *c* shows the horizontal oscillator running slower than the station.

When the two voltages are at the same frequency (Fig. 3*a*), the horizontal sawtooth is at zero volts, which puts point-*A* (Fig. 2) at zero volts and the resultant voltage at point-*B* is zero volts.

When the horizontal oscillator is faster than the station frequency (Fig. 3 *b*), a positive voltage is applied to point-*A* at the time of the sync pulses. This causes diode-2 to conduct more than diode-1, developing a positive voltage at point-*B*. This positive voltage will cause the horizontal oscillator to run slower until it is in time with the station, when the voltage at point-*A* is zero volts as shown in Fig. 3*a*.

When the horizontal oscillator is slower than the station (Fig. 3 *c*), a negative voltage is applied to point-*A* at the time of the sync pulses. This causes diode-1 to conduct more than diode-2, causing a negative voltage to appear at point-*B*. This negative voltage will cause the horizontal oscillator to run faster until it is in time with the station.

To check this circuit for proper action a *vtvm* should be connected between the horizontal oscillator grid and ground. The *dc* zero center scale should be used to preclude the necessity of switching from $+dc$ to $-dc$ volts and vice versa as readings are noted.

A TV signal should be tuned in, the horizontal-hold control rotated and the *vtvm* readings noted. Rotating the horizontal-hold control changes the frequency of the horizontal oscillator. In one direction, it will be faster than the station; in the other direction, it will be slower than the station.

This horizontal-oscillator frequency change will cause correction voltages to be developed by the phase detector and applied to the horizontal oscillator grid. These correction voltages should swing between approximately $+2$ and $-2v$.

Failure to obtain + readings would indicate:—

(1) Improper negative sync pulse from cathode of second clipper, (2) defective C_2. (3)

Needle Maker Honored

AT RECENT CEREMONY at the State House in New Jersey's State Capitol, Trenton, where Governor Robert B. Meyner, center, awarded a plaque to Steve Nester, left, president of the Duotone Company, Inc., in recognition of his achievements as a manufacturer of diamond needles. Looking on, J. Harold Hendrickson, president of the Keyport Businessman's Association. [SERVICE]

improper sawtooth at point-*A*, and (4) unbalance in selenium rectifiers; also defective D_2.

Failure to obtain — readings would indicate:—

(1) Improper positive sync pulse from plate of second clipper, (2) defective C_3, (3) improper sawtooth at point-*A*, and (4) unbalance in selenium rectifiers; also defective D_1.

To determine if the phase-detector circuit is causing the horizontal oscillator to be far off frequency or possibly not oscillating at all, the horizontal oscillator input grid should be shorted to ground. If the oscillator comes back to proper frequency or starts oscillating, the phase detector is applying an incorrect voltage to the horizontal oscillator.

Leakage Checks

For example, leakage in C_1 will allow some positive value of *dc* voltage to be applied to the horizontal oscillator grid. If the leakage is great enough, the voltage will prevent the tube from oscillating. The result is no high voltage caused by a shorted capacitor in the output of the clipper stage. Shorting out the horizontal oscillator grid would remove this positive voltage and the tube would oscillate and restore high voltage. Then checking circuits ahead of the horizontal oscillator would soon reveal the shorted capacitor.

If shorting out the horizontal oscillator grid did not restore oscillation or bring the oscillator in frequency, the trouble would be after the horizontal oscillator input grid.

Silicon Power Rectifiers

A silicon power rectifier is used in Motorola models 14P10 and 11. The advantages of smaller size, increased output and longer life make it a desirable inclusion.

From a servicing point of view, however, a silicon rectifier must be handled differently from a selenium rectifier. That is, a shorted silicon rectifier will cause the *B+* current-limiting fuse resistor to open.

This resistor, found in most all semiconductor type power suppliers, is generally in the order of five to ten ohms and is intended to open upon excessive current flow. This protects the power supply from overload.

Many have acquired the habit of shorting across an open fuse resistor and then proceeding to analyze the fault in the set. After the fault is found and corrected a new fuse resistor is installed.

This technique is not recommended for every type receiver, particularly those using silicon power rectifiers.

If the fuse resistor is shorted out for analyzing purposes in a set containing a shorted silicon rectifier, serious damage can result.

In the case of the Motorola TS-425 chassis, shorting out the fuse resistor, which would also short the silicon rectifier, will cause direct *ac* line voltage to be applied across the B+ filter and capacitor C_{801A-B} (Fig. 4; p. 27) will become very hot and could explode.

In a silicon rectifier voltage-doubler circuit, the same condition would obtain. Here, however, the filter capacitors affected would depend on which of the two rectifiers were shorted.

Therefore, one should avoid shorting out B+ fuse resistors for analysis purposes. The hazards involved are dangerous.

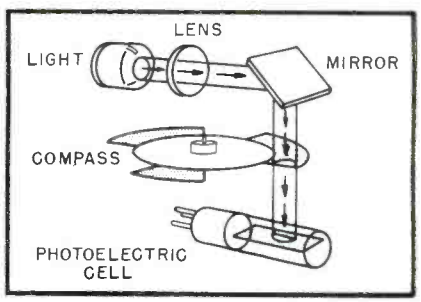
Service Engineering

(*Continued from page* 18)

100 watts input. A *pi* network in the transmitter output is used to attenuate harmonic and spurious radiations by more than 60 db. Speech-clipping circuits permit maintenance of a high overall percentage of modulation without spillover, resulting in higher effective voice power. A filter in the speech-amplifier circuit increases intelligibility by restricting bandpass to voice frequencies which at the same time keeps the transmitted signal narrower. Above 3,000 cps, audio response is sharply attenuated, being down 30 db at 4,000 cps.

The transmitter[1] has eight tubes of which three are in the *rf* portion, the balance in the speech amplifier-modulator circuit. A 6CL6 serves as the crystal oscillator and buffer amplifier, while a pair of 6146s serve as the final *rf* amplifier.

In the receiver[1] one watt of audio can be produced with an input signal of less than three microvolts. Image rejection is more than 60 db and *if* rejection is better than 100 db. To provide ample selectivity, but yet with a broad enough nose (6 kc) to prevent excessive distortion, the chassis have been designed to provide 60 db of attenuation of signals ±15 kc off resonance. *AVC* action keeps audio level changes to less than 12 db, even with *rf* signal input variations extending from 10 microvolts to one volt. An automatic disabling, series-impulse type noise silencer has been introduced to keep static and noise down, while an anti-fade squelch circuit serves to keep the speaker quiet until a signal of suffi-



PHOTOELECTRIC control of Bendix automatic pilot. A beam of light is projected through the compass onto a sensitive photoelectric cell. The slightest deviation from course causes the compass card to change the intensity of the light beam. This results in more or less light falling on the photoelectric cell, which, being sensitive to light variations, creates a corresponding change in electrical current. This small change in current, when amplified, causes the steering unit to give right or left rudder to bring the vessel back on course. Since the compass card serves only to interrupt a tiny ray of light, it is free and instantly responsive to the slightest change in course.

cient strength is received. The anti-fade feature keeps the speaker turned on even during a fade once the squelch has been opened.

There are eight tubes also in the receiver. An *rf* stage precedes the mixer which is followed by two *if* stages. A 12AB5 is used in a single-ended audio output stage. Plated hermetically sealed crystals are used to provide better stability than earlier types of crystals.

This particular model[1] does not include an AM broadcast band tuner, but is instead designed for use with an external remote broadcast tuner which can be installed at any convenient location on a boat. This is a practice often used on commercial vessels where a broadcast band tuner is not required. When broadcast reception is desired, a remote tuner can be installed initially or added later. Smaller, lower powered sets are generally provided with built-in broadcast tuners since they are more widely used on pleasure craft and fishing boats where the entertainment feature is often desired.

The markets for marine radio servicing are expanding. Recently, it has become a requirement that party boats and even small passenger carrying vessels be equipped with radiotelephones as a safety measure. Outboard craft are also being equipped with radiotelephones in ever increasing numbers. This has brought up the problem of adequate electric power.

Small boats are often equipped with 6- or 12-volt batteries. Larger vessels may have a 12-, 32, 110- or even a 220-volt *dc* power source. Sailboats and those using outboard motors may not have any source of electric power. To use the radio a battery must be installed or power may be derived from a gasoline engine driven generator.[2]

Servicing of marine electronic gear is a lucrative field for the Service Man. In addition to being skilled with electronic equipment, knowledge of boats and transmitters is essential. Anyone who services radio transmitters must possess either a first or second class radiotelephone operator's license or work under the direct supervision of a licensed man.[3]

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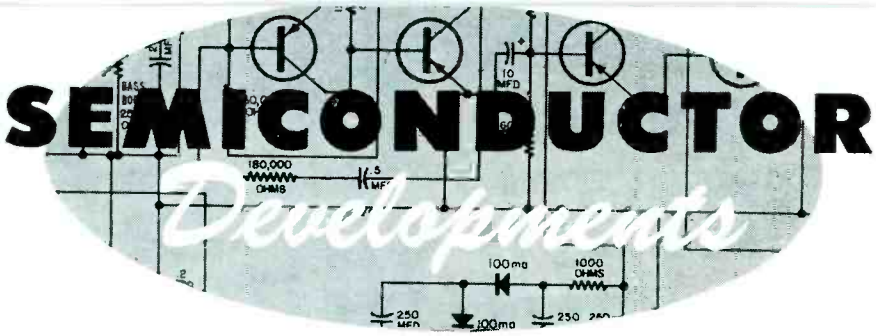
[2]*Such as the Bendix portable which delivers up to 750 watts at 110 v ac.*

[3]*Those interested in getting into the marine radio field can get a good start at getting familiar with the art by reading a new book* Ship Telephony Educational Program *published by the Radio Technical Commission for Marine Services, Federal Communications Commission, Washington 25, D. C. The book sells for 50 cents.*



Latest Information on Audio and Silicon Unijunction Transistors

JUNCTION TRANSISTORS (germanium *pnp*-alloy type; 2N407 and flexible-lead version, the 2N408) for class *A* and *B* audio service have been announced by RCA.

These transistors have a maximum *dc* collector cutoff current of −14 microamps, a maximum *dc* emitter cutoff current of −14 microamps, and a current transfer ratio of 65. In class *A* and *B* *af* amplifier service, their maximum *dc* collector-to-emitter voltage rating is −18 *v* and their maximum *dc* collector-to-base voltage rating is −20 *v*.

Junction Transistor Class A AF Driver

FOR CLASS A *af* driver service RCA has developed another pair of *pnp* transistors, the 2N405 and a flexible-lead version, the 2N406. In a common-emitter type of circuit, these transistors have a typical small-signal current transfer ratio of 35, and a matched-impedance power gain of 43 db.

Silicon Unijunction Transistors

SIX TYPES OF SILICON UNIJUNCTION transistors (2N489 through 2N494)[1] have been developed by G. E.

The unijunction transistor is said to be the nearest solid-state equivalent of a small controlled-grid thyratron.

In contrast to the conventional junction transistor, the unijunction transistor is a device exhibiting open-circuit-stable negative resistance characteristics. Thus it is primarily useful in switching and oscillator circuits. In addition, it is claimed to have the ability to sense voltage levels and temperature variations. Or by various circuit modifications, it can be made insensitive to temperature and voltage variations.

Application engineers say that the unijunction transistors are desirable for many different electronic circuits, and are particularly recommended for relaxation oscillators, sawtooth and pulse generators, pulse rate modulators, pulse amplifiers, multivibrators, flip-flops and time delay circuits; see circuit below.

The internal construction of the unijunction transistor consists of a uniform doped *n*-type single crystal silicon bar with ohmic contacts at each end and an aluminum wire attached to the silicon bar between them.

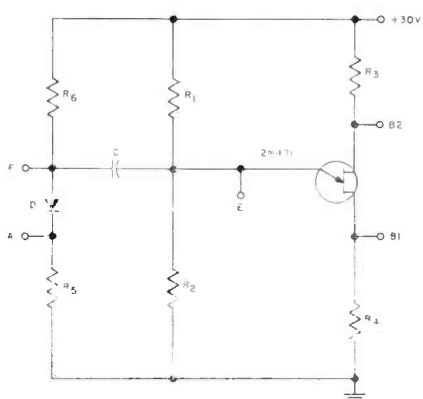
The two ohmic contacts to the silicon bar are called base 1 and base 2. The room temperature base to base resistance range is 5,000 to 10,000 ohms. The aluminum wire connected to the silicon bar between the two ohmic contacts forms a *pn* junction; this is the emitter.

The operation of the unijunction transistor is dependent upon modulation of the conductivity of the bar between the emitter and base 1 when the emitter is forward biased.

In the cutoff or standby condition, the emitter and interbase power supplies establish potentials between the base contacts, and at the emitter, so that the emitter is back-biased.

If the emitter potential is increased sufficiently to overcome this bias, holes are injected into the silicon bar. These holes are swept towards base 1 by the internal field of the bar. The increased charge concentration, because of these holes, decreases the resistance and at the same time decreases the internal voltage drop from the emitter to base 1.

[1]The unijunction transistor, originally called the double-base diode, was invented by I. A. Lesk of the General Electric Advanced Semiconductor Laboratory.



BASIC CIRCUIT for silicon unijunction transistor. Values of R_1 may vary from 2200 to 390,000 ohms; R_3, 820 to 5600 ohms; R_6, 330 to 47,000 ohms; R_4, 10 to 250 ohms; and R_5, 10 to 100 ohms, depending upon function.

Color-TV

(*Continued from page 13*)

converge red and green. With the perfect picture tube and associated components, red and green can be compared to blue and perfect convergence will result. However, production tolerances have to be taken into account and therefore some color fringing may result. The blue raster may be used for a reference for basic setup and if the green and red rasters match blue perfectly, the convergence job is completed.

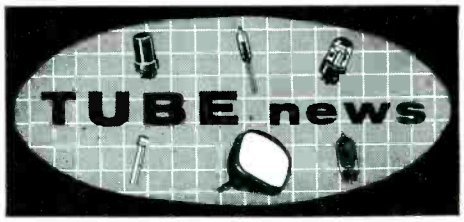
In some cases, red and green will not be perfectly converged over all areas of the screen. From this point all adjustments are compromise settings and the best compromise must be made. As already mentioned, blue is the best fringe color; therefore red and green convergence must be made as good as possible, and blue will be considered as of secondary importance. This procedure as outlined will produce the most effective end result.

A color-television receiver, adjusted as described, will produce a picture that appears as good as the receiver with the best selected picture tube and associated components at normal viewing distance.

The third factor, color temperature uniformity, is the result of the proper adjustments of the screen grid and bias voltages of the electron guns in the tube, and the video signal voltages applied. In some color-TV receivers, the video signal voltages are applied to the picture tube grids, and the blue and green video signals are made adjustable. The screen and background controls are adjusted without signal to produce a gray of the desired color temperature, and the blue and green video gain controls are adjusted to make the picture highlights match this color temperature. In a receiver of this type, we are adjusting the cutoff bias of each gun for the desired gray, and then adjusting the video signals to make the desired white with this preset bias.

Most color-TV receivers apply the monochrome video signal to the picture tube cathodes and the color video signals to the grids. The monochrome video signal is divided between the three cathodes in a ratio that will provide the desired color temperature. The G_2 and bias voltages of the tube are adjusted so that the beam currents of the guns, when driven by their monochrome video signals, excite the phosphors in such proportions

(*Continued on page 41*)



Miniatures for Auto Radios . . . 90° Replacements . . . Auto Headlight Dimming Phototubes

Two 12-v MINIATURE tubes for auto radios, a 12K5 and 12U7, have been added to the renewal line of Sylvania Electric Products, Inc.

The 12K5 is a tetrode designed for space-charge operation as a power amplifier driver where potentials are obtained directly from a 12-*v* car battery. The 12U7 is a general purpose double triode for 12-*v* hybrid auto receivers.

Low Grid-V TV Picture Tubes

Two 17-INCH, 90° picture tubes, designed with a low (50-*v*) grid-2 voltage, permitting operation with less expensive video output receiving tubes, such as found in *off-the-line* receiver circuits, or broader band video stages, have been announced by Sylvania.

The tubes, (types 17CMP4 and 17CNP4) feature magnetic deflection, electrostatic focus and do not require an ion trap. Both are aluminized.

Headlight-Dimming Phototube

A SHORT MULTIPLIER phototube (7117) of the nine-stage type, designed especially for use in auto headlight-dimming equipment, has been developed by the RCA Electron Tube Division.

The tube is said to have instantaneous response to meet the critical timing of headlight-control service, and a high luminous sensitivity allowing use of an amplifier with relatively low-impedance input.

Steam Iron Cleaner Display

DISPLAY CARTONS containing one dozen plastic bottles of Fast Chemical SSS-T steam iron cleaner. [SERVICE]

(*Continued from page 39*)

as to produce the desired color temperature white and gray. Assume, for example, a color-TV receiver whose picture tube has been replaced with one having a lower efficiency blue phosphor. It is obvious that some readjustment will be necessary to make it produce the same color temperature white. To make the blue gun draw more beam current, and thus produce more blue light from the phosphor—without increasing the blue monochrome video signal—we would lower the blue screen voltage and, since this changes the blue gun cutoff, we would lower the blue gun bias until a dark gray of the desired color temperature had been produced. If the screen voltage was lowered by the correct amount, the desired color temperature white will be produced.

This example illustrates how the screen voltage of the picture tube gun is used to control its transconductance, and thus produce more or less beam current (which is proportional to phosphor light output) from the same monochrome video signal. To make a touchup adjustment of color temperature, the brightness control of the receiver is adjusted for a dark picture and the background controls are adjusted for a neutral gray picture. This adjustment sets the cutoff bias on the three guns. The brightness control is then advanced for a bright picture and the brightest parts of the picture are examined. If the bright picture seems to be too red, blue or green, the corresponding screen voltage must be raised. If the bright picture lacks red, blue or green the corresponding screen voltage must be lowered. After any screen-control adjustment, the background controls must be readjusted as described to reestablish proper cutoff bias.

Probably the biggest single reason for misadjustment of color temperature in this type receiver is that the adjustment of the screen controls seems to be in the wrong direction. Thus, if more blue in picture highlights is desired, the blue screen control must be lowered, and this makes the highlights even more yellow until the blue background control is readjusted for cutoff. Because of this seeming contradiction, some Service Men have found they can do a fair job of adjusting color temperature by adjusting the screen controls to make the lowlights a neutral gray and adjusting the background controls to make the highlights a neutral white. This procedure will get the controls in range rather quickly, but makes a precise adjustment rather difficult.

A practice session, using the picture on a black and white television receiver for comparison, will be helpful in learning how to adjust the controls.

Another factor to be considered is that as the screen voltages are increased, the spot size is decreased and focus improves—resulting in a sharper picture. Highlight areas in the picture do not defocus or bloom as readily, and allow a higher brightness or contrast control setting. For this reason, maximum—or near maximum—screen-control settings should be used to the extent that the brightness control will allow the picture to be extinguished, or nearly so, when at the minimum brightness position.

The importance of a correct color temperature setup cannot be overemphasized. A poor job will accentuate small faults in purity and convergence to a point where they are readily visible, but a good job will make a very acceptable picture on a receiver which has marginal purity and convergence. The most common fault is to make the highlights yellowish and the lowlights greenish. This happens because we are accustomed to seeing the low color temperature white light reflected from white paper and painted surfaces. The source of this light is often an incandescent lamp, whose color temperature is 2400° Kelvin. Contrast this with the color temperature of the average modern black and white picture tube, about 8500° Kelvin, whose color temperature we should match when setting up the color television receiver. The light from a *daylight* fluorescent lamp, whose color temperature is approximately 6800° Kelvin, is much closer to the color of the white light we want than any other common source excepting a modern black and white tube.

When the principles involved in the purity, convergence, and color temperature adjustment procedures are fully understood, some practice in adjusting the servicing controls of a color-TV receiver is necessary to put them into effect. This practice is not easily obtained during the actual installation because working conditions in the customer's home usually do not allow the necessary concentration. This amount of concentration is needed if the eye is to be trained to recognize these principles of operation.

One or two undisturbed practice sessions of two hours each will enable one to reduce color-television setup

(*Continued on page 42*)

Color-TV

(*Continued from page 41*)

time by at least 50% during the *break-in* period. The following basic setup procedure can be used on most color-TV sets using a 21" round tube:

(1) Unpack the set, attach antenna lead, turn on the receiver, and demagnetize.

(2) Check all the customer's normal tuning controls that affect the black and white picture for proper operation. Keep room lighting as dim as possible.

(3) Observe center convergence. If acceptable, proceed to step 6.

(4) Short the blue grid of the picture tube with a 100,000-ohm resistor to ground. Converge the red and green rasters in the center of the screen using the red and green center convergence controls.

(5) Remove the short (in step 4) from the blue grid, and converge the blue and yellow rasters using the blue center convergence control and the blue lateral magnet on the neck of the picture tube.

(6) Connect the green and blue grids to ground through 100,000-ohm resistors.

(7) Observe red field for purity.

(8) If necessary, readjust the purity and field equalizing magnets.

(9) Remove the 100,000-ohm resistors connecting the green and blue grids to ground.

(10) Recheck center convergence and readjust if necessary.

(11) Observe the black and white picture. If satisfactory, no further setup is required.

(12) If the color temperature is unsatisfactory, make slight touch up adjustment as described earlier.

(13) Receiver performance should now be completely satisfactory for black and white pictures.

Cornerstone Ceremony

JOSEPH A. DeMAMBRO (front, left), president of NEDA, laying cornerstone for the new Merit Coil and Transformer Corp. building in Hollywood, Florida, while Charles C. Koch, Merit president (front, right); Gail S. Carter, Merit sales director (top, left); Nicholas Berkos, Merit general counsel, and Peter A. Consiglio, Parker Metal Goods Co., look on. [SERVICE]

Audio

(*Continued from page* 20)

recorder chassis which affects tape output only.

Tape Equipment Maintenance and Repair

PERIODIC CARE of tape recorders is extremely important. The magnetic head surfaces, capstan shaft, capstan pressure pulley and tension arm guides should always be inspected for sludge deposits left by the tape. The metal parts should be cleaned regularly with a soft, dry rag and a few drops of carbon tetrachloride, if necessary. The rubber capstan pressure pulley should be cleaned with soap and water only, and allowed to dry thoroughly. An oily rag or an abrasive cloth should never be used on these surfaces. Brake bands also should be checked periodically. Metal particles should be removed from the brake lining, using a soft rag dampened with carbon tetrachloride.

The capstan bearing requires periodic lubrication, depending on usage: Enough SAE 20 oil should be applied to soak the oil wick. The oil wick cover should be removed and the wick oiled.

The capstan motor should be oiled every week; SAE 20 oil should be applied through the two oil holes on top of the panel. A small amount of oil may be applied as needed around the bushings of other moving parts. All excess oil should be wiped off to prevent any from getting on the tape or inside the solenoids.

The supply and tapeup motors

(*Continued on page* 44)

TWEETER DEMONSTRATOR designed to show how a tweeter improves treble response in a single-cone speaker system. Preassembled unit, including tweeter and a crossover network, is connected to shop's single-cone speaker system. Flip of switch cuts in tweeter with its 1500-15,000 cycle response.—Model A1-404 (tweeter) and A1-421 (crossover network); General Electric Co., Box 101, Liverpool, N. Y. [SERVICE]

have ball bearings and require no lubrication.

It is also important to demagnetize the record and playback heads regularly, at least once each month. The tip of a demagnetizer should be run up and down the core three or four times and then the demagnetizer should be removed very slowly. The heads should always be demagnetized after they have come in contact with cutting shears, screwdrivers, or other metal implements. Occasionally the capstan shaft may also become magnetized, and it should be demagnetized in the same manner as the heads.

Tape Troubleshooting

If the mechanism fails to start in record, playback, or fast speed operation, the probable cause is that the tape is not properly threaded through the takeup tension arm, leaving the tape tension microswitch open.

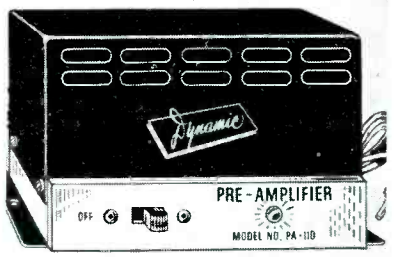
To correct, the tape should be rethreaded.

If the mechanism fails to start in rewind or fast-forward speeds, one should check the fast-speed potentiometer which is probably in neutral position.

The fast-speed control knob should be moved toward *R* or *F* as desired.

If tape breaks when the mechanism is started in record or playback, the trouble is probably due to failure of the capstan microswitch, which inserts a resistor in series with the takeup motor to reduce voltage after starting. Microswitch and capstan solenoid link which opens microswitch mechani-

TWEETER, with a program-capacity power of 35 watts, said to provide a wide angle distribution pattern throughout 2,000 to 17,500-cps range. Diaphragms are checked for weight and compliance to assure functional uniformity in production. Impedance is 12 to 16 ohms. Cabinet opening required is 6" x 2".—Model HR-3; Atlas Sound Corp., 1451 39th St., Brooklyn 18, N. Y. [SERVICE]



PREAMP featuring wide-range response, noise and hum level 60 db below 10 mv and overall gain of 34 db.— PA-110; Dynamic Electronics-New York, Inc., Forest Hills, Long Island, N. Y. [SERVICE]

cally should be checked. If trouble persists because of poor timing of the takeup motor, the stop bar on the lower microswitch should be adjusted so that it neither activates the takeup motor too late nor deactivates it too soon. Adjusting should continue until timing is correct. If the microswitch proves faulty, it should be replaced. If tape breaks when the mechanism is stopped in fast forward or fast rewind speeds, there is improper or unequal braking on the supply or takeup motor. Brakes should be adjusted to require tension using brake-tension-adjusting nuts. If the tape breaks when the mechanism is started in fast toward or fast rewind speeds, there is excessive voltage on the supply or takeup motor. Fast-speed control knob should be set nearer to neutral position to reduce voltage. Control can then be turned to *R* or *F* position for full-speed operation.

NEW VERSION of Studio Dynetic moving magnet-stationary coil phono tone arm and cartridge for installations where space is limited. Features one-gram needle (.7-mil diamond) pressure for microgroove records, and handles records up to 12 inches. Cartridge for 78s with a 2.7-mil diamond stylus is also available; tracking force here is 2 to 2½ grams.— Model M12; Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill. [SERVICE]

TV Antennas

(*Continued from page 23*)

sion line, which is impossible, or some technique to get around the loss.

Preamplification

If we can mount an amplifier, of the broadband type covering the FM spectrum, at the top of the antenna mast it will raise the antenna signal before the line loss has a chance to drop it down where the signal-to-noise ratio is too poor to allow it to be amplified. If the gain of the amplifier is greater than the line loss, then the tuner will see a signal greater than the one at the antenna terminals. The only limiting factor here is that the amplifier must have an extremely good noise figure, so that the amplifier's input noise does not become a significant factor. Such amplifiers are usually distinguished by calling them *preamplifiers*.

For this purpose, a mast-mounted type preamplifier with a 25 db gain (about 18 times voltage) has been developed.[1] It has been so designed that no power lines need be run up the mast; 24 volts *ac*, which pass up the same cable which brings down the signal, operates the amplifier. The 24 volts originate from a remote-power supply which is part of the unit. The unit, incidentally, has a 20-db signal-to-noise ratio with .6 microvolt input.

The same amplifier is available as an indoor unit.[2] These units require no tuning, being broadband, but certain precautions must be observed when powerful locals are close by, within a few miles. The preamplifiers can be overloaded, in which case the listener will find the powerful local appearing most of the way across his dial. A trap inserted ahead of the preamplifier, between antenna and preamplifier input to reduce the power of the local, will alleviate this difficulty.

Co-channel and Adjacent Channel Interference

The remarks about the powerful local bring up the difficulty of stations either on the same frequency or so close that the tuner cannot separate them. If the importance of the reception justifies it, an array of two antennas can be used to attenuate the undesired station, while giving gain on the desired station. Such

[1] *Jerrold DSA-FM Range-Extender.*
[2] *406-A-FM.*

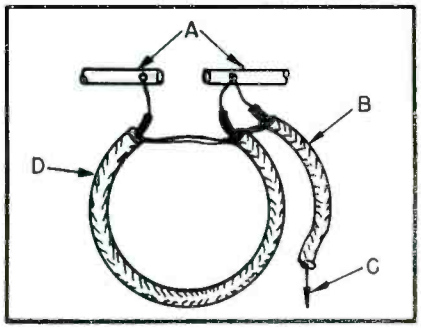


FIG. 3: CONSTRUCTIONAL DETAILS of a 300-75 ohm balun: a = 300-ohm antenna terminals; b = braids, which should be connected together; c = 75-ohm leadin of coax; d = one-half wavelength of coax.

problems are encountered in commercial FM sound installations and when off-the-air program-material pickup is involved.

With a horizontally-polarized signal, such as FM broadcast, two antennas placed side by side, and parallel, will show a null from four angles differing from the angle of orientation. These nulls will occur at different angles, dependent on the spacing of the two antennas. Properly connected, such an array will show a doubling of received power from the desired station, which is a 3-db voltage increase.

The theory of this action depends on the fact that antennas coupled with a symmetrical harness must intercept the same wavefront from the transmitter at the same time to be in phase. Currents must be in phase to add. At the same time, from some other angle, radiated wavefronts could arrive at these antennas such that one antenna was energized by one wavefront at the same time as the other antennas was energized by the following wavefront, which will of opposite polarity. Adding currents of opposite polarity, or phase, produces cancellation. A rejection ratio of 20 db can be obtained by careful adjustment of such an array.

In practice, the angle the undesired station makes with the desired station is determined by laying lines on a map, and measuring with a protractor. The angle is then spotted on a graph as noted in Fig. 2 (p. 23). The interception of this vertical line with the curve establishes the spacing of the antennas in wavelengths, at the frequency of the undesired station.

Such an array should use coax *harnessing* or phasing leads, to prevent the harness from acting as part of the array. Since almost all antennas are 300 ohms it is necessary to match this 300-ohm impedance, balanced, to 75 ohms impedance, unbalanced, to match RG-59 or RG-11 type coax cable. This is done with a balun, con-

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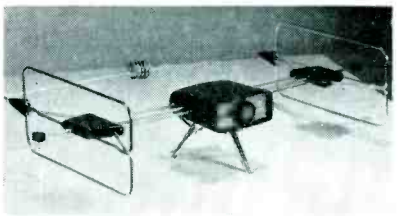
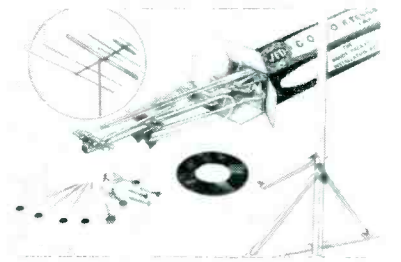


INDOOR TV antenna with a disappearing dipole to boost low-band performance and a parasitic reflector to aid high-band performance. Features a 12-channel variable inductance tuning system for channel selectivity. Rotates in all directions on a tripod. Total height is 6′.—Super Showman; Channel Master, Ellenville, N.Y. [SERVICE]

sisting of a half-wavelength of coax cable, of whatever type is used for the leadin. If the array is used for only one station, the balun should be cut to the frequency of the desired station. If it is used in a broadband application, then the balun should be cut to band center; 98 mc. The formula for the balun length is detailed in Fig. 2. This formula contains the correction for the reduced velocity of propagation in coax cable of the solid polyethylene types. If the new foamed polyethylene low-loss cables are used, the formula is ½λ (one half wavelength) in inches=4800/f(mc), since these cables have a higher velocity of propagation. The construction of a balun is shown in Fig. 3. It should be taped carefully and doped to waterproof the exposed cable ends. Braids should be soldered together. The balun may be tied or taped to the antenna boom or spine to provide strain relief.



COMPLETE TV-ANTENNA installation kit containing a factory-assembled antenna, aluminum mast, 50′ twin lead, three 3½″ and one 7½″ wood screw eye standoffs, two mast standoffs, and three self-sealing drive-in nails. The mount is said to facilitate mounting on the peak or side of the roof, on flat roofs, on eaves or on sides of the house.—Available with Standard Fireball FB500TP, Gold Anodized Fireball AB500TP, Standard Super-Helix RX511TP, Gold Anodized Super-Helix AX511TP, Standard Junior-Helix JX311TP, Gold Anodized Junior-Helix AX311TP; JFD Electronics Corp., 6101 Sixteenth Ave., Brooklyn 4, N. Y. [SERVICE]

PERSONNEL

ROBERT R. WILLIAMEE has been promoted to supervisor of renewal sales service, radio tube division, Sylvania Electric Products, Inc., Williamsport, Pa.

° ° °

HOMER L. MARRS has been appointed vice president and operations manager, Motorola Communications and Electronics, Inc., 4501 W. Augusta Blvd., Chicago 51, Ill. . . . *Harold A. Jones* succeeds Marrs as vice president and mid-western area sales manager.

° ° °

DAVID BRODY has been named general manager of Philco Distributors, Inc., Philadelphia, Pa.

° ° °

ROBERT J. HIGGINS has been appointed advertising supervisor, high fidelity phonograph and radio, radio and television division, Sylvania Electric Products, Inc., Batavia, N. Y.

° ° °

FRANK RANDALL has been appointed president of Amperex Electronic Corporation, Hicksville, Long Island, New York. *Randall* had been vice president and general sales manager.

Randall

° ° °

THE STEVE FISHER SALES CO. has been named to represent Jersey Specialty Co., Inc., in Metropolitan New York and New Jersey. . . . *The Dienes-Rife Co.* will cover eastern Pennsylvania, Maryland, District of Columbia, Virginia and southern New Jersey. . . . *Lewis and Trimble, Inc.*, for eastern Wisconsin and Illinois. . . . *Leon S. Bush Co. will cover* Colorado, western Nebraska, western South Dakota, New Mexico, Utah and Wyoming.

° ° °

ROBERT BLODGET has been named director of marketing, Electrical Communications, Inc., 555 Minnesota St., San Francisco, Calif.

° ° °

ROBERT G. MARCHISIO is now vice president and general manager of semiconductor operations, CBS-Hytron. . . . *Michael Callahan* has been named vice president and general manager of receiving tube operations.

° ° °

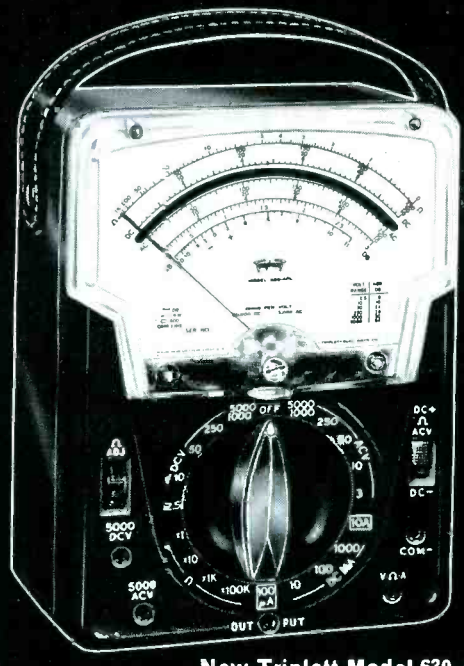
ROY RAYMOND has joined Stromberg-Carlson as district sales manager for commercial sound products in New York City.

° ° °

L. H. HARRISS has been elected president of The California Chapter of The Representatives. . . . *Charles E. Ault* was named vice president and *Frank Lebell*, secretary-treasurer. The new board of governors consists of *Win W. Tompkins, Sherwood French* and *Phil Belchamber*, with *Tompkins* as chairman.

the mighty nine plus two!

New Triplett Model 630-PL



New Triplett Model 630-APL

TWO NEW VOLT-OHM-MILLIAMMETERS

Now the Triplett Mighty Nine Has Expanded to A Line of 11 VOMs Tailored to Meet Your Preference, Purse or Purpose. Only Triplett Offers So Complete A Variety.

With the new 630-PL and 630-APL you get these important new features:

- Voltage scales for those who want ranges reading by 10's (2.5-10-50-250-1000-5000).
- Instant-vision, wider spread scales; streamlined case, handsome modern design.

- D.C. Polarity Reversing Switch.
- 5 to 50,000 Cycles per second frequency response in A.C. measurements.
- 5000 ohms per volt sensitivity in A.C. ranges; 20,000 ohms per volt D.C.

Both new testers — with the popular continued Models 630 and 630-A—offer these proved Triplett advantages:

- One switch will select any range; minimizes chance of incorrect settings and burnouts.
- Reads from .1 ohm (4.4 ohm center scale) to 100 megohms; four ranges.
- Molded circuit panel for instant component replacement.
- Models 630-APL and 630-A feature ½% resistors for greater accuracy; long mirrored scales to eliminate parallax in reading.
- Banana-type leads for low contact resistance at jacks.

how do you want it?

X 3s or X 10s

Triplett Models 630 and 630-A read volts 0-3-12-60-300-1200-6000); or Triplett New Models 630-PL and 630-APL reading 2.5-10-50-250-1000-5000.

Choose your preference in range reading.

MODEL 630-PL... Dealer Net $44.50
MODEL 630-APL. Dealer Net $54.50
MODEL 630..... Dealer Net $44.50
MODEL 630-A.... Dealer Net $54.50

Only Triplett offers 11 VOM's — a line complete enough to give you exactly what you want.

TRIPLETT

Triplett Electrical Instrument Co.
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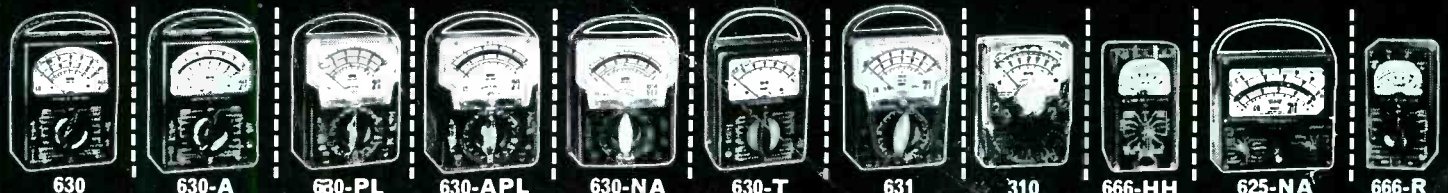
53 Years of Experience

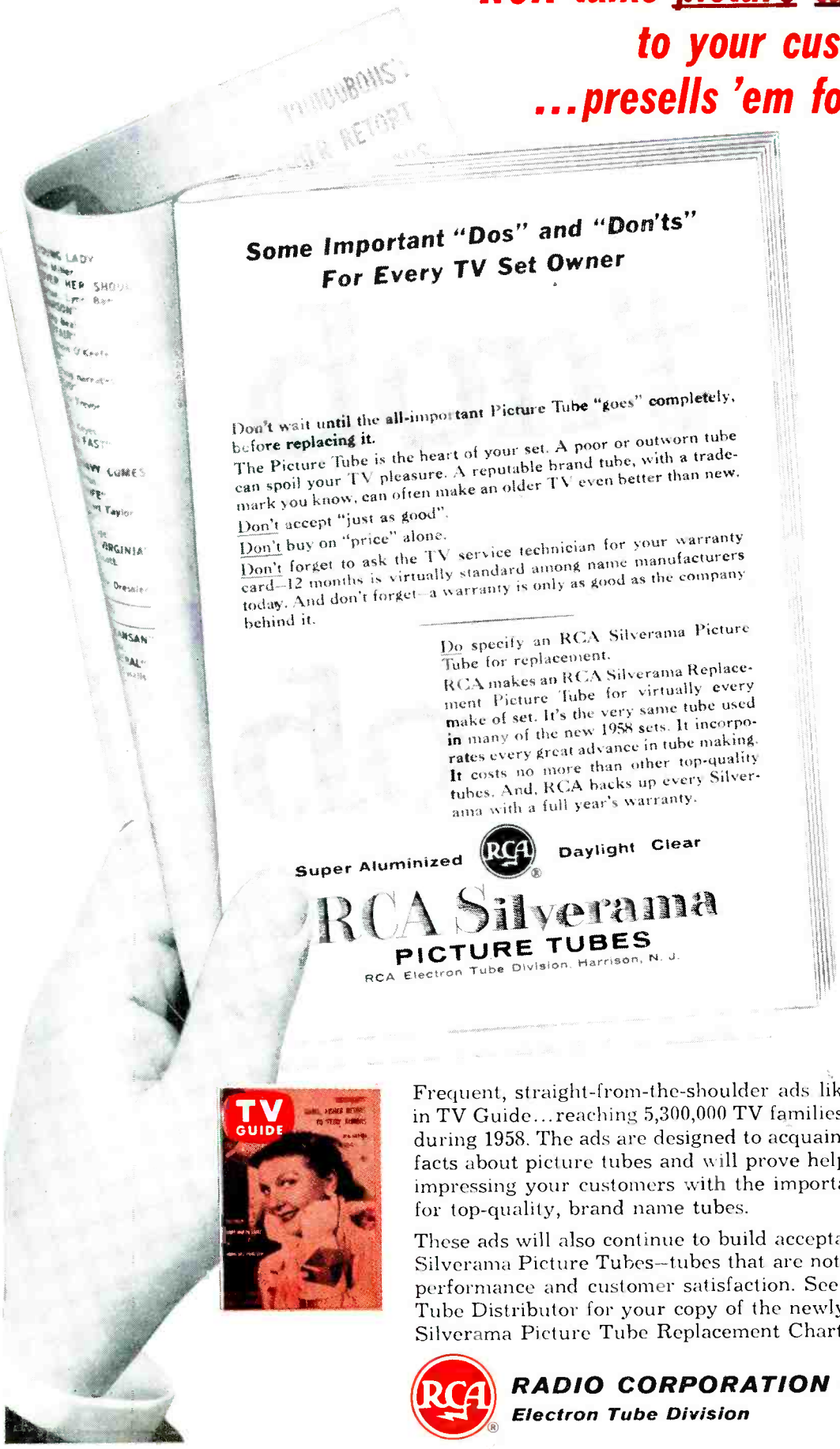
Triplett Model 630

Triplett Model 630-A

Burton Browne Advertising



RCA talks picture tubes to your customers ...presells 'em for you!



Frequent, straight-from-the-shoulder ads like this will appear in TV Guide...reaching 5,300,000 TV families coast to coast during 1958. The ads are designed to acquaint the public with facts about picture tubes and will prove helpful in impressing your customers with the importance of asking for top-quality, brand name tubes.

These ads will also continue to build acceptance for Silverama Picture Tubes—tubes that are noted for trouble-free performance and customer satisfaction. See your RCA Tube Distributor for your copy of the newly revised RCA Silverama Picture Tube Replacement Chart.

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