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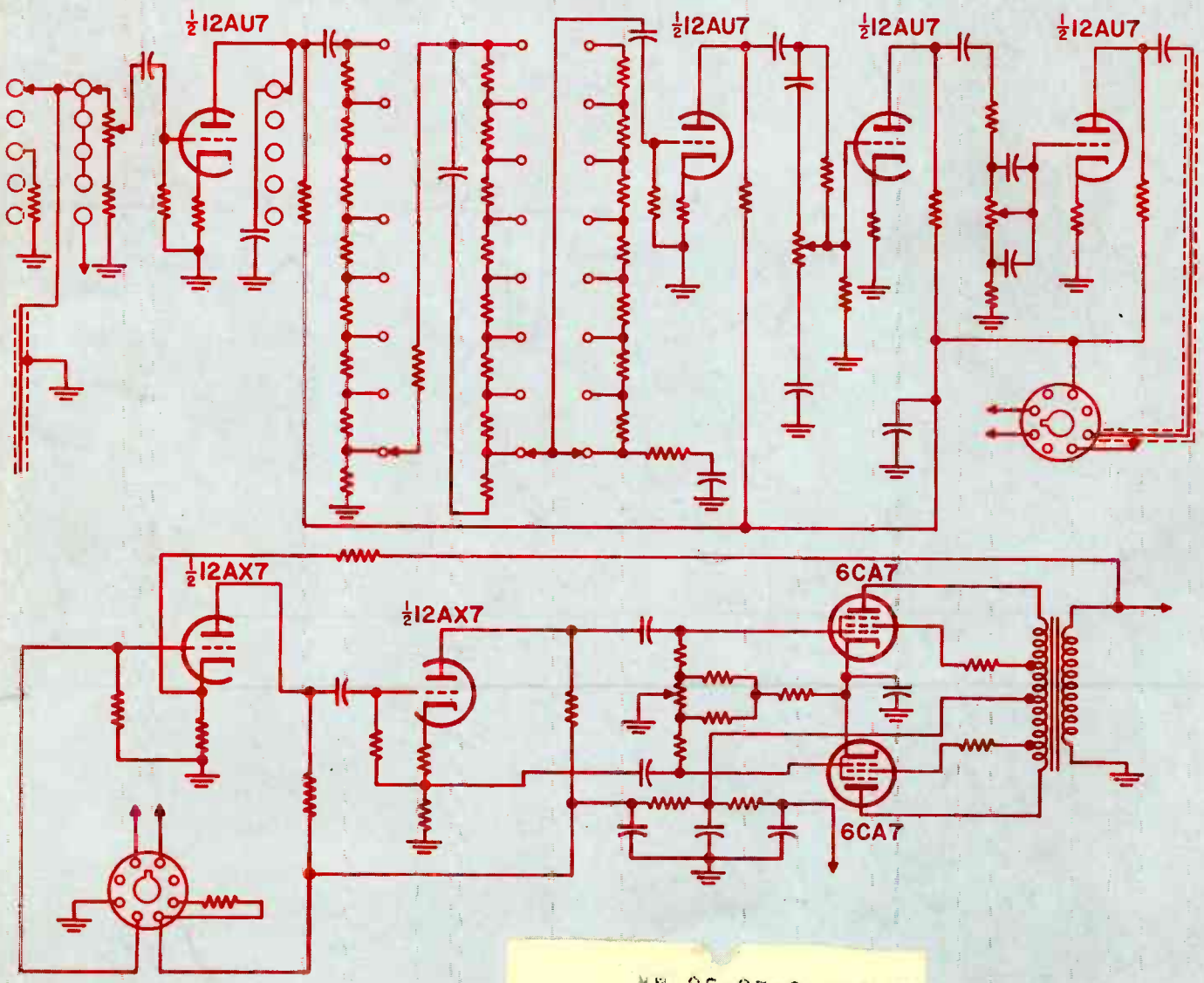
THE TECHNICAL JOURNAL OF THE TELEVISION-RADIO TRADE



Circuit of a 25-watt power amplifier and preamplifier with a push-button loudness control used in an AM-FM-PHONO chassis.

See circuit analysis, this issue

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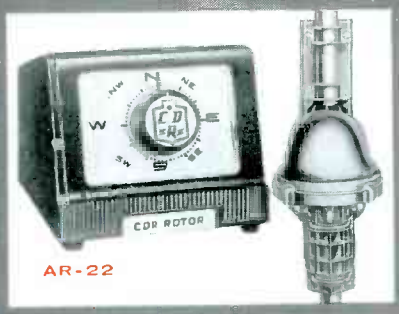

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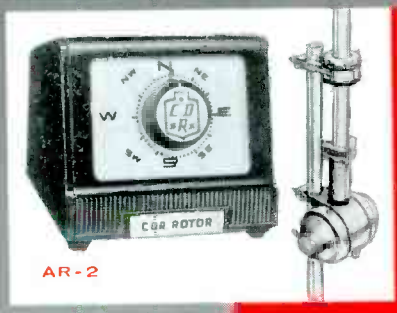

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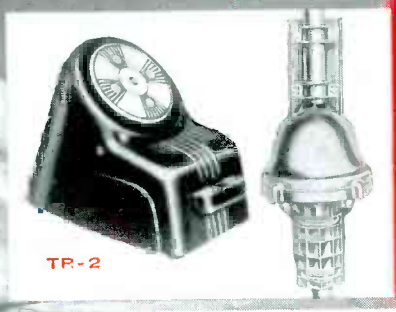
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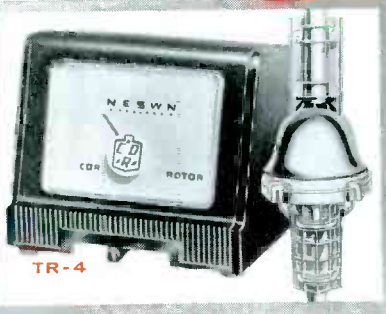

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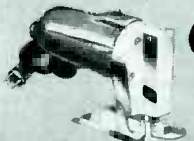

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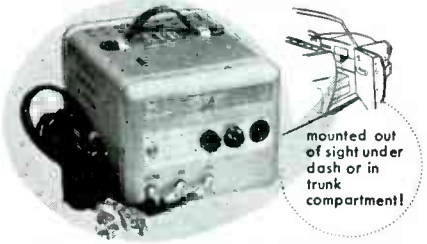

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COVER CIRCUIT

FEATURES

CIRCUIT DIAGRAMS

DEPARTMENTS

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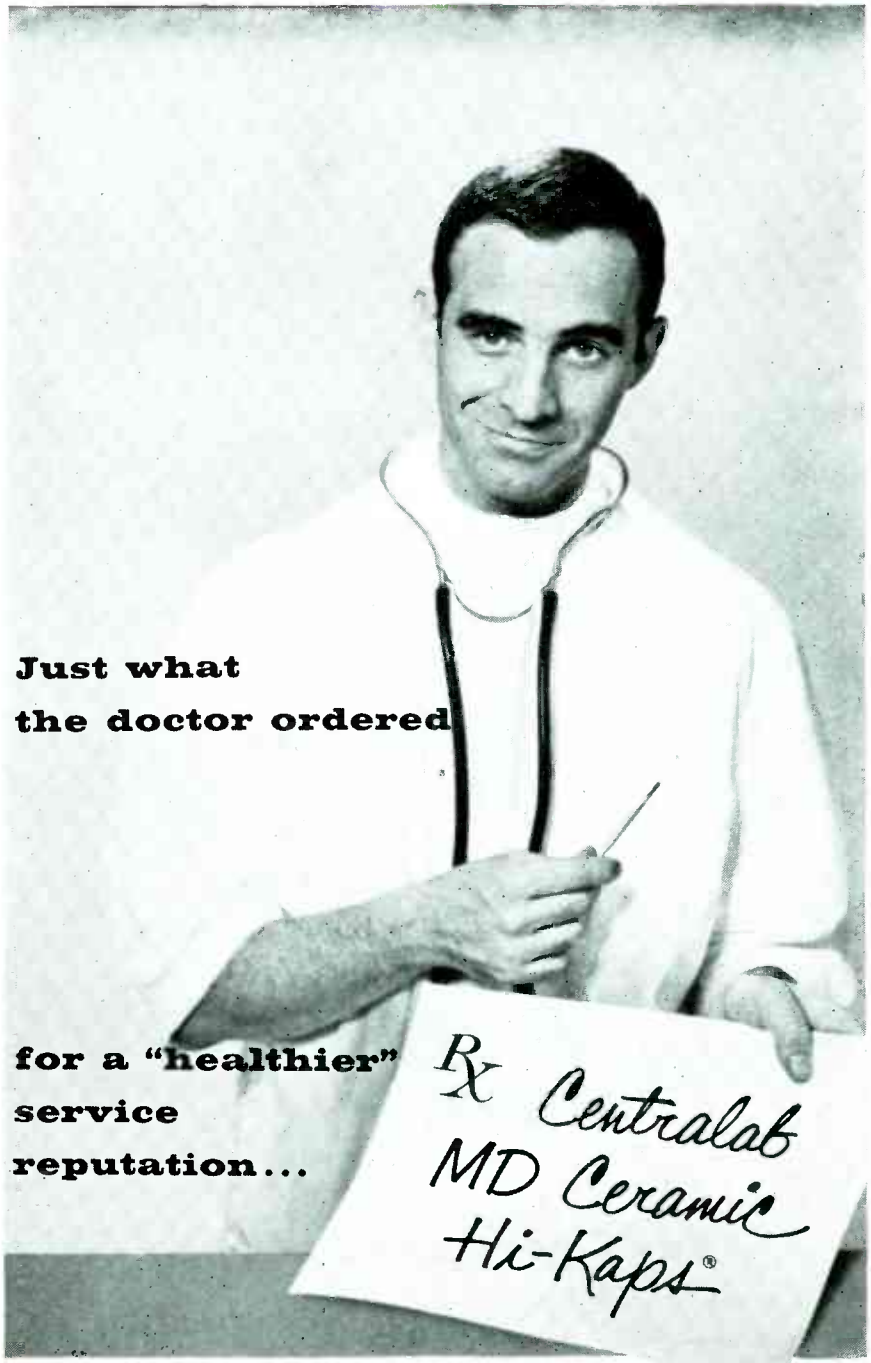

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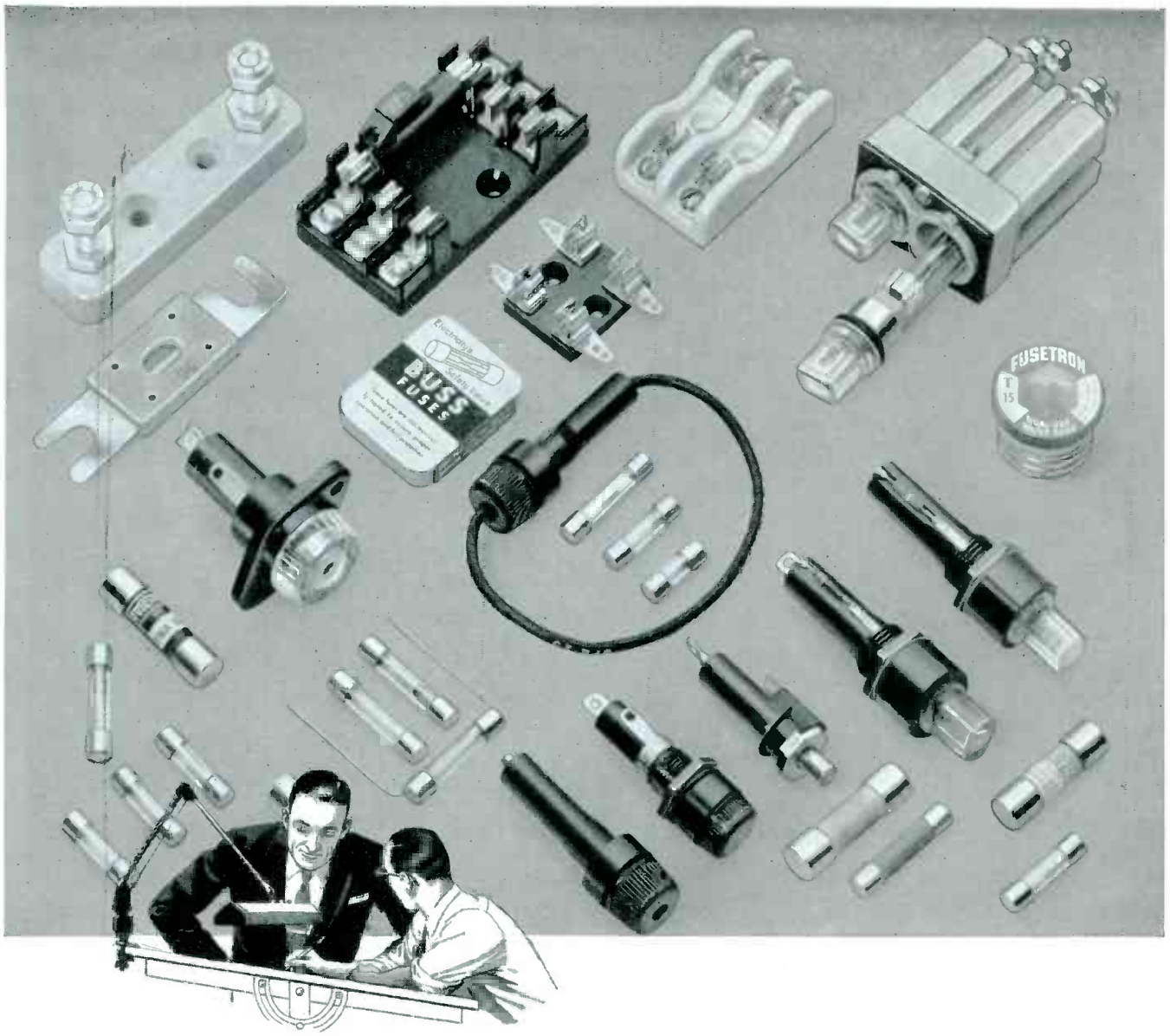

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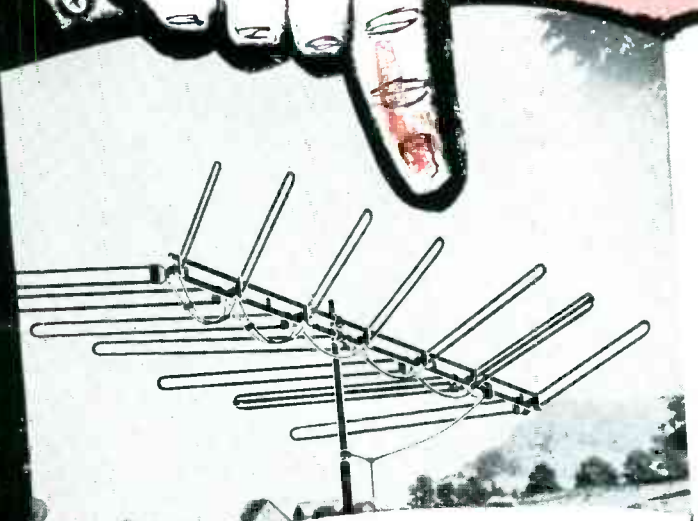

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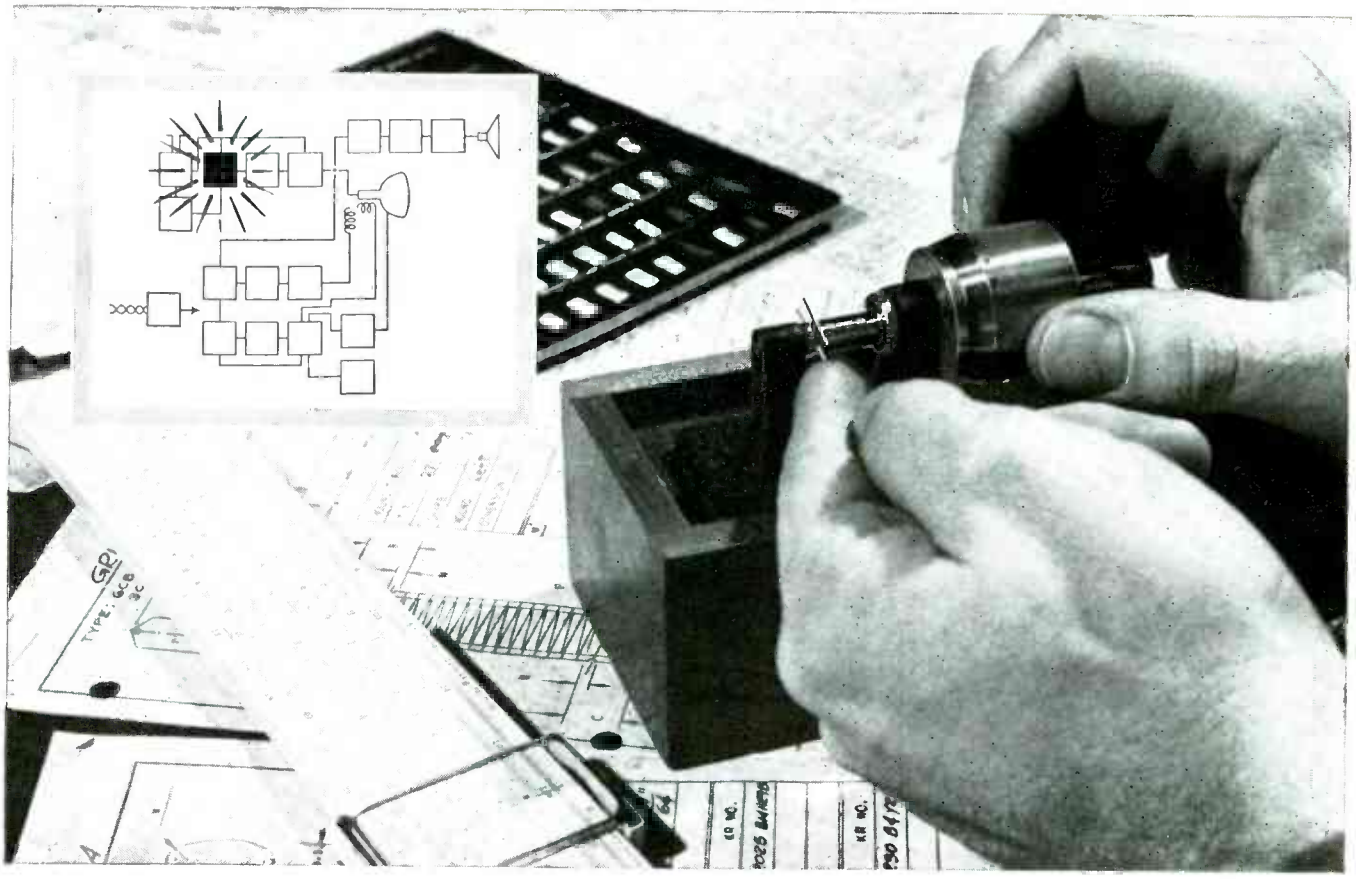

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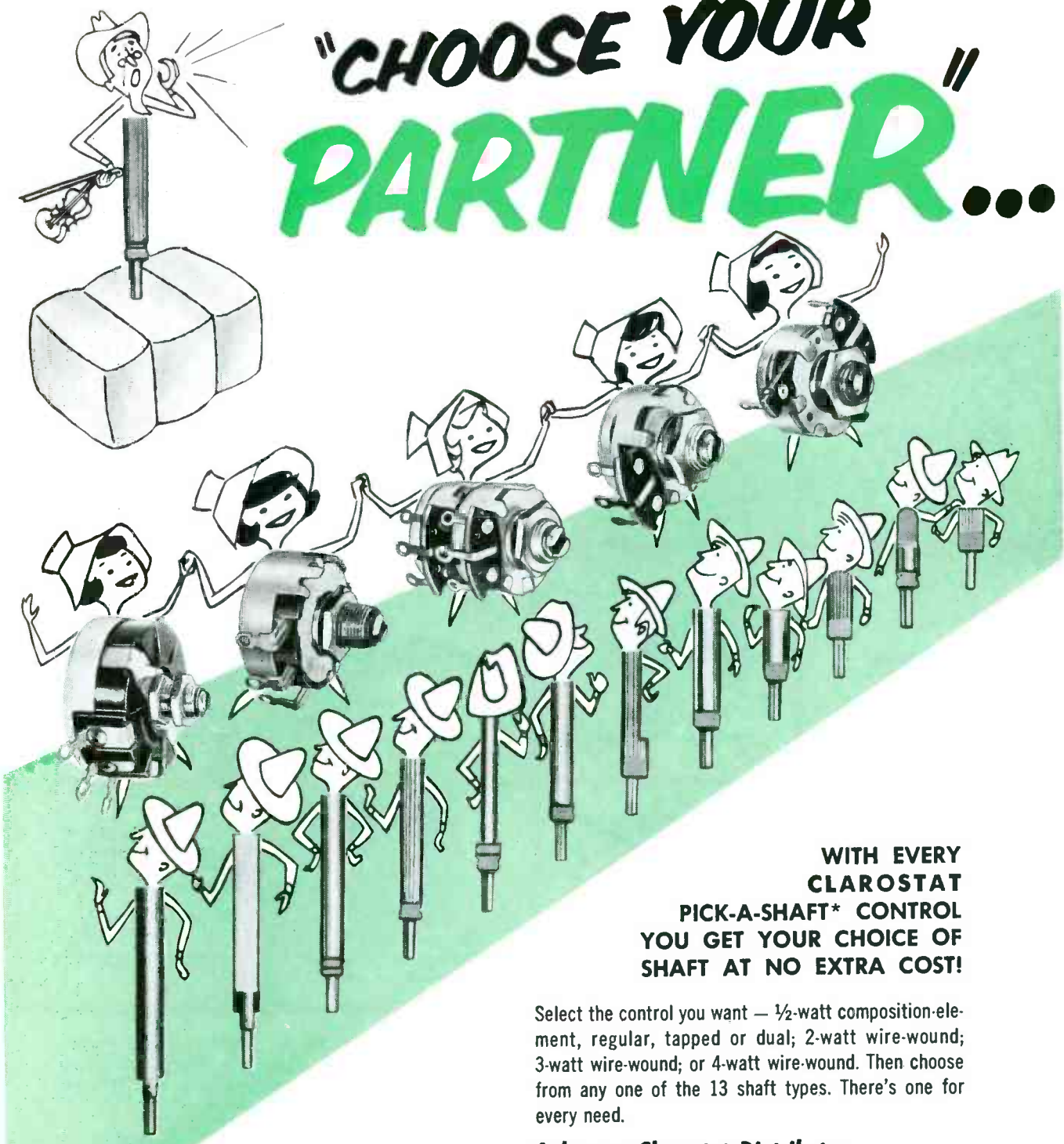

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The Changing Scene in Shop Equipment

INDUSTRY IS NOW in an era of vast change, resulting from the widespread use of new materials, new circuit-chassis engineering concepts, increasing automation and pace-setting research.

These rapid technological changes have produced not only radically new types of equipment for radio, TV and audio, but new families of components, accessories, tubes and semiconductors —all extremely small and requiring both new techniques and shop-equipment facilities for installation, maintenance and repair.

In the light of these new developments, manufacturers have designed an outstanding assortment of bench and field service items, ranging from special service bodies for pickup trucks to miniature tools for the printed-wiring boards used in a growing number of b-w and color-TV receivers, transistorized radios and audio amplifiers, as well as industrial-electronic systems.

FOR P-W REPAIR, there are now available such tools as flush-end cutting pliers, which can cut flush against surfaces that conventional pliers cannot reach; resistor-terminal cutters for packaged assemblies used on p-w boards, and needle-nose pliers which can reach into extremely-confined areas.

SOLDERING in the tight quarters of TV portables and transistor radios has also received careful consideration in the new-look program among tool manufacturers. Now on the market are a variety of new types of guns and irons of varying sizes, wattages and shapes for all types of chassis.

THE NEW CROWDED CHASSIS have also prompted the construction of an unusual array of specialty tools, such as extension-sleeve slug retrievers, long-blade screw-locking drivers and long-shaft aligners. Many aligners are now being made with low-capacitance metal and nylon tips. Some types feature a wire-dressing tip on one end. Another, a duplex aligning tool, has a pair of spring-steel tips, one of which fits into a horizontal slug and the other into a vertical linearity coil.

COLOR-TV has also brought about several interesting new tool developments. For alignment of the concentric potentiometers used on color chassis, there's a tool with a pair of sleeves, the outer sleeve fitting into the outside-diameter adjusting slot and the second sleeve for the inner drive. Completely framed degaussing coils, to demagnetize the magnetic fields around picture tubes, are also being made. Then, there is the cheater which permits the use of a high-voltage probe, and allows the color set to be operated with the back removed.

FIELD INSTALLATION AND REPAIR, involving particularly TV and auto antennas, where it is necessary to use electric drills and soldering equipment, and an external power supply is required, have brought about another unusual development—remote-powered systems using 6 or 12-volt inverters operating off car batteries. The use of such a supply for these tools has been found to provide a dependable source of power, avoiding the use of house systems which usually necessitate the running of long leads through windows, which is not only irksome to the set owner, but in many communities constitutes a violation of building, fire and zone regulations. In addition, the use of separate auto-fed power eliminates the possibility of line shock, which often occurs due to *ac* grounds.

OTHER ADDITIONS to the new-look tool parade include wide assortments of chemicals, hardware, storage bins, lighting equipment and even special screwdrivers for removing or starting the tiny screws used to hold phono cartridges in place.

AWARE THAT TOOLS are often lost or mislaid, manufacturers have devised kits featuring not only twin sets of key tools, but complements of other basic items required for indoor and outdoor activities.

IN THIS, OUR ANNUAL SHOP EQUIPMENT NUMBER, you'll find an exclusive series of on-the-scene photo-articles illustrating and describing a number of these new-look tools and their applications in the shop and out in the field.*

*See pages 26-33, this issue.

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AM-FM-Phono With

LEFT: PACKAGED RADIO-PHONO console with separate enclosure for speakers.

[See Front Cover]

THE CURRENT TREND in home entertainment is toward high-fidelity music. For the hi-fi enthusiasts there have been developed varieties of tuners, amplifiers, speakers and record changers that could be assembled to form a complete music center, the scope of each center depending on taste and available funds. However, as a growing number have found, the separate components introduce many system-matching problems which only qualified design-engineering departments with suitable testing equipment can resolve.

Accordingly, packaged systems are becoming increasingly popular.

Radio-Phono Circuitry

On the *cover* and in Figs. 1, 2 and 3 appear the circuitry[1] of a recently developed packaged unit, which not only features an AM-FM tuner and a 25-watt low-distortion amplifier, but a separate enclosure-type speaker system.

AM-FM Tuner

The AM-FM tuner utilizes a one-tube, completely-shielded FM tuner section, a slug-tuned device coupled by a short dial cord to the AM gang shaft. Rotating the shaft pulls spring-loaded slugs in and out of their respective coils. The two coils are at either end of a common coil form.

Shielding Facilities

A die-cast base is used in the tuner section, which with a tube shield affords low oscillator-radiation characteristics. To contribute further to low oscillator radiation, plate voltages on the converter, a 6BQ7A, have been kept rather low.

Separate Converters

The tuner has separate converters for AM and FM; one converter is inoperative, while the other one is in operation. Switching is done by changing B+ voltages from one section to another; this practice avoids switching of *rf* voltages.

Ferrite Antenna

In the AM portion is a ferrite antenna which has been found to have sufficient gain to eliminate the need for an *rf* stage in the AM section.

IF Stage Design

The *if* stages, though wideband, have been designed to develop high

[1] *Motorola model 15KT25.*

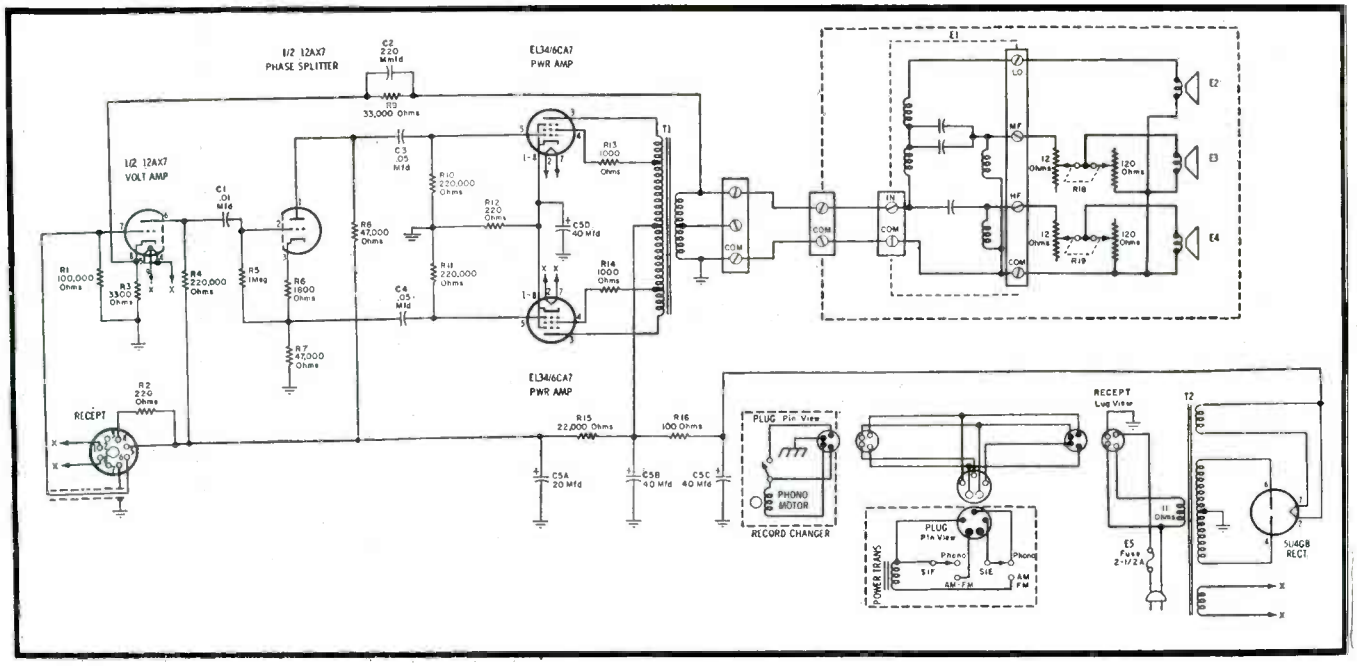

FIG. 1: THE 25-WATT power amplifier used in Motorola AM-FM-phono packaged system.

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Push-Button Loudness Control In Preamp

A Report On A Packaged System Using A 25-Watt Amplifier

by HARRY SCHMIDT, Audio Engineer, Motorola, Inc.

gain. For FM, the *if* bandwidth is such as to eliminate the effects of oscillator drift. Use of an EM-81 tuning indicator has been found to so simplify tuning that *afc* can be omitted. The overall tuner gain in FM is sufficient to cause limiting even at low signal levels.

Switching System

The only portion of the system in which signal circuits are switched is in the audio system. Audio is switched either from the FM ratio detector or the AM detector to the cathode-follower output. A low-impedance cathode-follower output is used to avoid the problems of hum pickup and the loss of *highs* between tuner and amplifier.

Phono Operation

The *ac* switching arrangement in the tuner is unusual. The *phono* position is also the *off* position. To operate the phono, the switch on the record changer must be used. This design not only permits removal of the power from the AM-FM tuner when not in use, but also turns off the record changer and amplifier completely after the last record is played.

The Amplifier

The basic requirement of a solid audio system is a substantially high power, wide-range amplifier. To provide reproduction that is as close to the original as possible, dynamic range is important. High power affords this potential.

Need for Wide Range

Why wide range? Amplifiers are designed to operate well out of normal hearing range, both above and below. The reason: A characteristic sound is made up of many overtones and sub-harmonics, which distort the fundamental, forming a particular well-known sound. If these overtones and sub-harmonics are not reproduced, though inaudible, our charac-

(*Continued on page* 12)

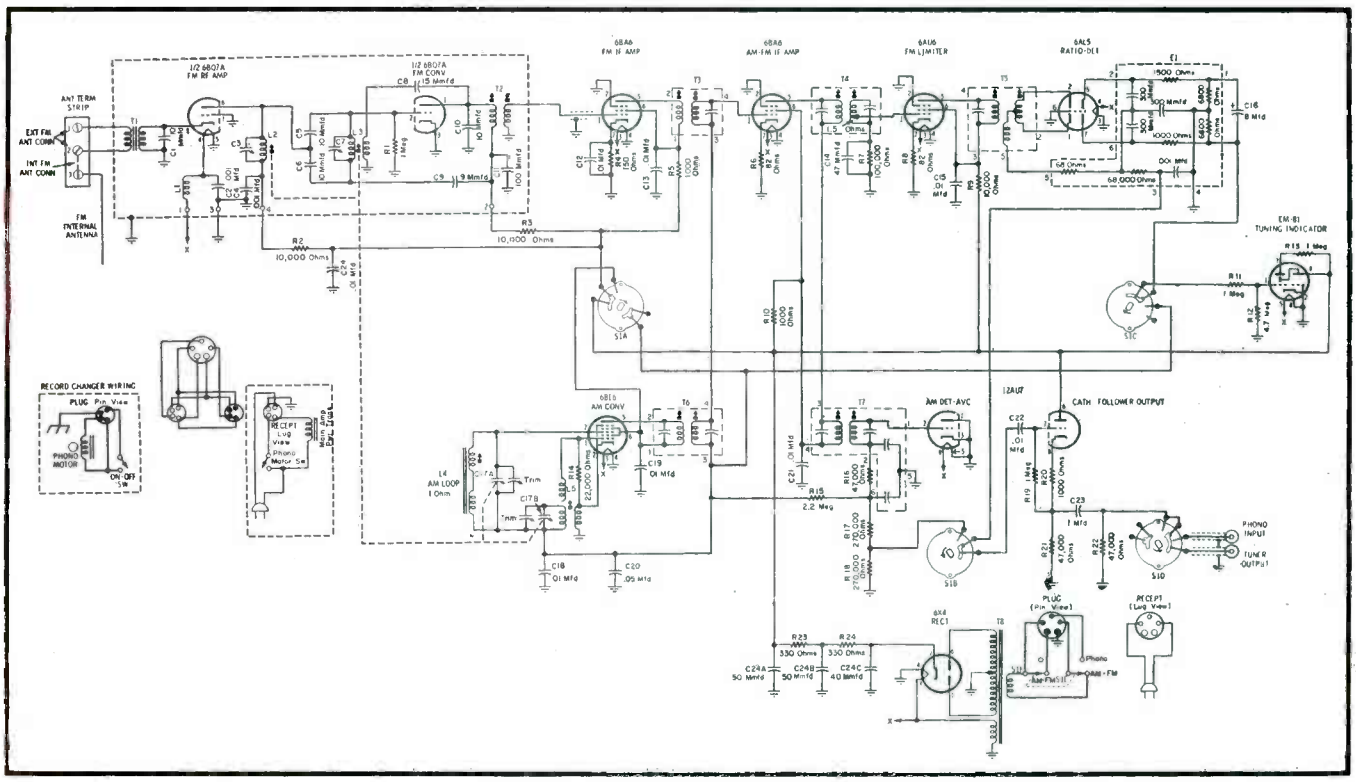

FIG. 2: SCHEMATIC OF the AM-FM radio used in the Motorola model 15KT25.

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(*Continued from page* 11)

teristic sound will not be exactly like the original.

In the system diagrammed, we have a 25-watt amplifier controlled by a separate preamp which features a push-button compensated-volume or loudness control.

Loudness Compensation

The loudness control is compensated to allow for the non-linear operation of the ear. The Fletcher-Munson curves for hearing illustrates this point. In these curves where we have a comparison of power versus frequency response, we find that we normally lose sensation of low frequencies at low levels and sensation of high frequency at high levels. Thus, loudness controls provide a matching network between the amplifier and the ear.

Preamp Controls

The preamp has a level control, which establishes maximum output for the last push-button. Other controls include colored, calibrated, illuminated tone controls and a hum-adjusting control which balances the filament voltage with respect to chassis ground.

Power Stages

A push-pull stage in the power amplifier is driven by a cathode-follower-type phase inverter.

The output tubes are operated halfway between triodes and pentodes, using a tapped output transformer for screen grid voltage.

This system has been found to increase the linearity of the operation of the output stage.

Negative-Feedback Network

A 220-mmfd/33,000-ohm (C_2/R_9) negative-feedback network returns a portion of the output signal from the secondary back to the voltage amplifier preceding the phase inverter. The resistor, R_9, is effectively in parallel with a 3,300-ohm cathode resistor, R_8. Together they form a combined cathode-resistive network for the voltage-amplifier tube.

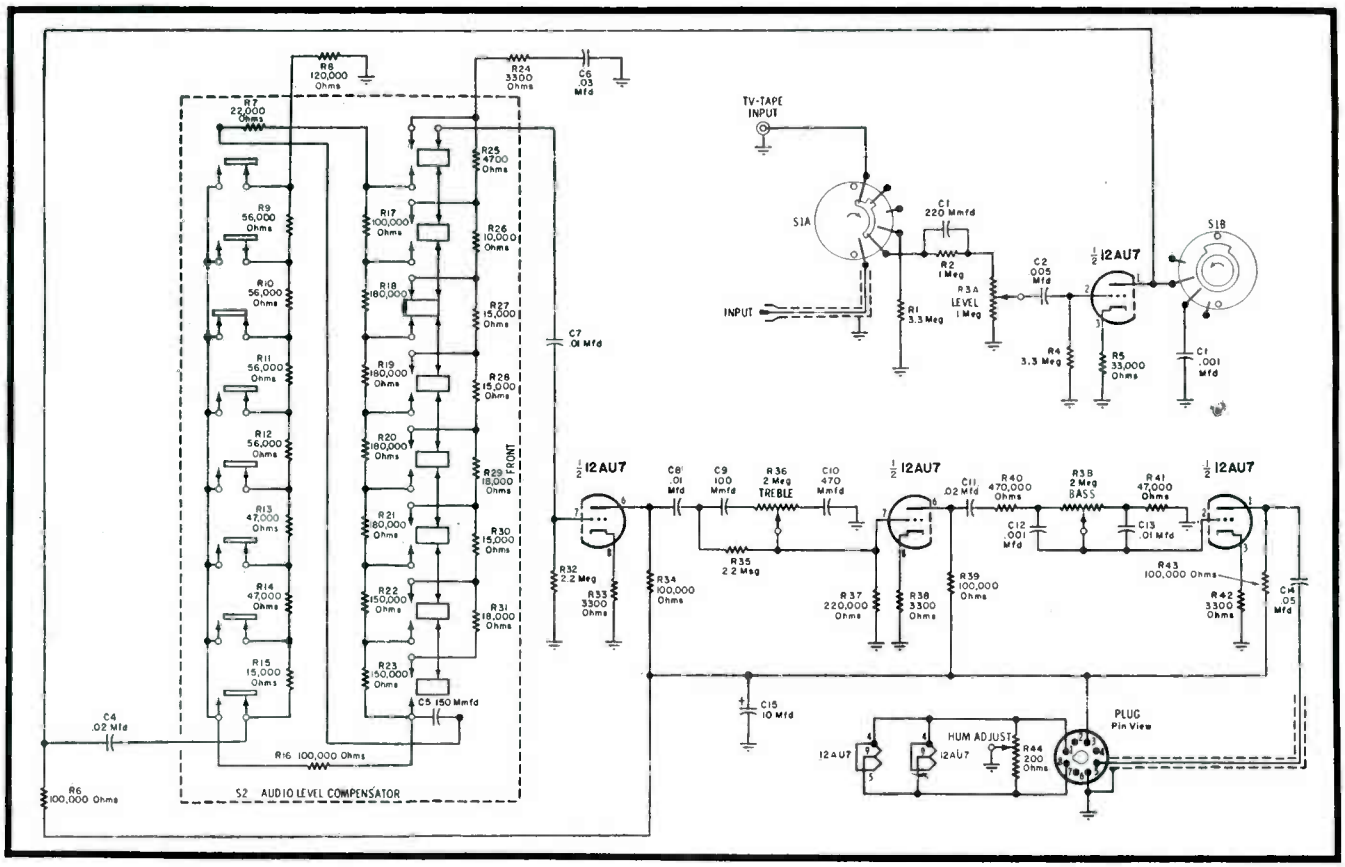
The Speaker Network

A 3-speaker system with a cross-over network has been designed for this radio-phono package. On the speaker enclosure are controls which permit one to *customize* the system to the room where it will be operated. As an example, if the package is operated in a room filled with sound-deadening material, high frequencies can be emphasized.

The Record Changers

Record reproduction is accomplished by a four-speed automatic changer with a flipover ceramic cartridge, with diamond and sapphire styli. The changer is balanced on a four-spring shock mounting. Normally audio feedback becomes a problem with higher-power audio amplifiers; here the problem has been eliminated by placing speakers in a separate enclosure.

FIG. 3: CIRCUIT OF PREAMP featuring push-button loudness-control system.



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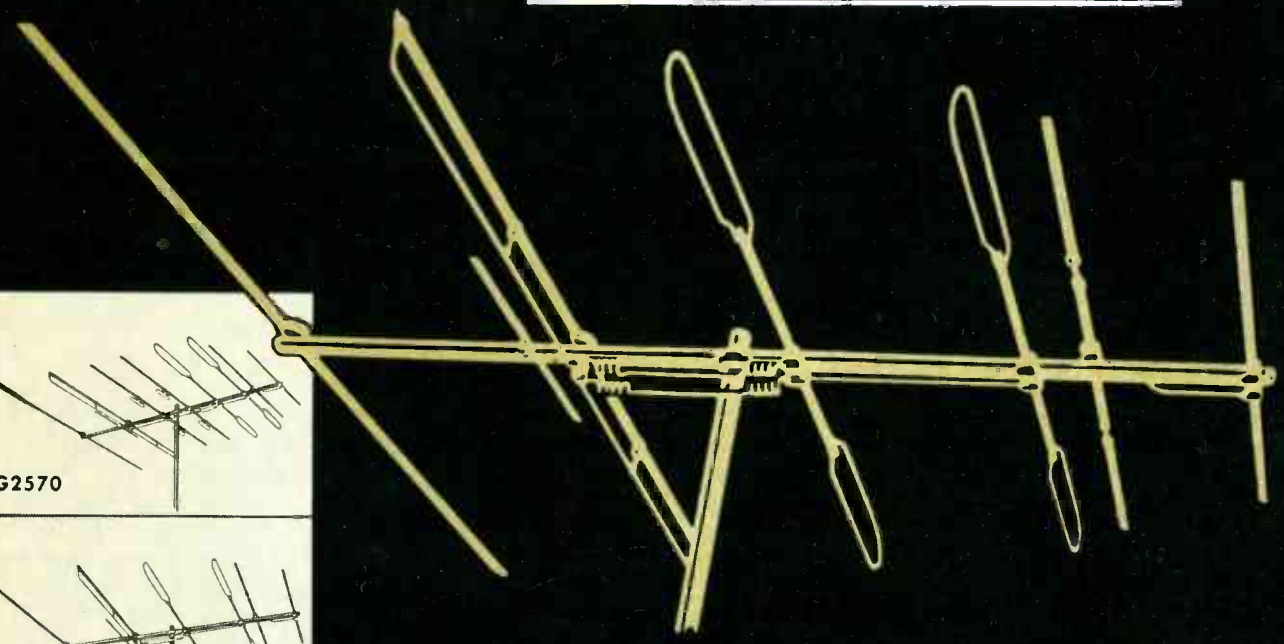
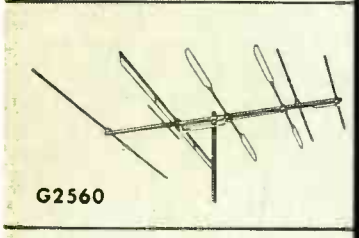


G2570



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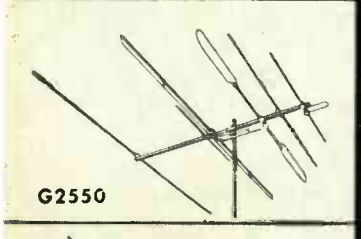

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THIS MONTH IN SERVICE

GROSS '57 INCOME OF OVER $2-BILLION FOR SERVICE AND PARTS PREDICTED--Industry specialists, appearing at the recent fifth annual clinic and fair of the Texas Electronic Association in Dallas, Texas, said that they expect that the electronic repair business (service and replacement-part sales) will reach a record $2-billion gross this year. . . . This huge income forecast was based on the maintenance and servicing required for a substantial portion of the 1.5-billion active sockets in the 150-million radios, 42-million TV sets, 20-million record players, 2-million tape recorders and hundreds of thousands of hi-fi systems in use. . . . It was estimated that over 180-million tubes will be needed for replacement. On the assumption that the average Service Man's work week is six days, one expert told the conferees that tubes are being replaced at the rate of nearly 600,000 a day.

RF-VIA-AC-LINE SYSTEM DEVELOPED FOR TV REMOTE CONTROL--A new use for carrier current, involving the old method of sending rf signals over power lines, has been adapted for a remote-control system by a TV set maker. . . . Control signals generated by a small transmitter at a viewer's finger's tips are carried over the house line to the TV receiver. These signals actuate relays in the receiver to control channel selection and sound muting. . . . Two types of carrier signals are used. A continuous wave of the required duration activates both channel-selecting and sound-muting relays so that the TV receiver can be tuned through program channels without sound blasting; picture muting is also provided to prevent annoying flashes. A modulated wave activates only the sound-muting relay. Four alternate carrier frequencies in the 50 to 75-kc range are used; these were selected so that a random distribution of carrier frequencies can be obtained to prevent interference between systems, if several are in close proximity. . . . Transmitter output is in the order of 12 milliwatts for continuous-wave operation; less for the modulated signal. Field tests have shown that this power level is sufficient for positive operation, yet low enough so that receivers with control systems installed in adjacent houses, supplied from the same power transformer, will not interfere with each other if tuned to different carrier frequencies.

67 PER CENT INCREASE IN COLOR SHOWS SLATED FOR FALL--NBC color programming for this fall will be increased by 67 per cent, providing 250 hours of color shows for the fourth quarter of this year. . . . Last fall, NBC offered 149 color hours. . . . The stepped-up program will provide an average of more than two hours of color daily and frequently will result in three to four hours of color during a single afternoon or evening. . . . At least 24 spectacles will be offered. . . . Sports events are also on the color program. Not only are the World Series games scheduled for color coverage, as noted earlier in these columns, but NBC also expects to colorcast a number of key college football games.

SIMPLIFIED ONE-TUBE PULSE GENERATOR DESIGNED--An inexpensive single-tube circuit for a relaxation oscillator, with fast rise and decay times, has been developed in Washington by the Bureau of Standards. . . . Advantages of this new design are said to be due mainly to the use of the gated-beam tube (6BN6), originally designed as a limiter-discriminator for TV and FM chassis. . . . In comparison with the conventional blocking oscillator or multivibrator, whose basic circuits are similar to the present one, use of the gated-beam tube permits the elimination of a transformer or an additional tube for positive feedback. The only components required, beside the tube itself, are three or four resistors and a single capacitor.

NEW NAME FOR RETMA--Members of the Radio-Electronics-Television Manufacturers Association voted recently to change the name of the 33-year-old industry organization to the Electronics Industries Association. . . . The new name marks the fourth change since the founding of the association in Chicago in 1924 as the Radio Manufacturers Association. In 1950, Television was added, and in 1953, Electronics was included.

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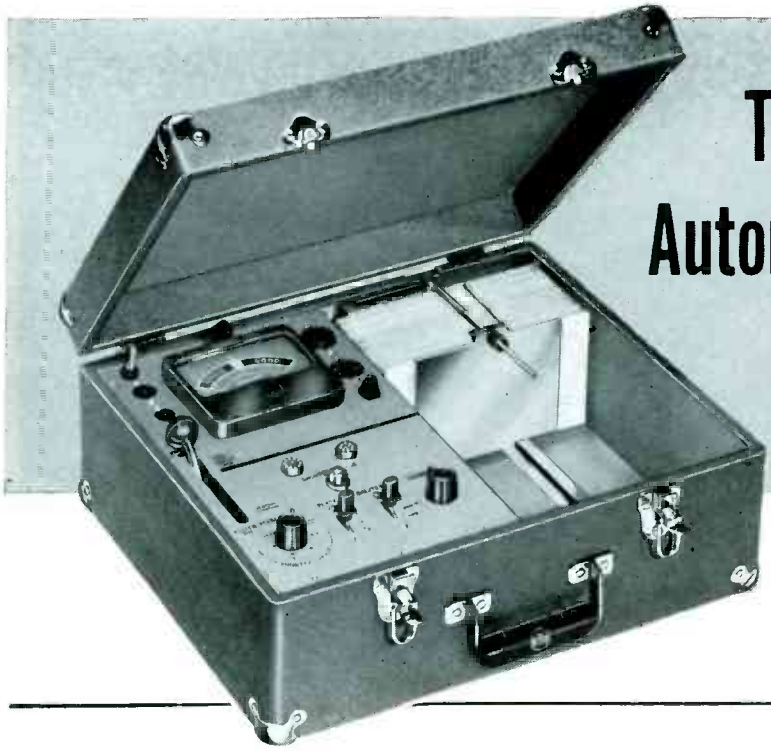

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- tubes tested under heavy load currents, such as rectifiers, at 140 ma per plate.
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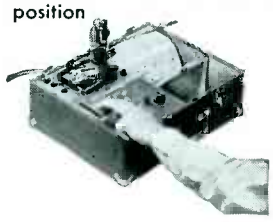
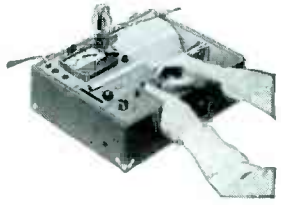


c. press calibrate lever and adjust calibration control



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Circuitry and Tube Requirements In VHF Tuner RF Amplifiers

by WAYNE S. RIAL, Application Engineer, Electronic Tube Division, Westinghouse Electric Corp.

SUFFICIENT GAIN is required ahead of the tuner mixer stage to improve the mixer's signal-to-noise ratio. In the *rf* amplifier voltage gains of at least 20 are usually required to accomplish this purpose. Naturally, it is desired to obtain as much *rf* stage gain as is possible with inexpensive methods. But considering the gains of a typical television receiver from antenna input terminals to the input of the picture tube, it appears as though the tuner contributes little gain to the system (Fig. 1).

To illustrate, let us consider the sources of noise (snow or static) which may interfere with television reception. Suppose an almost completely noise-free signal (containing 100 watts of noise power) is transmitted from a TV station transmitter whose output signal power is 100 kw; we can then say that the transmitted signal-to-noise ratio is 100 kw (signal power) divided by 100 w (noise power) or 1000 w=30 db.

Now the receiving antenna will pick up all electromagnetic radiations within the passband to which it is tuned. In addition to the desired signal, this receiving antenna will also pick up noise signals from interference sources such as automobile ignition systems and atmospheric *static*. Let us now suppose that the total received signal is 300 microwatts (300×10^{-6}) and the received noise is 30 microwatts (30×10^{-6}) within the desired passband, the signal-to-noise ratio appearing at the antenna terminals will then be only 300×10^{-6} divided by 30×10^{-6} or 10 (which equals 10 db). Thus these sources of noise have seriously degraded the available signal.

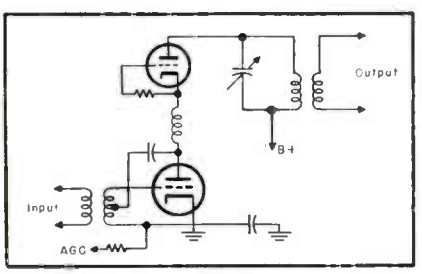

FIG. 2: SERIES-FED cascode circuit.

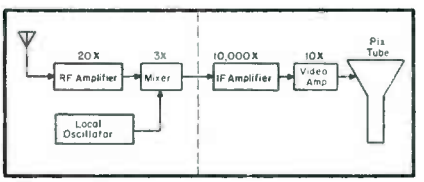

FIG. 1: BLOCK DIAGRAM illustrating signal-voltage gains encountered in typical TV receivers.

The foregoing example shows that there is nothing the tuner can do to improve the signal-to-noise ratio. Even with an ideal receiver, no better than a 10:1 signal-to-noise ratio could be achieved at the output of the tuner's mixer stage for ultimate presentation to the receiver's picture tube. In the practical case, it is impossible to build ideal tuners or receivers; some noise is always added to the incoming signal by the receiver.

The practical tuner noise can be compared to the ideal tuner noise by the following convenient method, which is the way tuner noise is now rated. This method requires dividing the noise power output of a practical tuner by the noise power output of a tuner having the same gain and bandwidth, and which generates no noise other than that of the antenna resistance. This ratio is called the *noise figure* of a tuner (or receiver) and is a method of comparing a practical tuner to an ideal tuner. Thus, a noise-free tuner would have a noise figure of zero db. Typical tuners have noise figures between 6 and 9 db. This means that such tuners generate 6 to 9 db more noise than a noise-free tuner with the same gain and bandwidth. These noise figures also mean that the incoming signal-to-noise ratio is degraded by the tuner's internally generated noise.

The effect of a 6 to 9-db tuner noise figure can be seen from the following example. Suppose a noise-free signal presented to the antenna of an ideal tuner produces a tuner output signal-to-noise ratio of 100:1. To provide the same 100:1 signal-to-noise ratio output from a practical tuner having a 9-db noise figure, it would be necessary to increase the incoming (received) signal power by 8 to 1. Thus, the 100-kw transmitter, previously mentioned, must have its output power increased from 100 to 800 kw.

The foregoing discussion emphasizes the fact that the tuner generates most of the television receiver's signal-circuit noise. The greatest noise offender in the tuner is the mixer stage which contributes more than 50% of the total receiver signal-circuit noise power.

Present VHF RF-Amplifier Circuits

Two circuit configurations are principally used as *vhf* tuner *rf* amplifiers; the cascode and pentode-amplifier circuits. Each of these circuits has certain advantages over the other.

Cascode Tuner Amplifiers: Actually the *reasonable* gain from the *rf* amplifier previously examined was not sufficient for the optimum signal-to-noise ratio using the single-triode circuits formerly employed in tuners. To achieve the minimum amplifier voltage gain required, two triode *rf*

(*Continued on page* 18)

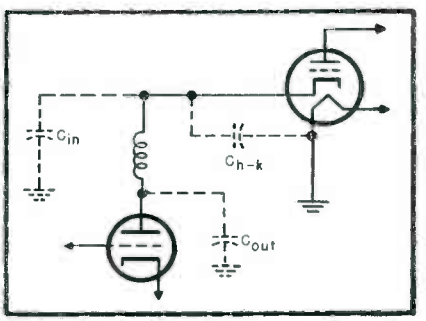

FIG. 3: TUNED CIRCUIT with rf coil between two cascode triodes which are resonant near high end of vhf bands.

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VHF Tuner RF Amplifiers

(*Continued from page 17*)

amplifier stages would be necessary. Experimental evidence indicates that the circuit yielding optimum high-frequency performance from two triodes would be a grounded-cathode stage followed by a grounded-grid stage. It can be shown that such a circuit has the gain of a pentode and noise of a single triode stage.

Two cascode circuit configurations are possible using conventional dual-triode tubes and component parts; i.e., the series-fed and shunt-fed circuits. The series cascode circuit (Fig. 2) is principally used today because the shunt-fed circuit required extra components and does not give the performance of the series circuit Also, the series circuit is widely used because is has good isolation between input and output circuits, has low effective interstage capacitance, very low noise output, high gain, and is relatively inexpensive.

The cascode circuit can be looked at from different points of view. The grounded-cathode stage can be considered as an impedance transformer that has a high input impedance whose output couples into the low-input impedance of the grounded-grid stage. The output of the grounded-grid stage is a high impedance and the voltage gain of the input stage is near unity. In other words, we can consider two triodes operating with the same transconductance (GM). Since the voltage gain of an amplifier stage is equal to GM x R_L where R_L is the load impedance, and the input impedance of a grounded-grid stage is approximately 1/GM, then the voltage gain of the input stage is equal to:

$VG = GM_1 \times 1/GM_2 = 1$ (if $GM_1 = GM_2$)
where GM_1 = transconductance of input stage and GM_2=transconductance of output stage.

The total cascode voltage gain is equal to:

$(GM_1 \times 1/GM_2) \times (GM_2 \times R_L) = GM_1 \times R_L$
or *gain of input stage x gain of grounded-grid stage, where* R_L *is the load impedance of the grounded-grid stage.*

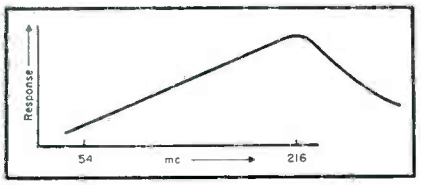

FIG. 4: Approximate response curve of a pi network.

Another way of discussing the cascode circuit is as follows: The cascode circuit minimizes the influence of the grid-to-plate capacity of a single-triode amplifier. This is accomplished by using a low-impedance plate circuit for the first tube (the effect of grid-to-plate capacity is kept to a minimum when a low-impedance plate load is used with a triode). This low-impedance plate load is really the cathode circuit of the second triode. Although the voltage gain of the first triode is approximately one, it acts as a power amplifier because the signal has been converted from a low-current, high-impedance signal at the grid, to a high-current, low-impedance signal at the cathode of the second triode.

Actually, the cascode GM is equal to the GM of the input section as was seen in the previous derivation of cascode-stage voltage gain. Measurements will also verify this fact. The output triode gives the greater voltage gain of the two triodes, and this voltage gain may approach 40. In a practical cascode circuit, the input triode voltage gain may approach 5, although theoretically it is unity. Thus, the total cascode-circuit voltage gain may approach 200, which is much greater than the minimum required *rf* amplifier stage gain of 20. Therefore, the input triode section is many times more critical for cascode-stage operation than is the output triode stage.

It will be noticed that the input stage of the cascode circuit is neutralized. Neutralization is necessary at *vhf* with present receiving triodes in grounded-cathode circuits to improve stage stability. This is because a fair portion of the signal energy appearing in the plate circuit is transferred back to the grid circuit through the relatively high grid-to-plate capacity, which increases the tendency towards stage instability. Also neutralization corrects for stage degeneration (and thereby increases stage gain) and increases the effective input impedance of the input stage. Therefore, neutralization improves stability and increases input stage impedance. Since the voltage gain of the input triode is very low, neutralization is usualy not critical, although neutralization can be adjusted for optimizing one of three effects. These effects are noise, *agc* cutoff, and *tilt;* since tilt is the most serious, neutralization is usually adjusted for optimum tilt. A typical value of neutralizing capacitor for use with a 6BZ7 might be 2.7 mmfd.

The *rf* coil between the two cascode triodes forms a tuned (pi network) circuit (Fig. 3), resonant near the high ends of the *vhf* bands, which helps to compensate for the signal bypassing effects of the heater-to-cathode capacity and input capacity-to-ground of the grounded-grid stage.

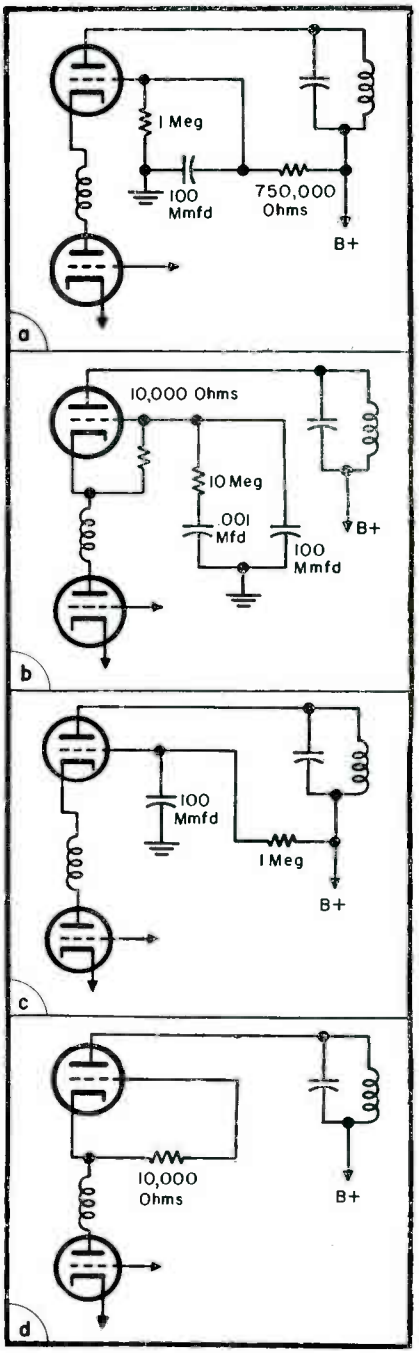

FIG. 5: POPULAR CIRCUIT configurations showing grid bias on grounded-grid stages.

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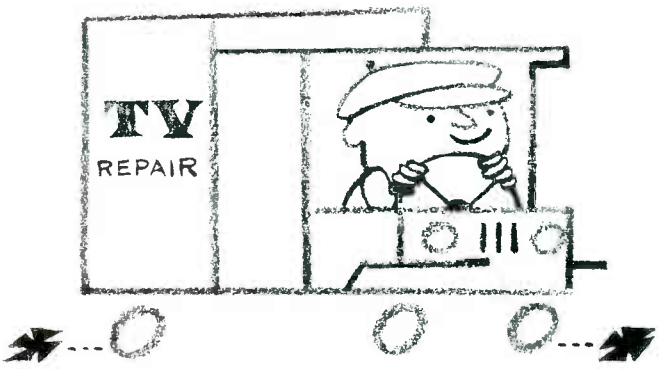

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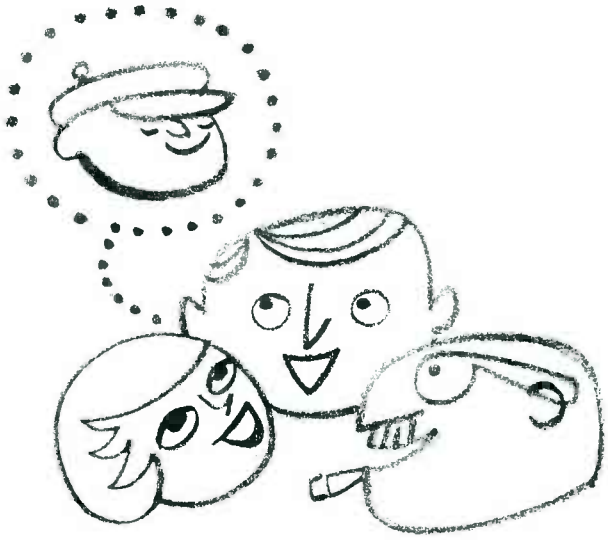

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Troubleshooting Horizontal AFC Gruen-Circuits*

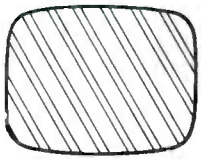
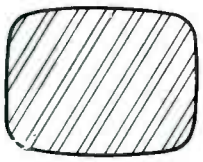
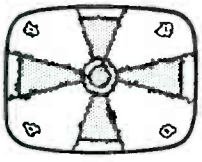
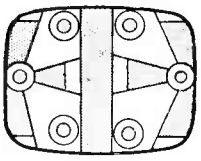
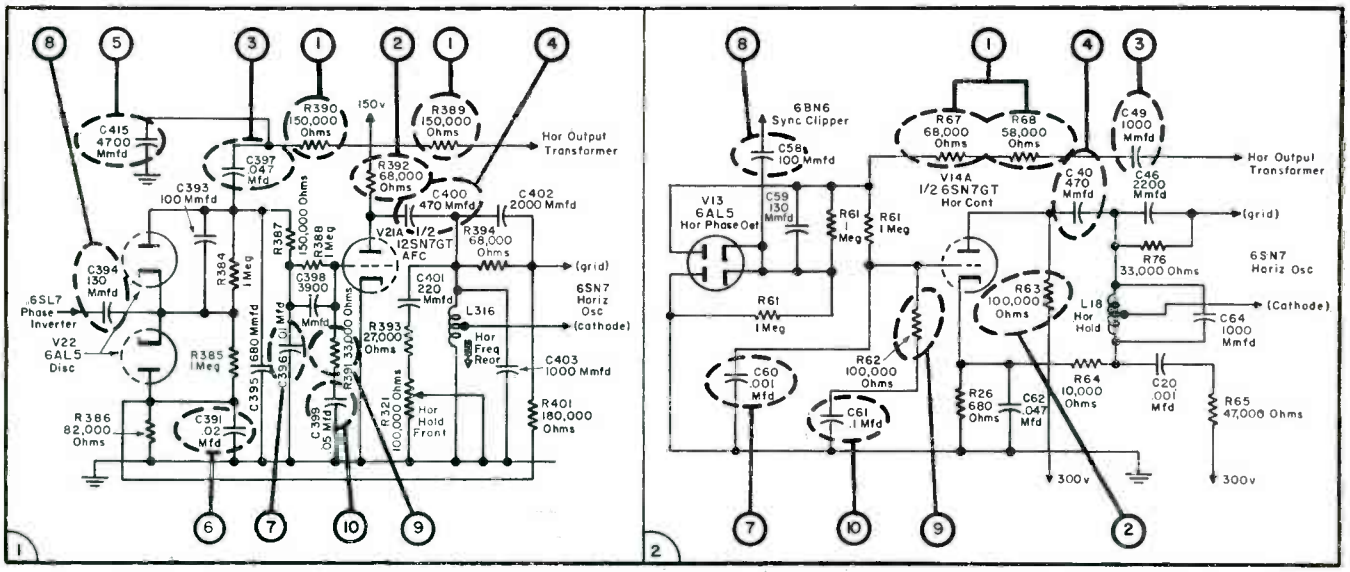
Trouble	Picture Indication	Cause	Remedy
Loss of horizontal sync (diagonal bars slant towards right). **(A)**		Oscillator frequency *too high*. The following components may be open, shorted or leaky: R_{389} (150,000 ohms), R_{390} (150,000 ohms) or R_{392} (68,000 ohms) open; C_{397} (.047 mfd) or C_{400} (470 mmfd) open; C_{415} (4700 mmfd) shorted or leaky. ***See circles 1, 2, 3, 4 and 5 in Fig. 1.*** Cause may also be due to defects in following components: R_{67} (68,000 ohms), R_{68} (58,000 ohms), R_{63} (100,000 ohms), C_{49} (1000 mmfd) and C_{40} (470 mmfd). ***See circles 1, 2, 3 and 4 in Fig. 2.***	Replace defective component.
Loss of horizontal sync (diagonal bars slant towards left). **(B)**		Oscillator frequency *too low*. Following components may be defective: C_{391} (.02 mfd) or C_{396} (.01 mfd) shorted, or C_{394} (130 mmfd) open. ***See circles 6, 7 and 8 in Fig. 1.*** Also check C_{60} (.001 mfd) and C_{58} (100 mmfd). ***See circles 7 and 8 in Fig. 2.***	Replace defective component.
Piecrust or geartooth pattern. **(C)**		Time constant of anti-hunt circuit is changing because of following defects: R_{391} (33,000 ohms) opens or *increases* in value or C_{399} (.05 mfd) opens or *decreases* in value. ***See circles 9 and 10 in Fig. 1.*** Also check R_{62} (100,000 ohms) and C_{61} (.1 mmfd). ***See circles 9 and 10 in Fig. 2.***	Replace defective component in anti-hunt network.
Split picture (vertical blanking bar). **(D)**		Leaky capacitors: C_{397} (.047 mfd) or C_{49} (1000 mmfd). ***See circle 3 in Figs. 1 and 2.***	Replace defective capacitor.

Chart-analysis prepared by Jesse Dines



FIGS. 1 AND 2: HORIZONTAL afc Gruen circuits used in G. E. 805-6-7-9 (Fig. 1) and Zenith 20H20 (Fig. 2).

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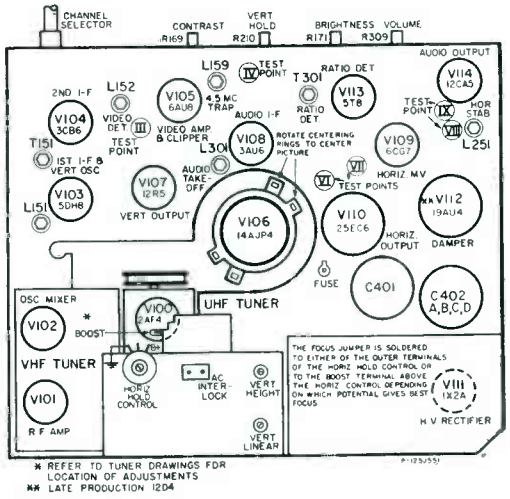
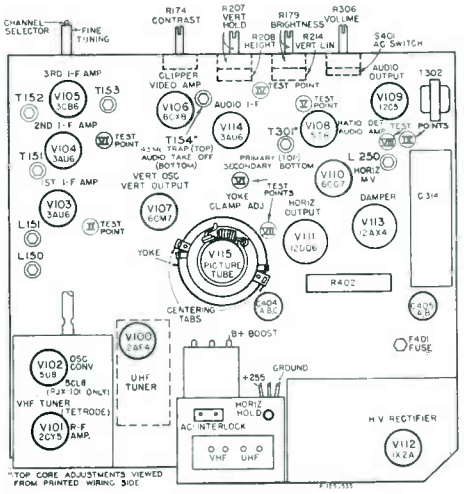
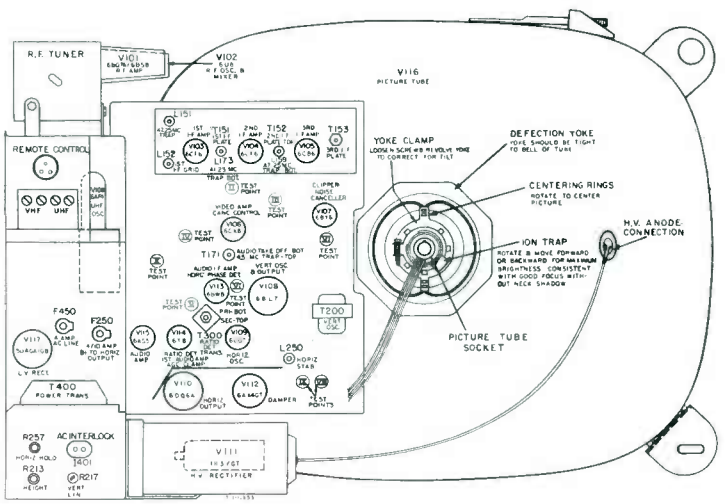


CHASSIS Q2—Covers models 14S206 and 14S207 in VHF and UHF versions.



CHASSIS M3—Covers models 17S305, 17S306, 21S405, and 21S505 in VHF and UHF versions.



CHASSIS U2—Covers models 21S406, 21S455, 21S456, 21S507, 21S508, 21S555, 21S556, 24S805, 24S806, 21S605 and 21S606 in VHF and UHF versions.

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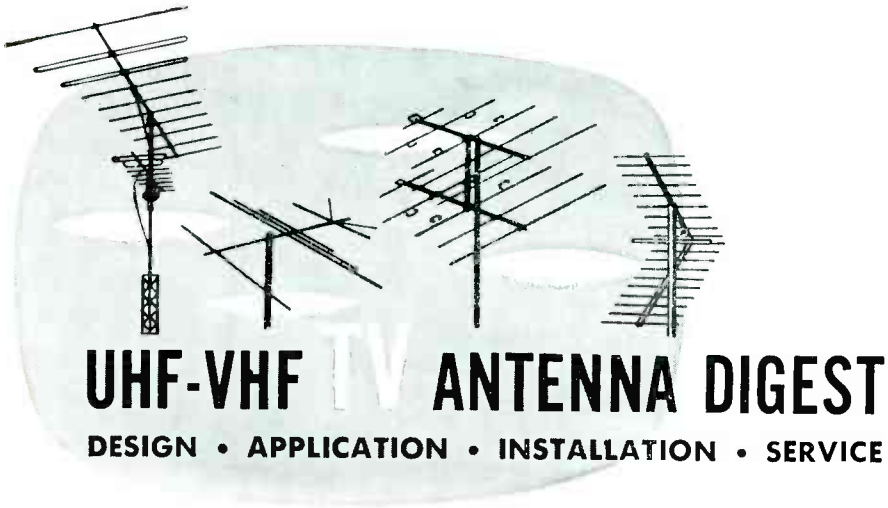
Design—Application Analysis of A Diplexer Two-Set Coupler



by HAROLD HARRIS, Vice President, Engineering and Research, Channel Master Corp.

TV DURING the past decade has progressed through successive stages: Limited market, restricted to those people able to afford the luxury of an expensive novelty; moderate public acceptance, hindered by the inconvenience of the 10″ and 12″ squinting screens; mass acceptance with the advent of the 17″ and 21″ screens, better programming and realistic pricing. We are now approaching the next plateau; the two-set home.

More and more the TV set is viewed not only in the living room, but in the dining room, kitchen and boudoir, as well. Junior wants to watch his favorite character, while dad prefers the newscast. The second set is rapidly becoming the answer to this problem.

The two-set trend has been accelerated by the availability of low-priced portables. Another important factor is the growing color-TV market. In both cases it often does not warrant selling or trade-in of the old set. Rather, this older model is retained as a second set.

The problem arising is how to hold the cost of the additional TV set and installation to a minimum. The answer has appeared in two-set couplers that make use of a single antenna installation.

The purpose of any two-set coupler is to provide the strongest possible signal power *equally* and *simultaneously* for two receivers from a single antenna. This should be accomplished without any interaction between the two sets.

Any standard of comparison as to coupler performance must be based on the performance characteristics of a single TV receiver operating on one antenna and the resultant characteristics when a signal is supplied to a second receiver by the same antenna.

Five prerequisites have been found necessary for an effective coupler: Good impedance matching, low insertion loss, high signal isolation between receivers, high impedance isolation between receivers and equal division of signal.

The objectives of good impedance matching are to maintain a perfect 300-ohm impedance match at the receiver's terminals and at the antenna's terminals, and at the same time hold insertion loss to the initial 3 db. Good impedance matching means that leadin lengths are not critical. Poor impedance matching results in additional insertion loss and ghosts.

The theoretical minimum insertion loss of *any* two-set coupler is 3 db (½ signal power to each receiver). Hence, the measure of a good coupler is its ability to limit insertion loss to the inherent 3 db or a minute fraction above this theoretical minimum. A very low insertion loss is also indicative of good impedance matching. Symptoms of high insertion loss are reduced picture contrast, snow and picture instability or rolling.

Signal isolation between receivers is the property of the two-set coupler to prevent any signal from one set interacting on the other set. Measurements of signal isolation include the inherent isolation characteristics of a coupler plus the insertion loss. Poor signal isolation causes *rf* interference (herring-bone patterns) and other annoying reception problems.

High impedance isolation is the property of the two-set coupler to prevent any impedance variation at one receiver from affecting the signal at the second set when both are tuned to different channels. Symptoms of poor impedance isolation are variation of picture quality on different channels and deterioration of the picture on one or both of the sets.

Finally, the coupler should divide the signal equally and simultaneously, without penalizing either receiver. Unequal power division would result in one set having inferior picture contrast and possibly snow, while the second set provides satisfactory picture quality.

There are two types of couplers most commonly used today; the *resistor* and the *bifilar-elevator-coil* types.

In the resistor-type coupler, the resistors do provide a good impedance match. The antenna is matched directly by one set, while the other is isolated by a high-attenuation resistor. However, this dependence upon high

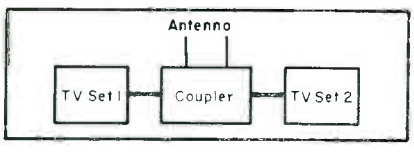


FIG. 1: TWO-SET COUPLER FEED to pair of TV sets.

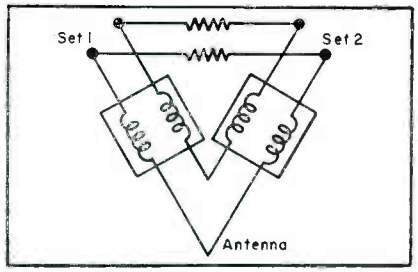


FIG. 3: RESISTORS used to provide 2-set isolation.

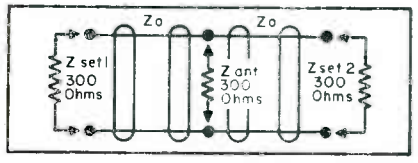


FIG. 2: ELECTRICAL EQUIVALENT of 2-set feed network.

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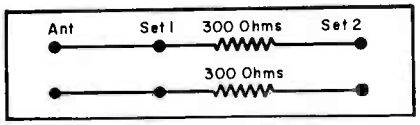

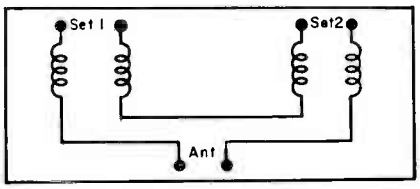

(Left)
FIG. 4: RESISTOR-TYPE 2-set coupler circuit.

(Left)
FIG. 5: CIRCUITRY FOR BIFILAR elevator-type coupler.

(Right)
HAROLD HARRIS, in lab, checking a 2-set coupler.

attenuation resistors has been found to cause a high insertion loss and poor division of a signal.

To achieve isolation, insertion loss of set 1 is low, but insertion loss of set 2 is high. This has been found to obtain because most of the signal is dissipated as it passes through series isolation resistors to reach set 2, the loss of set 2 running as high as 12 db, which is equivalent to the total gain of the most effective antennas.

Signal isolation, while apparently high, can be misleading because it is usually achieved at the penalty of high insertion losses, since high attenuation resistors are used to isolate set 1 from set 2.

Analyzing impedance isolation between receivers, we find that actually no impedance isolation is provided for set 2, because the signal received at set 2 passes through and is directly dependent upon the impedance of set 1. This usually causes variation of picture quality on different channels and deterioration of the picture on set 2.

One also finds that signal division is poor because the signal is fed directly to one set, and through a high-attenuation circuit to the second set. This gives most of the power to set 1, with very little going to set 2.

In summary, one finds that the *resistor* type two-set coupler delivers good impedance match and good signal isolation, but does not provide equal signal division or impedance isolation, and has a high insertion loss.

In the *bifilar-elevator-coil* type two-set coupler bifilar type windings are used to simulate transmission line sections. Two wires are wound separately, simultaneously and parallel to each other. This type of coil is subject to many manufacturing tolerances which have been found to affect adversely its characteristic impedance. It has been found virtually impossible to adjust the spacing between the coils to control impedance to overcome these limitations. The impedance characteristics of the bifilar windings are approximately controlled by the wire size, spacing between conductors, and spacing between bifilar turns or pitch. These bifilar windings are lumped sections of approximately 150 ohms (or lower) transmission line, causing an impedance mismatch of at least 2:1 at the set terminals.

In addition to the initial 3 db loss, further insertion loss is caused by impedance mismatch and *lossy* components. These insertion losses often run as high as 9 db.

Signal isolation, while apparently good in bifilars, is misleading because it is achieved at the cost of high insertion losses. Dependence on the attenuation of the lumped lines and physical layout (spacing) are other factors in the failure of this type of coupler to achieve good isolation.

Any low impedance at set 2, being transformed into a high impedance at the antenna terminals, greatly increases attenuation at set 1. This, in effect, approaches the condition where only *one antenna lead* is connected to the coupler. The resulting unbalance and attenuation greatly contributes to interference and ghosts on set 1.

The bifilar type of coupler does have good theoretical power division due to its physically symmetrical construction. It is designed to feed power directly from the antenna to each receiver independently.

Summarizing the characteristics of bifilars, it has been found that these couplers deliver good signal isolation and good division of signal, but are deficient in impedance isolation, impedance matching and insertion loss.

In a study of the foregoing problem in our labs, it was found that impedance and isolation could be independently controlled, if diplexing* techniques were employed.

To achieve impedance matching each leg of a diplexer was cut ¼

(*Continued on page* 38)

PERFORMANCE RESULTS obtained in field study of three types of couplers (left to right): Bifilar elevator, resistor and diplexer.

Channel	Insertion Loss - db		Signal Isolation - db	Input VSWR
	Set 1	Set 2		
2	7.9	7.6	21.2	10.0
3	7.6	7.8	21.6	10.2
4	6.1	6.1	20.5	12.0
5	5.2	5.4	19.7	12.5
6	7.3	7.2	22.8	10.2
7	8.7	8.4	16.0	2.7
8	4.2	4.2	14.3	3.0
9	5.7	5.7	17.9	5.0
10	6.7	6.3	19.5	6.0
11	6.5	6.4	19.7	6.0
12	6.6	6.6	20.2	6.3
13	6.7	6.5	20.2	7.2

Channel	Insertion Loss - db		Signal Isolation - db	Input VSWR
	Set 1	Set 2		
2	1.7	11.7	12.0	1.43
3	1.7	11.7	12.0	1.39
4	1.7	11.8	12.2	1.44
5	1.6	12.2	12.2	1.43
6	1.5	12.1	12.3	1.43
7	1.6	11.5	12.3	1.67
8	1.6	11.4	12.3	1.65
9	1.6	11.5	12.3	1.60
10	1.8	11.5	12.4	1.55
11	1.8	11.5	12.3	1.60
12	2.0	11.5	12.5	1.70
13	2.1	11.2	12.4	1.70

Channel	Insertion Loss - db		Signal Isolation - db	Input VSWR
	Set 1	Set 2		
2	3.1	3.1	19.5	1.27
3	3.2	3.1	19.7	1.25
4	3.2	3.2	18.6	1.24
5	3.0	3.1	15.1	1.27
6	3.2	3.1	13.6	1.29
7	3.2	3.2	15.9	1.18
8	3.1	3.0	19.0	1.14
9	3.1	3.0	21.3	1.10
10	3.2	3.2	20.3	1.13
11	3.0	3.0	17.8	1.15
12	3.0	3.0	15.4	1.23
13	3.0	3.0	13.4	1.30

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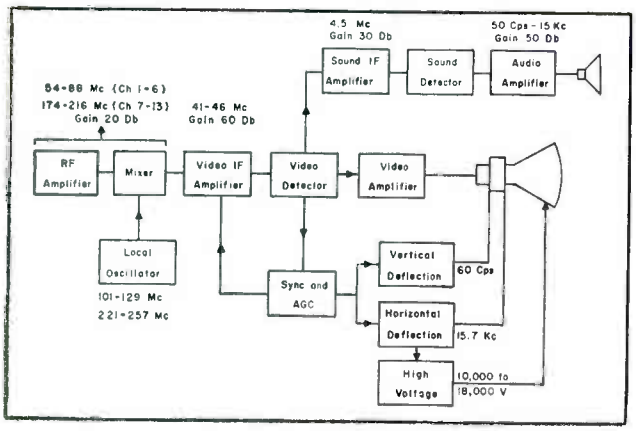

TV Circuits Suitable For Transistors and Diodes‡

FIG. 1: BLOCK DIAGRAM of a conventional TV chassis with frequency ranges and gain (power) figures for various sections.

DURING THE LAST few years, the frequency and power capabilities of transistors have been greatly increased opening up possibilities of applying transistors to TV circuits.

In TV applications, transistors would reduce the heat problem, especially troublesome in compact portable receivers, open the way to battery-operated portables and enable the construction of compact receivers.

In the *rf* stage of the tuner, transistors capable of amplifying frequencies up to 220 mc are required. Such transistors are not commercially available yet, and performance of available *rf* types would be marginal even on the low *vhf* band. But, for the tuner's local oscillator, such transistors will perform well on the low *vhf* band, while only marginal performance can be expected on the high *vhf* band. Semiconductor diodes, now used in conventional tuners as *uhf* mixers, can be employed in transistorized tuners on the *vhf* channels. Ultimately, as improved *rf* transistors become available, triode mixers will probably be used. Accordingly, at the present state of the art, it is possible to build tuners having transistorized oscillators, diode mixers, but no *rf* amplification. But, prospects are very good that transistors will be available soon for tuner *rf* amplifiers. Ultimately, a transistorized tuner should provide a minimum power gain of 20 db and a noise figure of less than 10 to 12 db.

Video *if* operation at 40 mc is now common practice in tube receivers. Resorting to 20 mc would ease transistor requirements, but would be undesirable because of interference and image rejection, especially if *uhf* operation is required. Available *rf* transistors will yield stage gains of 10-15 db at 40 mc. Therefore, engineering believes that four to five transistor stages will be required in a 40-mc video *if* amplifier.

As in tube *if* amplifiers, stagger-tuning will probably result in simple circuits which are easy to align on a production basis.

AGC Circuitry

The application of *agc* will require special attention as it may cause tilt of the *if* response. To some extent, this problem is, of course, present in tube circuits, being related to input capacitance variations (Miller effect). An analogous output capacitance variation is present in transistor circuits. However, a much more serious effect is that of change of input capacitance with emitter bias current, and attention will have to be paid to minimizing this effect.

A number of problems must be resolved in transistorized video amplifiers. Picture tubes generally require anywhere from 40 to 70 *v* (peak-to-peak) grid drive. The maximum available output voltage from transistor amplifiers is limited by the collector breakdown voltage rating of the transistor. Breakdown ratings of 30 to 50 *v* are common for certain types of high-frequency transistors, while other types have even much lower ratings. To take full advantage of the output voltage and frequency capabilities of the transistor, use of the common base circuit is advantageous. However, it has been found that this circuit results in lower power gain than the common emitter circuit. A common base-voltage doubler can produce a peak output voltage of twice the collector breakdown voltage rating. However, stage gain is so low (power gain=voltage gain=2), that one or two driver stages are required. Labs report though, that germanium high-frequency transistors for video applications, having collector breakdown voltage ratings of 100 *v* or more, will be available in the not-too-distant future and even higher ratings will be possible with silicon transistors. Such transistors will ultimately permit the design of simple, one-stage video amplifiers.

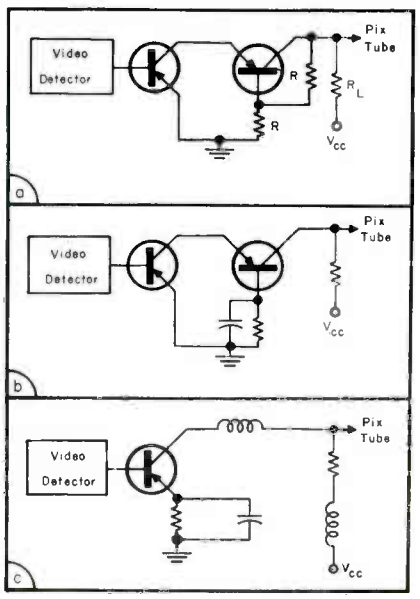

FIG. 2: FOUR TYPES of transistor video amplifiers. Circuit in (a) is a common-base voltage doubler which can produce a peak output of twice the collector value rating. The (b) circuit is a common-base output stage having a higher output gain but still requiring a driver stage. Shown in (c) is a video amp that it should be possible to build with the advent of high-frequency germanium or silicon transistors. In the ultimate circuit design no video amp will be required because of high GM picture tubes and high-level detectors.

High-Gain Picture Tubes

Conversely, the development of high-gain picture tubes requiring only 5 to 15 *v* peak-to-peak grid drive will permit the use of lower voltage transistor video amplifiers. This approach is especially desirable, since the low supply voltage used with all other stages of the receiver could also be used for the video amplifier. Ultimately, no video amplifier stage may be needed at all, if high level

(*Continued on page 32*)

‡*Based on a paper presented before the AIEE by* ***W. F. Palmer*** *and* ***G. Schiess****, Semiconductor Division, Sylvania Electric Products, Inc.*

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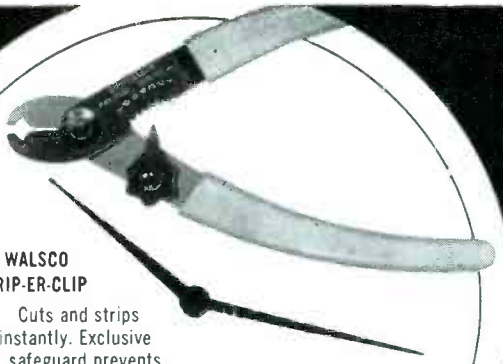

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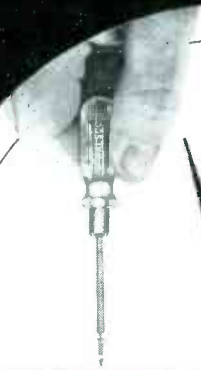

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Annual Shop Equipment

Below—Right: P-W Board Chassis Repair

IN COMPONENT REPLACEMENT and the repair of standard-wired and p-w board chassis, the use of the proper soldering iron or gun is an extremely important factor.

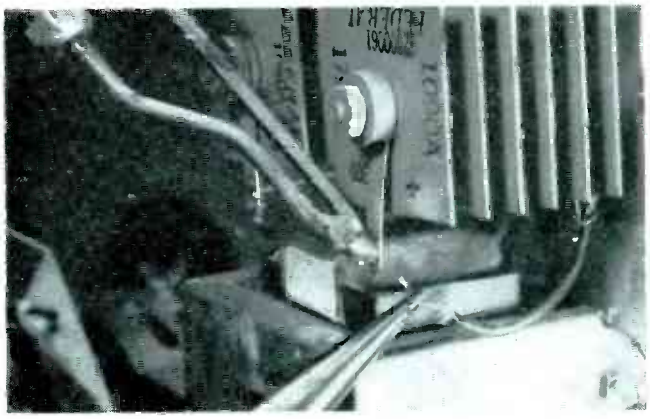
On this and the facing pages are illustrated a number of practical soldering techniques, evolved by service shops, using the latest type guns and irons to repair printed-wiring-board equipment.

The photos shown on this page (courtesy *Weller*) were taken in the shop of the Lee TV Service Co., Philadelphia, under the direction of *Sam Amato*.

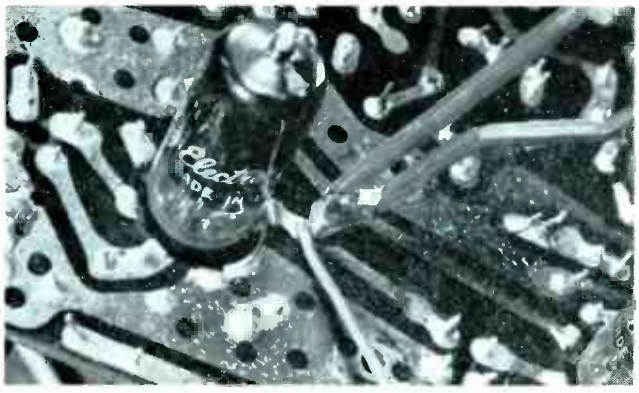
Illustrations on opposite page (courtesy *Ungar*) were made in the shop of Paramount Radio, New York City, operated by *Louis Bennett*. Shop engineer *Anthony P. Santoro* supervised the photography.

Both Lee TV and Paramount Radio are specialists in the repair of p-w transistor radios and TV sets, as well as commercial-sound equipment.

Additional on-the-scene photos illustrating latest types of tools and accessories appear on pages 28, 29, 30, 31 and 33.



ABOVE: APPLYING SOLDERING GUN to disconnect lead in power-supply circuit of a 17-inch TV chassis before removing the selenium rectifier for replacement.

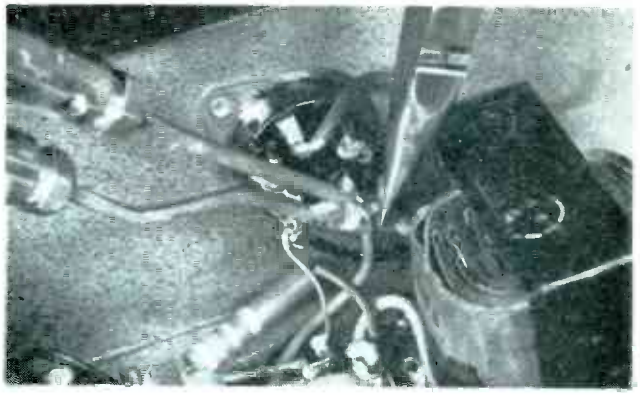


ABOVE: USING SOLDERING GUN to repair lead damage on a printed-wiring if strip. Gun must be held at proper angle and for only sufficient time at contact point to develop a solder flow to avoid injury to board and adjoining components.

ABOVE: REMOVING a video detector crystal from its socket on a TV chassis with a soldering gun. Plier serves to absorb heat from gun which could affect crystal.

BELOW: TIP OF soldering gun bent to reach area that would otherwise be inaccessible. Bending can be accomplished without injury to gun tip by heating gun to normal working temperature (about 15 seconds) and bending with pliers. Tip can be straightened by reheating gun and bending back to normal shape with pliers.

BELOW: ANOTHER APPLICATION for a soldering gun. Repairing output transformer circuit in an audio amplifier. Careful use of gun facilitates removal of transformer's fragile leads from other components and circuit contacts.



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Field Report _____ Pages 26-33

Using Latest Types of Soldering Guns and Irons

USING SEARCHLIGHT to spotlight a defective area on a p-w board, which can then be circled with a color crayon.

PREPARING P-W chassis for soldering of replacement. An upholstery tool (available in 3 sizes—fine, medium, heavy) can be used to clear opening, while it is being heated by a pencil-type soldering iron.

DISSIPATING HEAT through long leads of component (diode in this case) and long nose pliers. Leads can be cut after hole on p-w board has been cleared and part soldered in place.

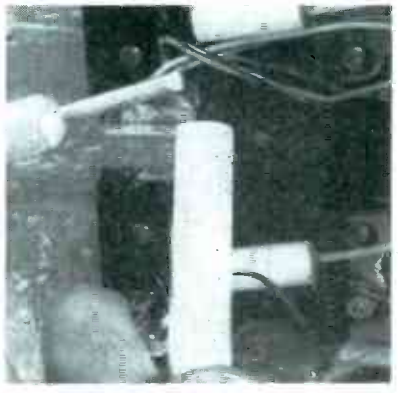
LONG-NOSE PLIERS gripping replacement components to dissipate any iron heat away from board components.

EXTENDING RANGE of soldering iron with a length of No. 14 wire which has been wrapped around tip.

USE OF A curved tiplet on soldering iron to reach areas in a p-w chassis impossible to reach with a standard-type tip.

SOLDERING IN a transistor whose long leads have been retained to dissipate heat and avoid possible damage to delicate semiconductor. Long nose plier also serves to absorb iron heat.

CLEANING SMALL tip of pencil iron with white chalk whose light abrasive action has been found to be excellent for cleaning. To maintain tip efficiency frequent cleaning is recommended. When soldering, little or no soldering paste should be used.



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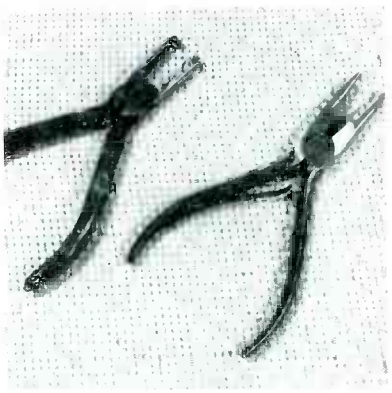
Course, given by the company's sales-engineering department, covers equipment design and application, installation of various types of wired systems, factory production and service procedures and demonstration of new products.

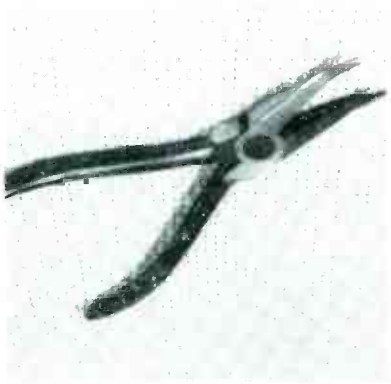
A TRANSISTOR home-study course for Service Men has been announced by CBS-Hytron. Course, prepared by *Albert C. W. Saunders*, includes ten lessons covering simplified basic theory, practical experiments and servicing techniques for transistor amplifiers, oscillators and rectifiers.

Free correction and consulting services, as well as supplements for certified graduates, are provided. Course may be obtained from CBS tube distributors.

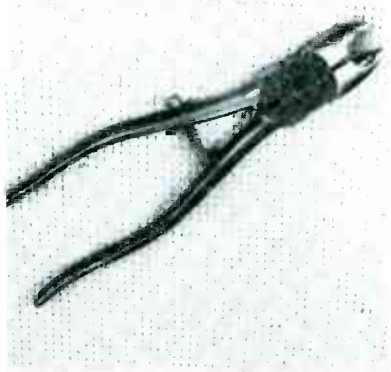
Tight-Spot Tools



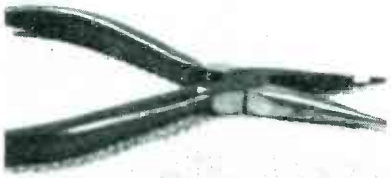
RESISTOR TERMINAL CUTTERS for cutting the terminal ends of packaged-assembly type resistors. Plier severs terminal wires which are inaccessible except from over the resistor.



PLIER designed to cut soft copper wire or connections in close quarters. Plier has thin nose of cutter and anvil type.



ANOTHER TYPE OF PLIER for holding and inserting a pin retainer in a groove in relatively close quarters. After locating ring slight pressure will close retainer over spindle and permit plier to be removed.



NOSE-CUTTING PLIER designed to reach into tight spots and grip or cut small wires.

(Photos above courtesy Kraeuter)

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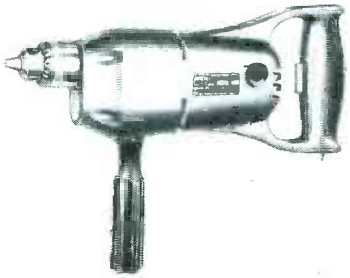
Outdoor Installation Equipment

ABOVE: CAR EQUIPPED with inverter to power tools for outdoor installation and repair, and also operate a tape recorder to report details of outdoor assignment for future reference.

ABOVE: INVERTER-POWERED electric drill cutting hole into concrete wall to mount stud for leadin.

ABOVE: OUTDOOR SOLDERING with iron powered by car-inverter supply.

(Photos above courtesy ATR)

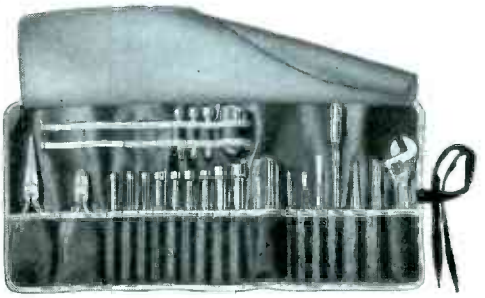


ABOVE: A 2-SPEED POWER drill which can be powered by a car-inverter supply for outdoor work. High speed (3,000 rpm) for drilling through steel to 5/32", wood to 3/8", aluminum, brass, copper to 1/4". Low speed (1,000 rpm) can be used for masonry or concrete to 1/2". (Wen.)

XCELITE Hand Tools PREFERRED BY THE EXPERTS

HERE'S XCELITE'S NEW "ALL-IN-ONE" KIT!

The 99 SM ...For 99% Of Your Service Calls



99 SM Service Master Kit

Count 'em . . . 23 items in this convenient new kit . . . all selected from your most-used, most-wanted XCELITE Nutdrivers, Screwdrivers, Pliers, Reamers and Detachable Handles. The 99 SM Service Master Kit features tools from the famous XCELITE "99 Line"—the *complete* line that's most in demand by professional Radio, TV and Electronics Servicemen. Included is the popular 99 X-10 Extension Blade for nutdrivers and screwdrivers. Snap this in for an immediate 6" additional length.

You can build your own "custom" kit of "99" tools, if you like. Simply select just the items *you* want, and fill your 99 SM Kit with the exact tools you need to fill your own service needs. All the XCELITE tools in the 99 SM Kit are highly-polished nickel chrome finish. The attractive roll kit won't mark or scratch any surface it's placed on. Order From Your Dealer Today!

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Available in all practical Tin-Lead Alloys; 40/60, 50/50 and 60/40 in diameters of 3/32", 1/16", 3/64", 1/32" and others.

Printed Circuit Soldering
On Copper-etched boards use 60% Tin - 40% Lead Alloy . . . for those that are Silver-surfaced use 3% Silver-61½% Tin-35½% Lead

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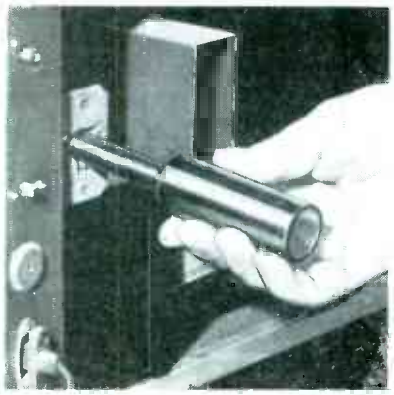
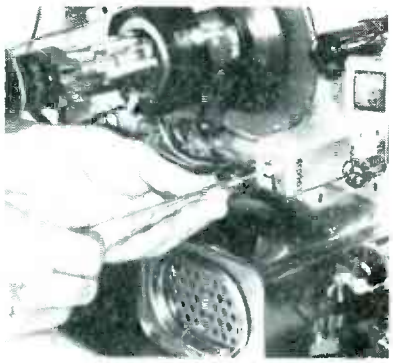
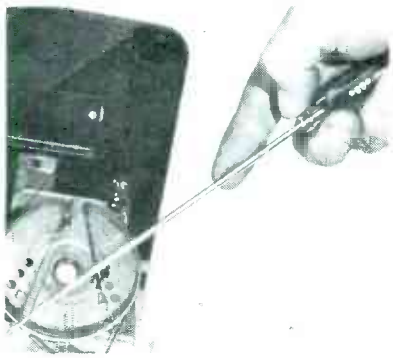


ABOVE: COLOR-TV cheater, an installation-service safety device. This tool permits use of a high-voltage probe and allows the set to operate with the back removed.

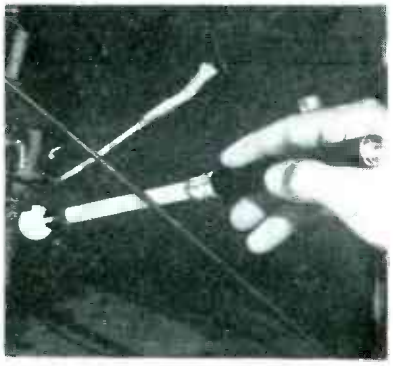


ABOVE: A DUPLEX ALIGNER. This tool has two spring steel tips. One end fits the horizontal oscillator slug, the other fits the vertical linearity coil. Can also be used on if transformers and trimmers.

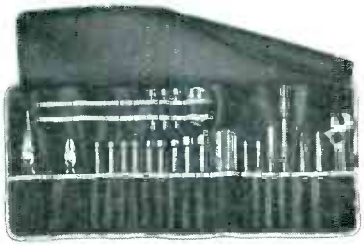
ABOVE: KIT OF ALIGNMENT and specialty tools, which includes solder-ease and wire-dressing tools, alignment screw drivers, stubby-stud drivers, double-ended hex aligners and a pocket container of lubricating oil. (Walsco.)



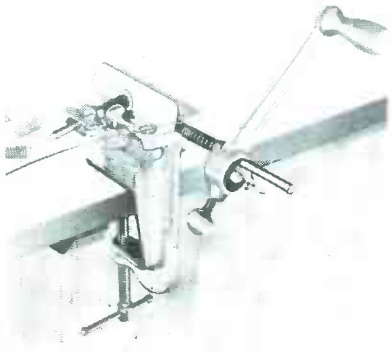
ABOVE: DIAL CABLE TOOL which replaces dial cord springs. Tool has sufficient length to reach difficult places when replacing worn-out dial cables or cables that have slipped off the drum.



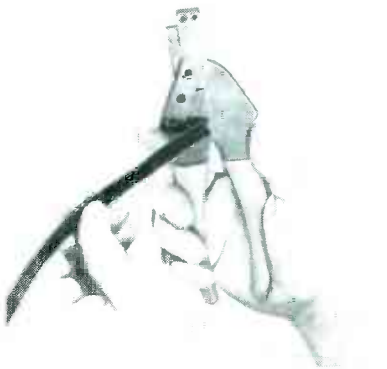
ABOVE: ILLUMINATED INSPECTION MIRROR, a handy tool for the Service Man. Has an insulated handle and a mirror hinge-mounted to a 6″ lucite rod which transmits the light. Enables one to inspect any remote recess of a chassis. Overall length is 12¼″.



ABOVE: FIELD TOOL KIT which contains a long-nose plier, diagonal plier, adjustable wrench, stubby nutdrivers, slotted and Phillips screwdrivers, reamers and extension handles. (Xcelite)



ABOVE: A SPRING WINDER. Springs have a way of becoming lost or broken and are usually difficult to replace. This tool will make any size or type spring used in record players, radios, TV, or any other type of electronic equipment. Equipped with a screw clamp for fastening to bench or table.



ABOVE: A 300-OHM TOOL which can slot, strip and cut 300-ohm line and also crimp solderless lugs. Can also be used to cut standard types of wire.

(Photos at left and above, courtesy General Cement)

ABOVE: CRIMCUT TOOL which serves as a crimping tool, bolt and wire-cutter, and insulation stripper. Front part of the jaws are used for crimping; sizes of wires are engraved opposite each crimping slot. Behind bolt cutting openings is a ½″ section for cutting wire, and behind the wire cutting section are six graduated slots for stripping wire. (Vaco)

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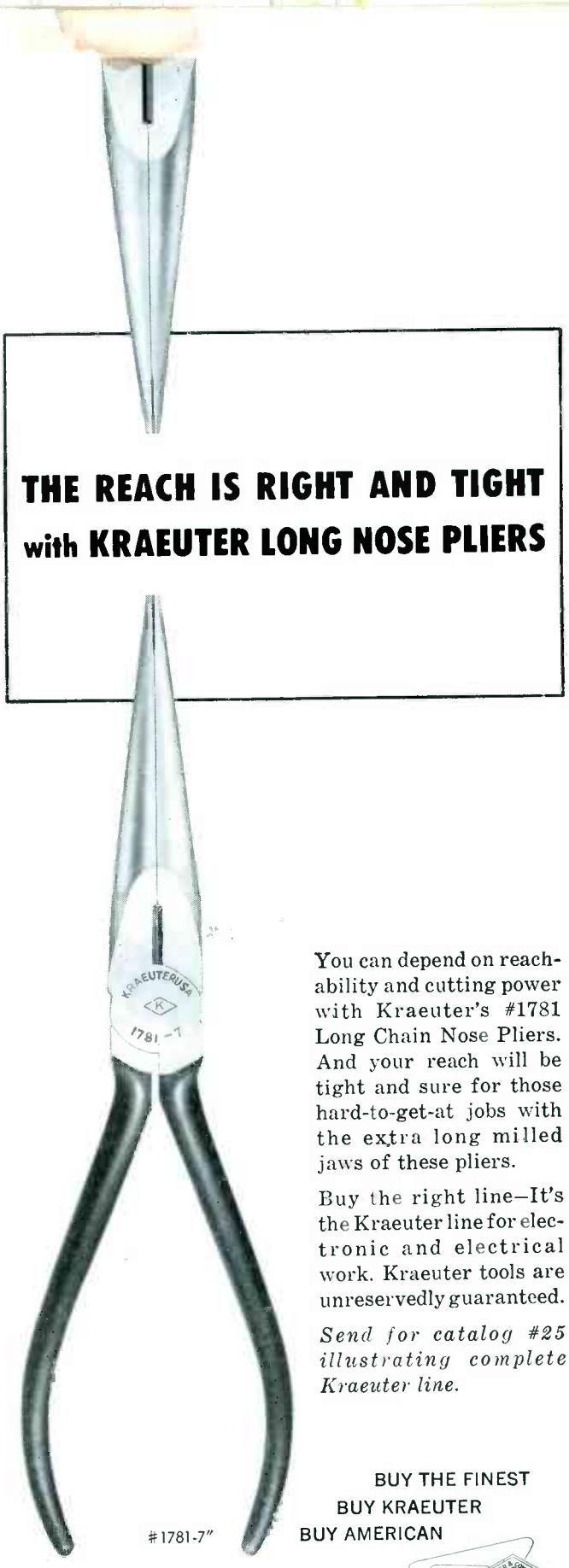
Storage Bins . . Dollies . . Pickup Trucks

PANEL TRUCK of a service shop, used for field installation and repair, equipped with a storage unit with a combination of drawers and bins which can hold tools, hardware, components, test equipment, tubes and accessories. (Equipto)

CONSOLE - CHASSIS DOLLIES designed for station-wagon pickup and delivery. Dollies feature folding platform, strap-ratchet fastening, caterpillar step glide and pivot wheels. (Yeats)

PICKUP TRUCK fitted with side-compartment type utility body which can not only be used to store tools, parts and accessories, but chassis going to or from service shop. Installation equipment which can be carried on trucks of this type include overhead rack with adjustable ladder, side-mounted brackets for pipe or conduit and adjustable mounting bracket for pipe threader. (Dodge Trucks)



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Transistor-Diode TV Circuits

(*Continued from page 24*)

detectors can be used with high GM picture tubes.

The transistorization of sound *if* and audio circuits does not appear to impose particular difficulties in TV chassis design. Transistorized sound sections capable of delivering 1.5 watts of audio output are now available. Transistors in the common emitter configuration, operating at 4.5 mc, can be used to drive conventional ratio detectors, designed so that an optimum power transfer can be obtained between it and the comparatively low input impedance of the audio amplifier.

A second *if* stage will generally have to be used, sharing its functions with other circuits (sync amplifier or video amplifier).

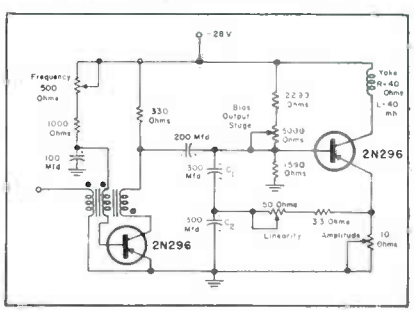
In the sync circuits, available *medium* frequency transistor types (such as those used in the *rf* and *if* sections of broadcast receivers) can be used. The sharp cutoff and saturation characteristics of the transistor make it very suitable for this application. Double-clipping can be obtained in one stage, where two stages are usually required with tubes to perform this function.

In contrast to tube circuits, the deflection transformer may have to convert the yoke impedance to a lower value at the collector, depending upon the combination of yoke impedance, transistor, and supply voltage used. Direct coupling may also be possible with low-impedance yokes. Retrace pulse amplitudes of 5 to 6 *kv* are common in tube-plate circuits, while pulse amplitudes of the order of 100-200 *v* will be used in transistor circuits because of their voltage limitations. Conversely, peak currents of several amperes must be handled by the deflection transistor. The usefulness of transistors in such applications will depend on a number of factors: (a) The collector breakdown voltage rating will have to be high enough to accommodate the yoke flyback pulse. (b) The transistor will have to have sufficient current gain and linearity at several amperes of collector current. Otherwise, excessive driving power may be required or excessive sweep nonlinearity may result. (c) The turnoff time of the deflection transistor will have to be short to allow short beam retrace times.

The power consumption of a fully transistorized 21" receiver can be estimated at 30 to 40 watts. About 4 watts or 10% of the total power will be consumed by the picture tube heater, and a power demand of 20-25 watts has been estimated for the deflection circuits. Responsible for this drastic reduction in power consumption is the lack of filament power (amounting to 50 to 70 *w* in all-tube receivers) combined with the higher operating efficiency of transistors.

According to present knowledge of the semiconductor art, it has been estimated that a transistor TV chassis might use a total of 43 semiconductors which would include the necessary complement of transistors and diodes.

FIG. 4: TRANSISTOR vertical deflection section for a 21-inch 90° deflection chassis using a power-transistor blocking oscillator and a common-emitter power-output stage. Transistors are 2N296.



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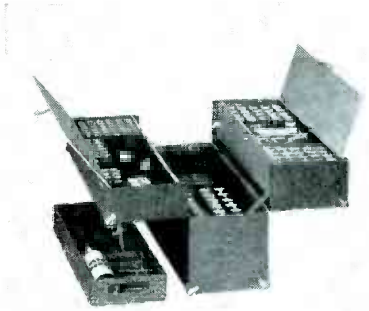
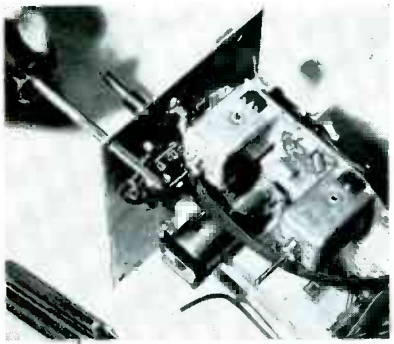
Caddies . . . Special Tools

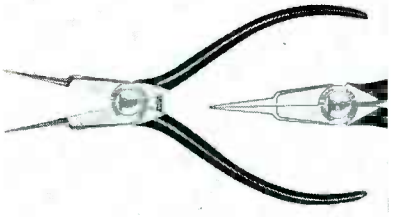


ABOVE: TUBE CADDY with special compartments for tools, instruments and repair chemicals. (Argos)

ABOVE: TUBE-TOOL tote box with compartmented lift-out trays designed to hold assorted shop-equipment items, including antenna leadin, fuses, test equipment and installation-repair tools. (Mastra)



ABOVE: TRI-TAP TOOL with 6/32″, 8/32″ and 10/32″ tap on single shank. (R. N. Hunter)



ABOVE: NEEDLE-NOSE PLIER for wiring amplifiers or reaching into confined spaces. Tip of nose is 1/16″ in diameter. Furnished with a coil spring to keep handles open. (Mathias Klein and Sons)

4 IDEAS

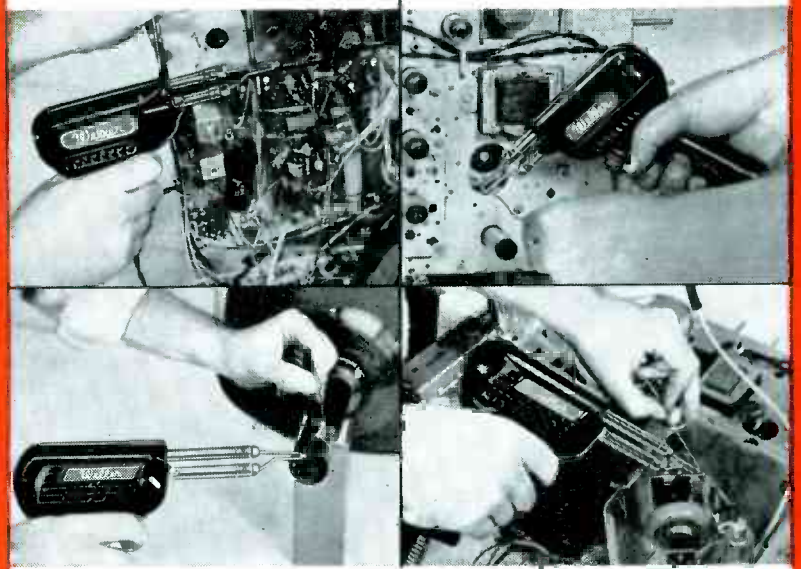
for getting even more use from your

Weller SOLDERING GUN

Your Weller Soldering Gun is the most useful tool in your shop. Service technicians find new, practical uses for it every day. Here are some time-saving applications:

1 CIRCUIT AND COMPONENT DEFECT ANALYSIS. Energized tip of Weller Gun is substituted for signal generator to find defective components in both audio amplifier section and picture circuit. Quickly uncovers thermal intermittance trouble.

2 REACHES COMPONENTS THROUGH CHASSIS CUT-OUTS. Weller Guns, with their long, thin electrodes, reach recessed tube sockets and connections through small chassis cut-outs. Pre-focused twin spotlights light up this hard-to-get-at work.



3 NEW SOLDER FOR CATHODE TUBE BASE PIN. Defectively soldered (or loose) base pin is re-sweated to remove imperfections. New solder is then applied to establish uninterrupted contact. Weller Gun is ideal for this type of repair.

4 SOLDERING BROKEN TERMINAL LEADS. Weller Soldering Gun permits controlled application of heat. Solder is maintained at correct viscosity. This enables serviceman to produce rounded joints and prevent corona discharge in high-voltage compartment.

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Troubleshooting DuMont TV Chassis*

CRYSTAL VIDEO FAILURES, reported in some DuMont Models (RA-380/381/392/393), have been found to be due to cold solder joints; not faulty crystals.

In cases where a defective crystal is indicated, it should not be replaced until the solder connections have been thoroughly sweated to insure good contact. Caution should always be observed in using a soldering iron at a crystal junction. This can best be accomplished by dissipating some of the heat by holding the crystal lead with a pair of pliers while heat is applied.[1]

Stopping Sweep Radiation

IN WEAK AREAS where an *indoor* antenna is used on DuMont RA-392/393, the following precaution should be observed in lead dress to reduce sweep radiation pickup on the antenna lead which could, under these extreme signal conditions, produce horizontal instability and *snivets*.

Looking at the rear of the chassis, the antenna lead should be dressed to the extreme right hand side taping it in place at this point.

Cures For Horizontal Instability

INTERMITTENT HORIZONTAL instability in DuMont RA-370/371, RA-380/381 can be caused by mechanical defects in the mounts for capacitors C_{285A} in RA-370/371 and C_{286A} in RA-380/381 chassis. The specific problem in these capacitors is due to poor mechanical staking of the solder lugs to the aluminum wires coming through the bottom of the B+ output section. This has been found to cause insufficient filtering at 15.75 kc on the B+ line, permitting horizontal information to be introduced as a spurious response. The resultant symptom has been noted as varying in magnitude dependent on signal strength. In strong-signal areas on-intermittent movement of the raster may occur. The section involved could be at any point of any given time, moving approximately ⅛". In weak areas the symptom is the same as the above but more perceptible, possibly causing the set to go out of horizontal lock. The symptom can also be described as poor interlace, which shows up usually at the top and bottom of the picture intermittently, while the center portion of the picture remains in perfect interlace.

Rather than replace the capacitor, a simple field expedient is to squeeze the lug to the aluminum wire with a good pair of pliers. It is recommended that all four lugs in this capacitor should be mechanically staked in this fashion as a precautionary measure.

Improving Tuner Performance

IF POOR or no high channel performance is observed on DuMont TV receivers, the trouble is probably due to a shorted capacitor C_{109} (27 mmfd. — 5%) in the tuner. Field replacement is recommended in such cases.

Investigation has revealed that the capacitor was rated adequately, but a bad lot had been received from the manufacturer. DuMont reports that steps have been taken to screen all such components in the future to prevent a recurrence of this condition.

Vertical Jitter-Sync Instability Remedies

IF VERTICAL JITTER or hook at top of picture occurs in DuMont RA-372/373, the probable fault is in C_{202} (120 mmfd) in the noise inverter-bias setter circuit. This value should be changed to 330 mmfd.

SYNC INSTABILITY on DuMont RA-372/373 has been found to be due to poor staking of voltage terminals on electrolytic capacitor C_{303A} in the power supply.

To remedy terminals on C_{303A} should be recrimped with a pair of pliers. The results may be checked by connecting a 'scope on the B+ line which will be clean of horizontal sweep information.

Couplet Replacements

DISTORTED, WEAK or no sound on DuMont RA-372/373 chassis can be due to a defective N204 couplet, which should be replaced.

POOR HORIZONTAL sync on some DuMont RA-372/373 sets has been found to be due to a defect in N203; the unit should be replaced.

[1] *See pages 26-33, this issue, for annual shop-equipment report with additional repair-technique information, using latest types of tools.*

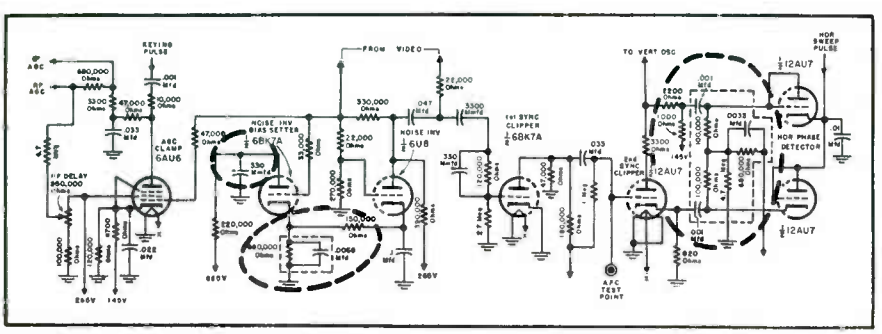

FIG. 1: CAPACITOR and packaged-assembly changes in DuMont RA-372-373 which were found to cure vertical jitter (in noise-inverter bias-setter circuit) and improve horizontal sync (in horizontal phase detector circuit).

*Based on information supplied by **W. E. Whitacre**, Service Manager and **Jerome Roth**, Service Publications, Allen B. DuMont Laboratories, Inc.*

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long life

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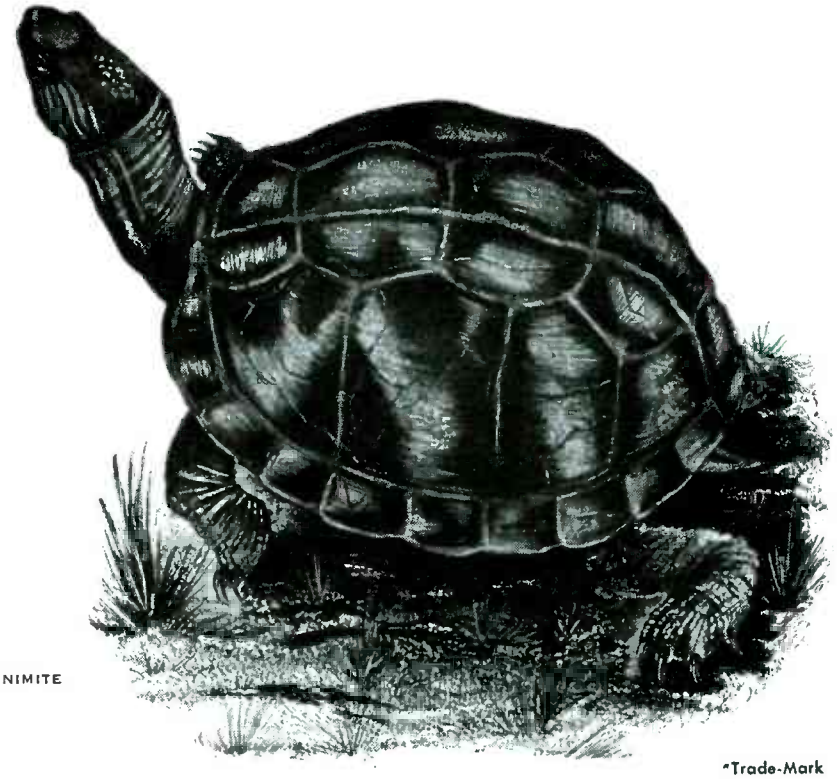
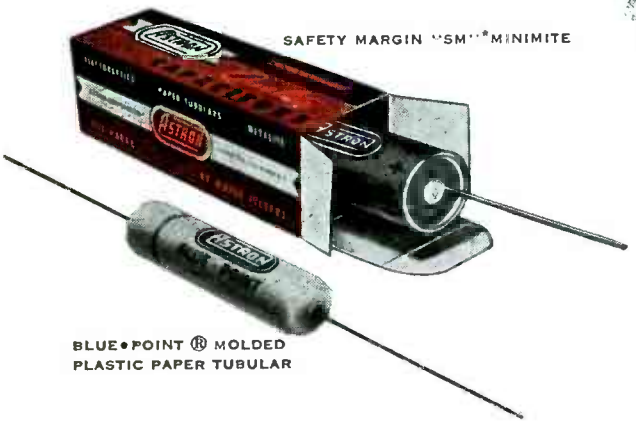
You can put your trust in Astron . . . your assurance of top performance . . . **every time.**

There is an Astron "Staminized" Capacitor built especially to fill the specific, exacting replacement requirements of any job you tackle.

Remember, your reputation is our business, too. Build it, guard it, protect it . . . Buy Astron!



*Trade-Mark



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ASSOCIATIONS

SRRT, California

AT THE ANNUAL MEETING of the East Valley Society of Radio and Television Technicians, Inc., of California, *Buzz Bizzell* was elected president; *Jim Scarborough,* vice president; *Web Benedict,* secretary; and *Walt Avril,* treasurer.

The board of directors now include *Del Davis, Gene Kono, Ralph Johonnot, Jim Swartzbaugh* and *Buss Dixon.*

° ° °

RTSA, Durham, N. C.

CHARLES MCBROOM has been elected president of the Radio and Television Service Association, Durham, N. C.

Other officers are: *Garland Hoke,* vice president; *L. L. Leathers,* secretary, and *Walter Cobb,* treasurer.

On the rules committee are: *Garland Hoke, Carl Wallace, Carter Linthicum, M. A. Turner* and *Cobb.*

° ° °

TSDA, San Mateo County, Calif.

AT THE FORTHCOMING San Mateo County Fair, the San Mateo County Television Service Dealers Association will exhibit an operational display of service instruments.

The booth will be manned by TSDA members who will explain the equipment and techniques being demonstrated.

The booth committee is chairmaned by *W. D. Haines,* assisted by *Ed Mitchell.*

° ° °

ESA, St. Louis, Mo.

BARNEY LEWIS has been named chairman of the board of the Television Electronic Service Association of St. Louis.

Wally Hirschberg is now president of the group. Others elected include *Ralph Newberry,* executive vice president; *Harry Haus,* first vice president; *Ray Wirtel,* second vice president; *Fred Riechman,* secretary; *Robert Matteson,* treasurer; and *Charles Luensman,* sergeant-at-arms.

Seven directors were named: *Howard Freiner, Walter Berganti, Vincent J. Lutz, Tom Knowles, J. G. Alexander, Russ Adelman* and *Nick Koclanes.*

° ° °

RTA, Santa Clara County, Calif.

THE JULY, 1957, issue of *RTA,* the official publication of the Radio and Television Association of Santa Clara Valley, Calif., features a schedule of bench and home-call labor charges for TV repairs.

The fees listed include charges for modifications; transformer, rectifier, capacitor, resistor, tuner and control replacements; alignment; antennas (built-in and outdoor); and picture-tube installations.

° ° °

ESFETA, New York

GORDON VROOMAN has resigned as president of the Empire State Federation of Electronic Technicians Associations.

Dan Hurley, Syracuse, has been chosen to replace *Vrooman.* Other officers of ESFETA now are *Bob Larsen,* Long Island, vice president; *George Carlson,* Jamestown, secretary; *Pat Pratt, Buffalo,* treasurer, and *Thomas Salisbury,* Mohawk Valley, sergeant-at-arms.

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OFFICERS OF THE ELECTRONIC TECHNICIANS Guild of Massachusetts: (seated) Nicholas A. Averinos, president; (left to right) Remo DiNicola, assistant to the president; Albert N. Giddis, treasurer; Gilbert P. Clark, vice president; and Lawrence J. McEvoy, secretary.

° ° °

ETC, Mass.

A STATE ORGANIZATION, chartered as the Electronic Technicians Guild of Massachusetts, was formed recently by delegates from six cities in Massachusetts.

Elected president was *Nicholas A. Averinos.* Others named were *Gilbert P. Clark,* vice president; *Lawrence J. McEvoy,* secretary; *Albert N. Giddis,* treasurer, and *Remo DiNicola,* assistant to the president. All officers were elected for one year.

The guild has an initial membership of 350 members. The charter was signed by delegates from local organizations representing servicing firms in Boston, Brockton, Lawrence, Lowell, North and South Shore areas.

° ° °

RSA, Luzerne County, Pa.

THE ANNUAL CLAMBAKE of the Radio Servicemen's Association of Luzerne County, Pa., was held recently at Twin Lakes, near Wilkes-Barre, Pa.

° ° °

TSDA, Philadelphia, Pa.

CHARLES F. SETTLE has been elected president of the Television Service Dealers Association of Philadelphia.

Harrison Neel, formerly president, was named vice president, and *Jack Rubin,* treasurer.

Other officers include *Richard Schoefield,* recording secretary, and *Steward Kersting,* corresponding secretary. *Albert M. Haas* and *Kersting* will serve on the board of directors.

TEN YEARS AGO IN SERVICE

BOOMING SALES of 2-way equipment received headline attention in service association bulletins, and prompted a number of groups to program 2-way installation-repair clinics for the fall of '47. . . . Doubling of FM station space, from 400 to 800 kc, was announced in an exclusive report in SERVICE. The new technique enabled circuit designers to reduce the number of tuned systems from eight to four, and in addition cut the cost of FM receivers. . . . The first field report on TV-antenna installation, published in SERVICE, detailed the types of antennas found most effective in local and fringe areas, and the types of twinlead and coax lines, poles and towers available for metropolitan and rural installations. . . . *T. P. Cunningham* was appointed advertising manager of Sylvania Electric. . . . Sprague Products released a service-shop wall chart containing diagrams and descriptions of common circuit troubles involving capacitors.

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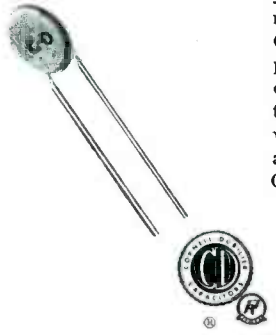

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TV Antennas

(*Continued from page 23*)

wavelength long at 65 mc, the middle of the low band, which resulted in a ¾ wavelength length at 195 mc, the center of the high band. The legs thus served to function as ¼-wavelength impedance transformers. The characteristics of the ¼ wavelength section of transmission line were found to be such that the section has the property of matching different impedances, so that there is no electrical discontinuity in the system in which it is incorporated.

The formula for determining the desired impedance for the ¼ wavelength matching transformer is:

$$Z_m = \sqrt{Z_1 \times Z_o}$$

Here Z_m is the unknown matching transformer impedance, Z_1 is the input impedance, and Z_o is the output impedance.

Applying this formula to a problem involving the matching of two 300-ohm receivers to a 300-ohm antenna, with minimum impedance mismatch, we find that each set must have its impedance stepped up to approximately 600 ohms at the junction point where the 300-ohm line to the antenna is connected; the two transformed impedances of 600 ohms each are in parallel. Paralleling these impedances produces an impedance of 300 ohms at the junction point; the exact impedance required to match the 300 ohms transmission line.

Solving for Z_o, we find

$$Z_o = \sqrt{Z_{\text{set 1}} \times Z_{\text{transformed}}}$$

$$Z_o = \sqrt{300 \times 600} = 425 \text{ ohms}$$

Therefore, the characteristic impedance of both of the ¼-wavelength transformer line sections should be 425 ohms.

$$Z_{ant} = \frac{\frac{(Z_o)^2}{Z_{\text{set 1}}} \times \frac{(Z_o)^2}{Z_{\text{set 2}}}}{\frac{(Z_o)^2}{Z_{\text{set 1}}} + \frac{(Z_o)^2}{Z_{\text{set 2}}}}$$

$$Z_{ant} = \frac{\frac{(425)^2}{300} \times \frac{(425)^2}{300}}{\frac{(425)^2}{300} + \frac{(425)^2}{300}} = 300 \text{ ohms}$$

Solving for the terminal impedance of either set we find that

$$Z_{\text{set 1}} = \frac{(Z_o)^2 \left[\frac{(Z_o)^2}{Z_{\text{set 2}}} + Z_{ant} \right]}{\frac{(Z_o)^2}{Z_{\text{set 2}}} Z_{ant}}$$

Impedance mismatch $\frac{900}{300} = 3:1$

This temporary impedance mismatch of 3:1 can be corrected by the addition of two isolation resistors in parallel. Either set terminal impedance then becomes:

$$\frac{2R \left[\frac{(Z_o)^2}{Z_{ant}} \right]}{2R + \frac{(Z_o)^2}{Z_{ant}}} = 300 \text{ ohms}$$

Isolation between receivers is controlled by two resistors, equal in value, and is achieved in the following manner.

Any interfering voltage originating at one receiver follows two simultaneous paths. The first path is through the two resistors. The second path is through the total of ½ wavelength of transmission line loaded by the antenna. There are equal transmission losses through the two paths. However, the transmission through the ½ wavelength of line will arrive 180° out of phase with the transmission through the resistors. This results in cancellation of the interfering voltage at the other receiver's terminals.

Having the inherent property of dividing power equally and indepen-

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dently between the two sets, optimum power can be delivered to either set, regardless of the impedance of the other.

Because the receiver circuits are both physically *and electrically* symmetrical, signal power can be transmitted equally, directly and simultaneously to both receivers.

In addition, because ¼ wavelength transformers are used in each leg of the circuit to maintain a constant 300-ohm impedance, it was found that no insertion losses occur from impedance mismatch. The transformers can be adjusted and set for the correct operating impedance characteristics to result in equal division of signal. Another factor in eliminating insertion loss is the absence of power dissipating or *lossy* components in the signal path.

After having found an electronic solution to the problem, it was necessary to find a way to reduce a 46" length of 425-ohm transmission line (a ¼ wavelength at 65 mc) so that it could be fitted into a container and assembled without adversely affecting its electrical characteristics.

To replace the excessively long length of transmission line, two pairs of coils were wound on separate forms with a specified number of turns and predetermined pitch so that the required distributed constants of the transmission line could be simulated. Each pair of coils was assembled so that the turns were interwoven and the spacing between the coils could be adjusted. In this way it was possible to maintain control over the two parameters of characteristic impedance; inductance and capacitance. In production the spacing between the coils is manually adjusted, while observing a test pattern on a 'scope.

---

*A *device which splits into two equal parts a source of electrical energy without introducing discontinuity into the system in which it is incorporated.*

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(Left)

SIDNEY L. CHERTOK, sales promotion manager of Sprague Products Co., North Adams, Mass., receiving NATESA Friends of Service Management Award from Harrol O. Eales, NATESA west-central vice president, at a recent association conference in New Orleans.

(Right)

MOBILE RESEARCH LAB unit recently developed by the engineering staff of the Finney Co. to help resolve individual reception problems in communities throughout the country. Equipped with test instruments, a sixty-foot telescopic tower and twin antenna circuits.

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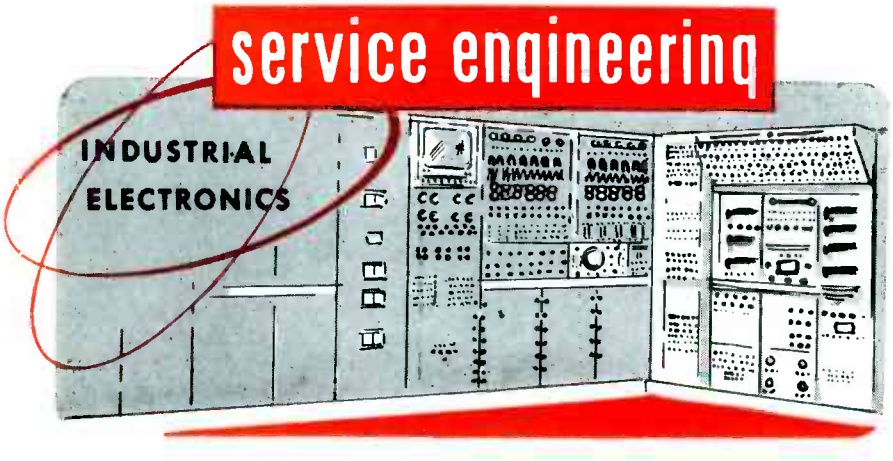

Servicing The Microwave System: How Termination, Multiplex, RF, Repeaters and Standby Fault-Defection Equipment Operates

by LEO JOERGENSEN, Product Service Engineer
Communications Products Department, General Electric Company

AT PRESENT there are several hundred private microwave communications systems in this country, either in use or in various stages of planning and construction. This business is growing rapidly, particularly with small-system users who normally contract for their maintenance with organizations specializing in this type of service. Any firm, with a competent staff, now engaged in commercial electronics services should be planning now to extend the scope of their activities to include microwave.

Termination Equipment—Handling Information

Any communications system is by definition a complete device which will accept information at points of origin and recreate them intelligibly at points of destination. The microwave system is a versatile member of this family. It will not only transmit information over many channels simultaneously, but accept and translate information in any of the common forms. These include voice, signalling, telegraph, teletype, telemetering, and facsimile. It will accommodate any or all of these, at the same time, between any number of points.

Voice communications are arranged for termination in any standard telephone or telephone exchange (manual or dial). Remote paging, recording and operation of *vhf* base stations are other common uses of the voice channels. The voice frequencies, usually 300 to 3400 cps, can be handled at any volume and impedance level.

Signalling takes all required forms. Telephone ringing at 20 or 60 cps is handled directly, as on wire lines. Audio tones are also used. Tones are often coded or used in combinations to achieve selective calling on party-line systems.

Telegraph and teletype signals belong to the same group. Here, the intelligence to be transmitted is converted into bits of *on/off* information. These are easily changed at high speed, into the presence or absence of a signal in a channel. One microwave voice channel can easily take care of more than a dozen of these signals, in the form of keyed tones at speeds consistent with all ordinary mechanical reproducing devices.

Facsimile is the transmission of photographs, maps, or printed material. This is usually done by photoelectric line scanning at one end and synchronized line reproduction at the other end. The information is transmitted in the form of a simple amplitude function of light intensity at frequencies within the voice band.

So far, we have discussed specific useful forms of information. These are prepared for transmission, or converted for use in the end devices, by our termination equipment. The termination equipment converts our intelligence to be transmitted through the microwave equipment into one or more of three standard types to be processed further in the multiplex equipment. These are: (*a*) audio—variable in frequency or amplitude, (*b*) keyed audio, and (*c*) keyed *dc*.

Multiplex Equipment—Processing and Separating Information

Microwave equipments presently supplied to private users have a normal capacity of up to 25 two-way voice channels. These voice channels may be subdivided further for signals not requiring a complete 300 to 3000-cycle band of frequencies to convey the required intelligence. The purpose of multiplex equipment is the combining of these many voice channels into a modulation convenient for transmision on an *rf* carrier, and the separation of these channels from that same modulation after reception at any point in the system. A multiplex system is required to do this combining and separating of channels without distorting the information they contain, and without mixing the information in a way that will cause crosstalk, noise, or confusion.

A typical modern microwave system* can accomplish this effectively through the use of pulse-time tech-

(*Continued on page 42*)

*G. E. *Quadriphase*.

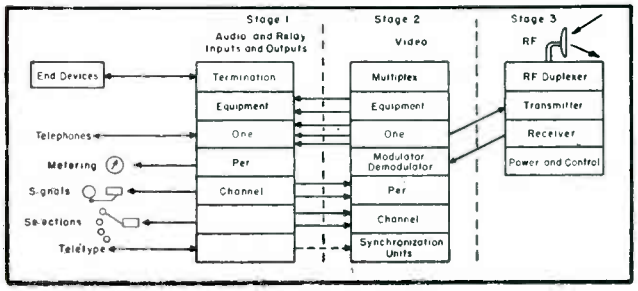

FIG. 1: TERMINATION EQUIPMENT facilities. In stage 1 (at left) information is converted to usable forms. Stage 2 (center) provides for the preparation of information in standard form and its allocation in channel space. In the final or third stage the information is transmitted and received.

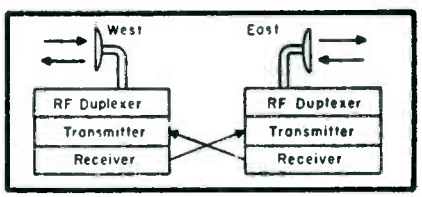

FIG. 2: BASIC FORM of a repeater station with drops.

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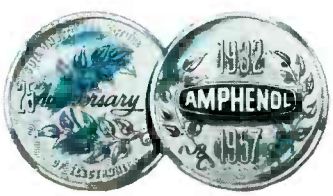
TELECOUPLER
by AMPHENOL



AMPHENOL ELECTRONICS CORPORATION

Service Engineering

(*Continued from page* 41)

niques, in which definite intervals of time, called time bases, are established. These time bases are divided into a number of smaller time spaces. The exact interval of the time base, and its precise division into equal and identifiable time spaces are very accurately controlled by a synchronizing unit. Time spaces are provided for each of the voice frequency channels. Additional time space is allotted for information to synchronize the exact recurrence rate of the time base at all receiving stations, and to permit the accurate redivision of this time base at all stations into the time spaces selected for each information channel.

Signals representing synchronized and selected time spaces are fed to basic multiplex units; channel modulators and demodulators. The modulator is concerned with transmitting information. Audio information for each channel is fed to its modulator. The modulator is permitted to operate only during the time space selected for it. In the center of this time space it generates a video pulse of short duration. Voice-frequency modulation is made to effect the generation of the pulse in time within the selected space. The result is a channel pulse which moves in time at a frequency corresponding to the audio modulation, frequency and an amount proportional to the amplitude of the modulation. This is called *pulse-time modulation*. It amounts to sampling the information in each channel at the time base repetition rate, and arranging this information as bits of pulse-position information in regular sequence at selected intervals.

The channel demodulators are locked in synchronism with their associated modulators. They select the pulse from the same time space and convert its pulse position variations back into the same audio information with which we started. In transmitting simple keyed information, a pulse or no-pulse condition may be used at the modulator. The demodulator will translate this as a voltage on or off at its output. There can be no mixing of information in this form of modulation and demodulation, because no two bits of channel information ever exist at the same time.

RF Equipment—Transmission and Reception of Information

RF equipment, like multiplex, handles signals in two directions. The transmitter in a typical system

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contains a stable frequency source, a number of frequency multiplier stages, a modulation section, and a power amplifier. The output of a crystal oscillator is multiplied 21 times to a frequency near 2000 mc.

The receiver is a conventional superhet arrangement. Frequency preselection is accomplished in a cavity resonator which is coupled to a mixer diode. The local oscillator signal can be generated in a set of multipliers, but for the sake of economy, adjacent transmitters and receivers are usually operated at a frequency difference equal to the required intermediate frequency. This permits using a little of the output from the transmitter multipliers as a receiver local oscillator injection voltage. In our equipment this frequency difference is 60 mc. This high *if* frequency accommodates the wide side bands needed for good video reproduction and also assures good image rejection. The *if* amplifiers are usually stagger-tuned in a fixed fashion and require no adjustment. Amplified *agc* is always provided. A conventional diode detector and video amplifier complete the receiver.

Standby and Fault Detection

The design of microwave systems must include elaborate measures to insure reliability. With good maintenance, 99.9% reliability is an ordinary goal. One of the measures taken to reach this is the provision at each station for standby equipment. Fault-sensing circuits are designed into all major units of the system. These are used to initiate an automatic changeover to standby equipment before service is seriously affected. Standby power units are automatically started and switched to the equipment in the event of power failure. All of these fault-sensing circuits include a fault-signalling circuit, usually a pair of relay contacts. These fault indications can be coded in several ways and transmitted to any terminal point in the system. Recording devices are often provided. These indicate the nature of the failure and the station location.

Accent on System Reliability

The stress placed on system reliability in the design of this type equipment necessitates close attention to ease of maintenance. Maintenance is the single most important factor in long-term reliability. Responsible manufacturers are aware of this, and they are eager to stimulate microwave interest and activity in the service industry.

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Design-Application Notes on Color-TV, Audio and Semiconductor Replacements

AVAILABLE NOW for color-TV is a high-perveance beam power tube[1] designed especially for use as a horizontal-deflection amplifier.

The tube (6DQ5) has a maximum plate dissipation of 24 watts and a maximum grid-No. 2 input of 3.2 watts. These ratings, in addition to a peak positive-pulse plate voltage rating of 7000 *v* (absolute maximum) and a peak cathode current rating of 1000 *ma*, is said to enable a single 6DQ5 to provide full deflection for the 21-inch-type color picture tube.

Another tube, recently announced for color and b-w chassis, is a multi-unit tube of the 9-pin miniature type (5CQ8) containing a medium-mu triode and a sharp-cutoff tetrode. It is intended for use as a combined *vhf* oscillator and mixer in tuners with an *if* of 40 mc.

The triode unit, which features high transconductance (8000 micromhos), is suitable for use not only as a *vhf* oscillator, but also as an *rf* amplifier, phase splitter, sync-clipper and sync-separator.

The tetrode unit is intended primarily for use as a mixer. Its characteristics are said to permit mixer operation with good linearity, reduction in the feedback often encountered in mixer circuits operating at a 40-mc *if*, and the use of a high-impedance, plate circuit with resultant increase in mixer gain. The tetrode unit may also be used in video and sound *if* amplifier circuits.

The 5CQ8 is like the 6CQ8, but utilizes a 4.7-*v*/600-*ma* heater.

Audio Tubes

A 7-PIN MINIATURE beam power tube (6DS5) has been designed for use as a class *A* amplifier in the audio output stages of TV and radio receivers.[1] In cathode-bias circuits the tube can deliver a maximum-signal power output of approximately 3.6 watts with a peak *af* grid-1 voltage of 9.2-*v*.

The structure of the 6DS5 is said to have been designed to permit cool operation of grid 1 with the result that grid emission is minimized. Because of this, the tube can be used with cathode bias and a relatively large value of grid-1-circuit resistance, of particular significance in TV receivers where the audio output tube is driven directly by the FM detector tube.

ALSO AVAILABLE now is a nine-pin miniature power pentode (EL84/6BQ5)[2] designed for the output stages of low-distortion amplifiers with relatively low-voltage power supplies.

A pair of tubes in push-pull will deliver 17 watts at 4% harmonic distortion (without feedback) in class *AB* operation, with 300 *v* B+ supply. As a single-ended output stage, one tube delivers 5.7 watts at 10% harmonic distortion (without feedback). Plate dissipation is 12 watts.

Semiconductors

A SILICON TV RECTIFIER replacement has been introduced.[3]

Featuring eyelet construction, this rectifier employs a silicon diode mounted on a finned heat exchanger.

One rectifier, in a half-wave circuit, it is claimed, will deliver 500 *ma* and 130 *v dc*, with an input voltage of 117 *v* rms. Two units in a half-wave voltage doubler circuit will deliver 500 *ma* and 240 *v dc*, with an input voltage of 117 *v* rms.

SELECTED MATCHED pairs of *pnp* and *npn* transistors are now available for use in complementary symmetry circuits.[4] The pairs are matched in five contiguous beta categories and can be used in transformerless class *B* push-pull output stages, *dc*-coupled amplifiers and balanced modulators.

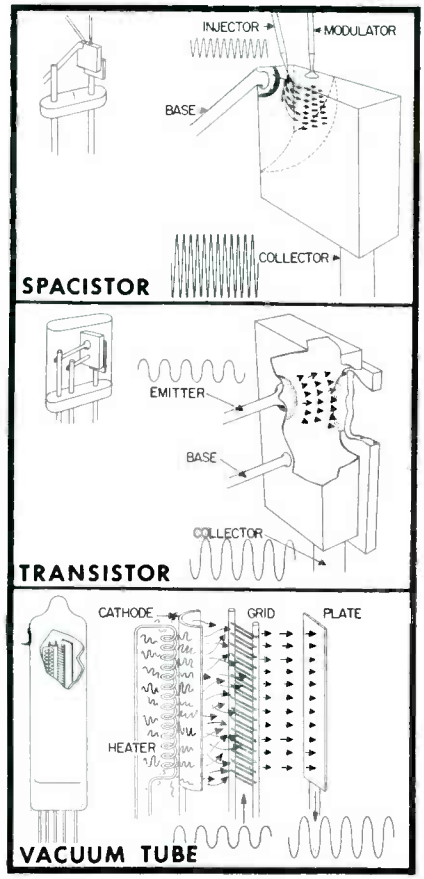
[1]*RCA* [2]*Amperex* [3]*International Rectifier* [4]*General Transistor*

COMPARISON OF NEW TYPE OF SEMICONDUCTOR, THE SPACISTOR, AND THE TRANSISTOR AND TUBE

In the spacistor a voltage is applied between a base and collector in such a direction as to produce a high electric field and virtually no current. A voltage, applied to the injector, causes electrons to enter the region of high field. The electrons flow extremely rapidly to the collector contact. This current (flow of electrons) is modulated by the application of a signal to the modulator as shown. Since the modulator draws only a negligible current while causing the current between injector and collector to fluctuate, amplification thus results.

In a typical transistor, a negative voltage is applied between an emitter and base. This causes a current (flow of electrons) between the emitter and the positive collector. The small fluctuating signal to be amplified is applied between emitter and base as shown (under base). This causes the negative emitter voltage to fluctuate accordingly. The more negative the emitter, the greater the current (flow of electrons) between emitter and collector. The transistor amplifies because the input resistance is lower than the output resistance, while the input current is substantially equal to the output current. The result is a net signal power gain.

In a vacuum tube the cathode is heated by a filament heater. A large number of electrons boil off the negative cathode and are attracted to the positive plate. The small fluctuating signal, to be amplified, is applied to the negative grid as shown. This causes the negative grid voltage to fluctuate accordingly. The more negative the grid, the smaller the current (flow of electrons) between cathode and plate. Thus the grid acts as a valve or shutter, a very small signal controlling a relatively large current. The large output signal (shown under plate) is the amplified counterpart of the small input signal. (Courtesy Raytheon)



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

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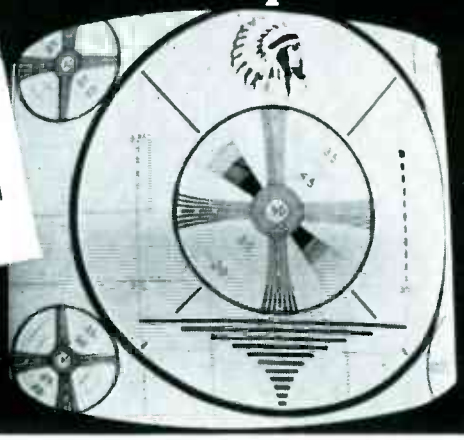
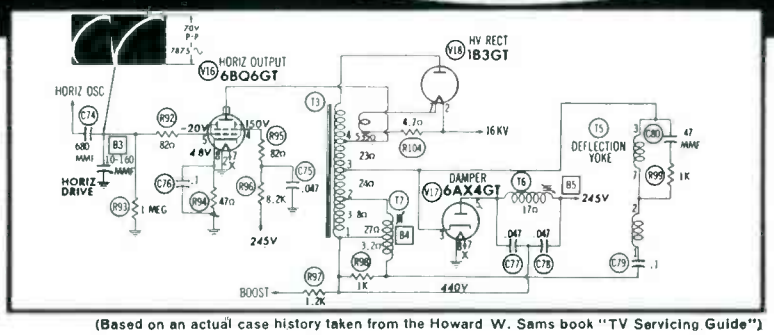
helps you lick problems like this in just minutes for only *2½¢ per model!

SYMPTOM: Horizontal Foldover affecting the right side of the screen, accompanied by an overall reduction in width





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

Let's look at this problem: When the foldover occurs at the right side of the picture, the trouble usually originates in the horizontal discharge or output circuits. Look for the following possible causes:

1. Defective tube in the flyback circuit
2. Leaky coupling capacitor (C74)
3. Misadjusted or defective drive control
4. Open or leaky capacitor (C76) in the cathode of the output stage
5. Incorrect value of the grid resistor (R93) in the horizontal output stage
6. Open or leaky screen bypass capacitor (C75) in the output stage
7. Incorrect value of the cathode resistor (R94) in horizontal output stage
8. Incorrect value of the screen resistor (R96) in horizontal output stage
9. Defective yoke or flyback transformer

With the applicable PHOTOFACT Folder at your fingertips, you'll trouble-shoot and solve this problem in just seconds. Here's-how:

Using the Tube Placement Chart (you'll find it in every PHOTOFACT TV Folder) you'll quickly locate and check the tubes in the Flyback Circuit. Tubes okay?—then: A waveform analysis of the signal in the sweep section is perhaps the quickest procedure you can use to localize the trouble. Check the waveform at the junction of the two capacitors, B3 and C74. The correct waveform and peak-to-peak voltages are shown right on the PHOTOFACT Standard Notation Schematic. Waveform incorrect?—Then, using the easy-to-read resistance chart and the correct voltages shown on the schematic, check for proper resistance and voltage values to determine which part is defective. The exclusive PHOTOFACT chassis photos with "call-outs" keyed to the schematic help you locate the faulty part quickly. Important! Horizontal Foldover may result from improperly matched components in this circuit. It is *imperative* that all parts replaced duplicate the originals. You'll find the proper replacement parts for all components listed in the complete PHOTOFACT parts list.

Remember, whatever the trouble may be, you'll locate it faster and solve it easier and more profitably with a PHOTOFACT Folder by your side.

Use the servicing method you prefer—checking of waveform, voltage or resistance—you'll find all the information you need at your finger-tips in PHOTOFACT. For only *2½¢ per model, PHOTOFACT helps you solve your service problems in just minutes—helps you service more sets and earn more daily!

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

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CATALOGS—BOOKS

TOBE DEUTSCHMANN CORP., 2900 Columbia Ave., Indianapolis, Ind., has issued a 26-page catalog (5701) covering molded tubular, metallized paper, ceramic disc, twist-prong electrolytic and tubular electrolytic replacement capacitors.

° ° °

OHMITE MANUFACTURING CO., 3638 W. Howard St., Skokie, Ill., has released a 2-page bulletin (149) with specifications, resistance values, dimensions and prices of subminiature molded composition potentiometers.

° ° °

TRIAD TRANSFORMER CORP., 4055 Redwood Ave., Venice, Calif., has published a 108-page TV replacement guide (TV-57) featuring an expanded service-installation information section on requirements of current receivers.

° ° °

RECOTON CORP., 52-35 Barnett Ave., Long Island City 4, N. Y., has issued a new edition of its *Simplified Replacement Needle Wall Reference Chart* listing replacements for all major cartridges currently in use.

° ° °

COMPONENTS DIV., RCA, Camden, N. J., has released a 22-page illustrated brochure, *RCA Electronic Components*, covering test equipment and accessories, replacement speakers, hi-fi speakers and enclosures, styli and cartridges, TV receiver parts, service parts for radios and phonos and batteries.

° ° °

HARRY G. CISIN, Amagansett, N. Y., has issued fall bulletin S-14 describing TV and radio service books, tube location guides, tube substitution guides, color-TV service aids, picture guides to TV troubles and radio faults.

° ° °

JOHN F. RIDER PUBLISHER, INC., 116 W. 14th St., New York 11, N. Y., has announced publication of *Closed Circuit TV System Planning* by *M. A. Mayers* and *R. D. Chipp*. Book explains costs and manpower needed for installation and maintenance of closed-circuit systems, equipment and uses, in addition to information on practical applications of closed-circuit TV in education, business and industry. Priced at $10.

° ° °

JOHN WILEY & SONS, INC., 440 Fourth Ave., New York 16, N. Y., has published *Transistor Circuit Engineering* edited by *Richard F. Shea*, covering characteristics and characteristic curves; equivalent circuits; bias and its stabilization; audio amplifiers; *dc* amplifiers and their applications; tuned and video amplifiers; oscillators; modulation, mixing and detection; transient response and pulse circuits; systems, and special circuits. Contains 468 pages; priced at $12.

° ° °

QUAM-NICHOLS CO., 234 E. Marquette Rd., Chicago 37, Ill., has issued catalog *Q-N* 57 listing specifications of 114 replacement outdoor, *pa*, intercom and hi-fi speakers and rear-seat auto-speaker kits.

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ACCESSORIES

PICTURE-TUBE TESTER/REJUVENATOR ADAPTER

AN ADAPTER, *C40*, for testing and rejuvenating color-TV and 110° picture tubes, has been introduced by B&K Manufacturing Co., 3731 N. Southport Ave., Chicago 13, Ill.

Unit is designed for use with models 400 and 350 cathode rejuvenator testers; said to test each gun of color tube for continuity, interelement shorts, opens or leakage, emission and cutoff voltage.

° ° °

COLOR PICTURE-TUBE TEST ADAPTER

A COLOR-PICTURE TUBE test adapter, *T-201*, said to enable individual testing of guns in three-gun color picture tubes on tube checkers designed for *b-w* tubes, has been announced by Perma-Power Co., 3100 N. Elston Ave., Chicago 18, Ill.

° ° °

TUBE PROTECTORS

TUBE PROTECTORS, 250 and 300, designed for use with TV, radio-phonos, amplifiers and other electronic equipment having input ratings of 100 to 300 *w*, have been introduced by American Television & Radio Co., 300 E. Fourth St., St. Paul 1, Minn.

Model 250 plugs directly into wall socket; 300 is equipped with cord set to plug in wall socket. Units utilize a thermal cushion-action principle said to protect other components by eliminating initial surge current.

° ° °

VIBRATOR TEST ADAPTER

AN ADAPTER, *VB-2*, for checking three and four-prong vibrators, has been announced by Service Instruments Corp., 171 Official Rd., Addison, Ill.

Tester is set to accommodate a 6AX4 or 6SN7 when checking 6-*v* vibrators; to accommodate a 12AX4 or 12SN7 for checking 12-*v* units. In use vibrator is inserted in adapter. Two indicating lamps at top of unit glow if vibrator is good. If neither or only one lamp lights, vibrator is defective.

° ° °

DUAL-RANGE FILTERED-DC SUPPLY

A DUAL-RANGE FILTERED-*dc* power supply, *EFB*, designed for use with transistorized circuitry, has been introduced by Electro Products Laboratories, 4500 N. Ravenswood Ave., Chicago 40, Ill.

Unit is said to have less than 10 *mv* ripple at top load. Supplies a continuously variable power source from 0 to 16 *v* for current loads to 8 amps; 0 to 32 *v* for current loads to 4 amps.

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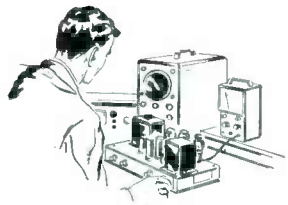

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How Phono Pickups Can Be Tested Before Installation To Insure Best Performance

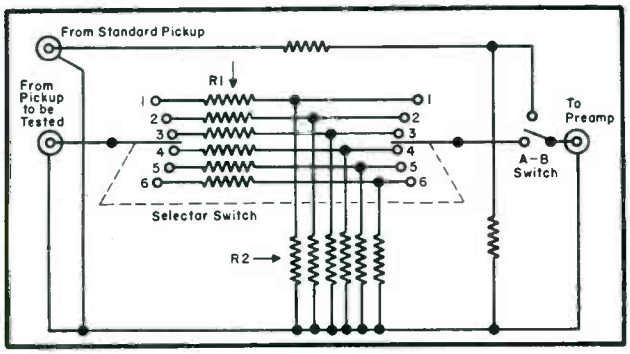


FIG. 1: SCHEMATIC of simple multiple cartridge checking device. Values of R_1 and R_2 for each position (6-way shown) can be chosen for intended cartridge, so that R_1 and R_2 will give the correct loading for the cartridge and $R_2/R_1 + R_2$ will provide input to the preamp, insuring equal loudness for both pickups.

WHEN ONE buys a replacement electric light bulb, invariably the bulb is placed in a test socket to be sure that the lamp lights. Similarly, tube performance is checked by many shops before either direct sale or installation. However, the phono pickup, an expensive and delicate component, is rarely tested before it is sold or installed. As a result operational problems occur frequently.

What seems to be needed is some kind of a *A-B* check, so that one can take any pickup cartridge in stock and make a test against a standard.

Such an arrangement requires a high quality preamplifier and a couple of tonearms, which includes one with a *standard* high-quality permanently-mounted cartridge, and another for testing any of a variety of replacement cartridges. These should feed into an *A-B* switch, and a rotary switch for selecting the correct loading condition for the particular cartridge to be checked.

The rotary switch also makes it possible to insert some attenuation so that the input level to the amplifier is the same regardless of the cartridge involved, provided, of course, that the cartridge is up to standard. Correct values of resistance for attenuation can be calculated from the velocity specification of cartridge output, or by checking a representative number of cartridges and making adjustments until movement of the *A-B* switch on each cartridge gives no apparent change in loudness.

A two-pole 6- or 11-way rotary can accommodate many cartridge types (Fig. 1); if more terminals are required, a second switch can be used to almost double the switching facilities (Fig. 2).

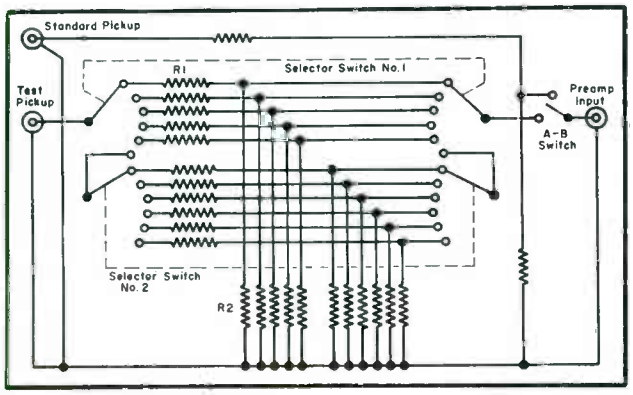
One must also be able to make sure that each cartridge has the correct stylus force pressing down on the groove. As some cartridges are heavier or lighter than others, the force conditions can vary when different cartridges are plugged into the same arm. Usually the stylus-force adjustment on the tonearm takes at least a minute or two to make, so a quick and ready tonearm adjustment should be available.

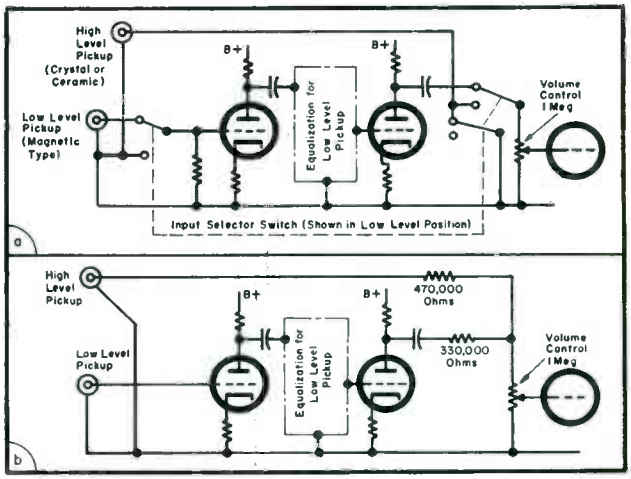
One method of doing this is illustrated in Fig. 4 (p. 50); a sliding weight is placed in a slot along the tonearm. To indicate correct operating positions for this weight for differ-

(*Continued on page 50*)

FIG. 3: CHANGES in preamplifier circuit to accommodate both high and low-level pickups in the same checker. A: Original circuit. B: Modified circuit to accept checker input of Fig. 6 (p. 51).

FIG. 2: ADAPTATION of Fig. 1 circuit showing how two 6-way switches can be used to accommodate 11 variations. Similarly, two 11-way switches could be used to accommodate 21 variations.





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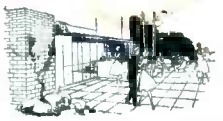

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Here's weatherproof high fidelity that is also low in price. With the MLC, you can economically extend a music system outdoors and retain hi-fi quality.

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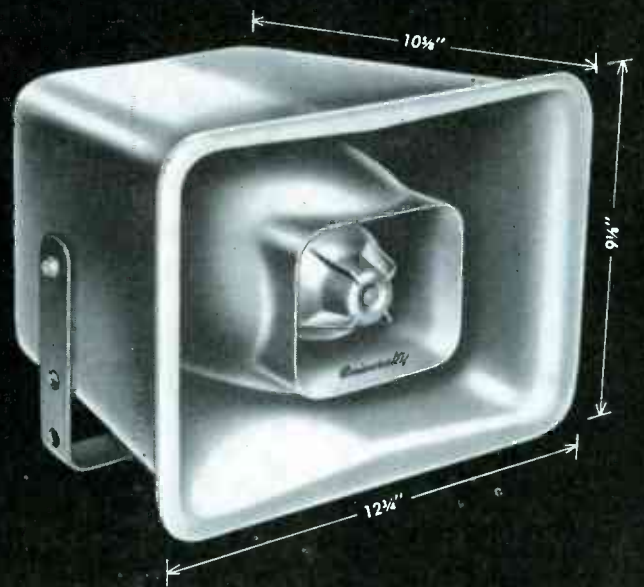
In paging applications, the MLC penetrates high noise levels . . . its wide frequency range adds deep richness to music reproduction. Here's double duty, double value!



MODEL

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BETTER LOWS: Balanced "compression" folded horn, starting with 8" throat and energized by top quality woofer driver provides *more* lows than other designs.

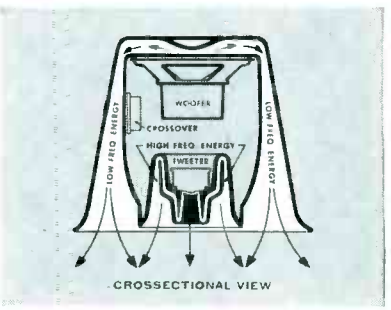
BETTER HIGHS: Driver unit tweeter with wide angle horn transmits more highs with greater uniformity . . . high frequency response that you can hear!

BETTER EFFICIENCY: Dual range theater type system permits uncompromising design of the woofer and tweeter sections for greatest efficiency. Penetrates noise with remarkable fidelity and intelligibility.

LESS DISTORTION: *Separate* low and high frequency driver systems reduce intermodulation and acoustic phase distortion found in other systems which use two different horns on a single diaphragm.

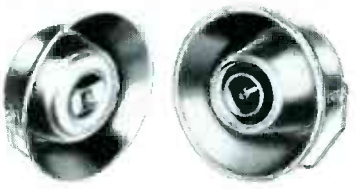
MORE DEPENDABLE: Experienced mechanical engineering and careful electrical design meet the challenge of diversified application and environmental hazards. Rugged and conservatively rated—you can *rely* on the MLC.

SPECIFICATIONS: Power Capacity, 15 watts; Frequency Response, 150-15,000 cps; Impedance, 8 ohms; Dispersion, 120°; Sound Pressure Level, 117 db taken at 4 ft., 750-1250 cps with 1 cps sweep; Dimensions, Bell Mouth 12¾" W x 9⅛" H, Overall Depth 10⅝"; Shipping Weight, 10 lbs.; **$54.50 List.**



CROSSECTIONAL VIEW

FOR HEAVY DUTY APPLICATION...


MODEL BLC MODEL WLC

MODEL BLC employs same design principles as the MLC except for heavy duty 8" woofer with uniform response from 70 cps, exclusive "reciprocating flare" wide-angle tweeter and has 25 watt power capacity. Exceptionally shallow depth, only 9", ideal for close quarters. **$86.00 List.**

MODEL WLC, largest of the series, has 30 watt power capacity, 12" super-efficient woofer with response from 50 cycles, heavy duty radial tweeter . . . and a decade of successful performance in concert halls, rinks, auditoriums, stadiums and outdoor theatres throughout the world. **$250.00 List.**

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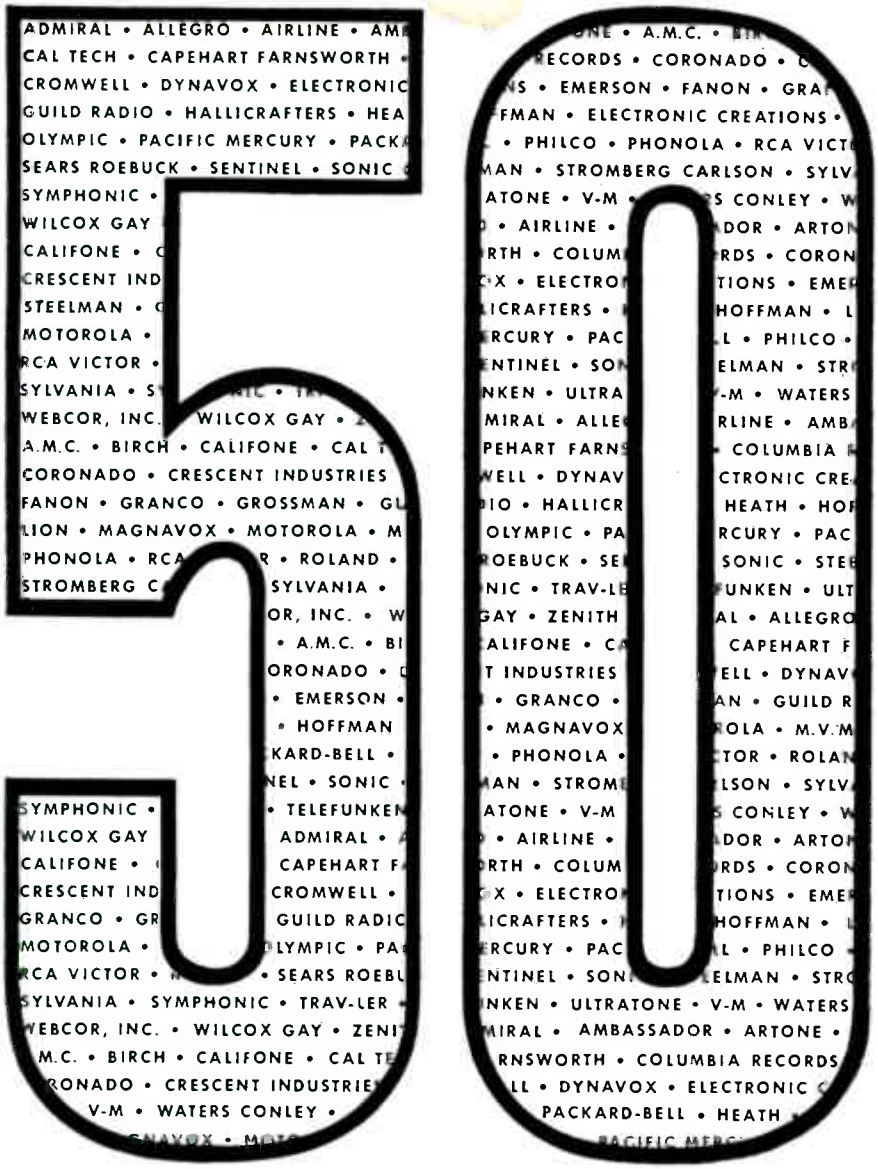

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Audio

(*Continued from page 48*)

ent cartridges under test, a gummed strip, containing letters or numbers at measured distances, can be applied along the side of the slot.

This arrangement could be set up for *either* the low level *or* high-level input of the preamplifier. This arrangement will only permit comparisons between low-level pickups, such as the moving coil and magnetic type, or between high-level pickups, such as the crystal and ceramic type. But it is possible to modify the circuitry so that we can make comparisons between the two types.

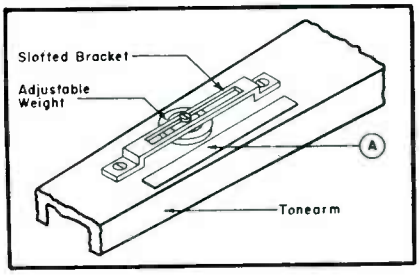
The circuit of the preamplifier will have to be altered so that both high and low-level inputs are operative at the same time. This involves removing the *program selector* switch from the circuit, and making a permanently-wired connection to the two inputs; Fig. 3 (p. 48) illustrates this change. Then the rotary switch, together with the *A-B* switch, are so connected that the unused input for each condition has its circuit closed through a suitable resistance value. In the original preamplifier, we find the unused circuit short-circuited to avoid pickup of hum.

The same procedure can be applied to the external switching; a suitable basic circuit for this is shown in Fig. 6. Resistance values for each pickup will have to be determined so that the performance will be comparable when the *A-B* switch is flipped for each pickup inserted.

Further Refinement

A further refinement involves the preparation of a wall chart noting not only the correct switch positions for each pickup model, but the weight setting. All switching must be properly shielded by enclosure in an aluminum box which has been grounded, and shielded connecting leads must be used. The switch con-

FIG. 4: FIXTURE that can be made to adjust stylus pressure to suit each cartridge. A = Gum strip inscribed to indicate correct position for each cartridge.



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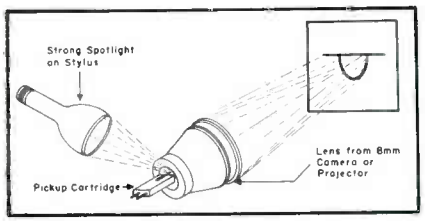

FIG. 5: SET UP for stylus projection using an 8-mm lens to show condition of a stylus.

trols can be flush-mounted on the front of the turntable base.

This demonstration device will enable you to play short selections, using standard demonstration discs,[1] so that the phono owner can actually hear how the two pickups sound.

Incidentally, this method of test might well be a means of persuading one to buy a better grade of pickup than the one he originally had in mind. If you use a really high-quality pickup as a standard for comparison, this check will show up the difference in quality and serve to convince one that a better pickup should be bought. At least, the test will provide a means of satisfying the often-asked question "Is this one worth the extra cost?"

Other Checks Required

The method described is a convenient means of determining that the pickup is in good shape when sold or installed. But some questions that involve further investigation may arise. For example, one may buy a pickup either checked or not, and find that distortion obtains with the new pickup on a number of recordings. If the cartridge had been tested, it could hardly be defective and thus we have to look elsewhere. Often one will find that the distortion is showing up now, because of the damage caused to the record by a cartridge *which did not show up the distortion.*

This problem also requires a check of the stylus using a microscope, so that the contour of the stylus may be critically examined.

A lens, designed for an 8-millimeter movie projector or camera, can be set up as a projection microscope to throw an image of the stylus onto a white screen, so that its contour can be critically examined.

The screen can be provided with some outlines take from styli known to be good, representing the different standard radii. Suitable mounts for different types of pickup cartridges will facilitate making this presentation, to show that the stylus is in good shape, or not, as the case may be.

[1] *Excerpts from second side of RCA SRL 12-1 are ideal for demonstration.*

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- **Better construction**
- **No call-backs**

Thank you, Mr. Serviceman. We appreciate the vote of confidence.

Brand Name Surveys of Chicago, Illinois, asked 22,000 service technicians from coast to coast, "What brand of *replacement* speakers do you prefer?" Overwhelmingly, from Maine to California, the preference was for Quam. In fact, twice as many servicemen now prefer Quam as the next most popular brand—and as many prefer Quam speakers as the other three leading brands combined! This is the fourth consecutive year in which Quam has led the Survey.

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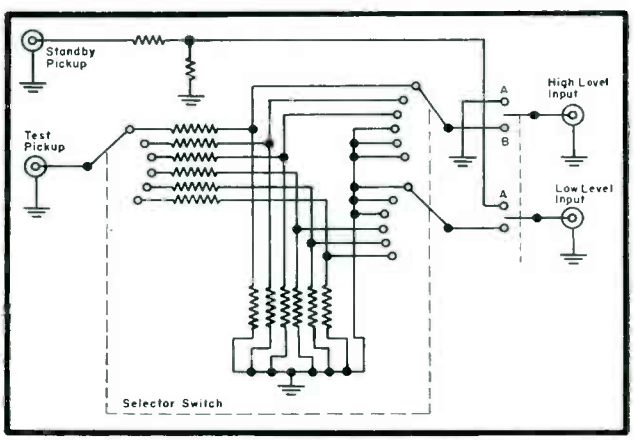

FIG. 6: CIRCUIT of a checker, using a low-level-input standard. First three positions of selector switch use high-level input for test position; second three use low level input. Circuit can be adjusted, following this pattern, to suit any combination, and any number of pickup types.

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Transistor-Radio AF/RF Repair Tips‡

Remedies For Audio Distortion . . . Low Sensitivity

IF AUDIO DISTORTION is present on a transistor radio, the best way to find out where the distortion originates is by using a 'scope. After finding out the source of the distortion, a voltage check (especially bias voltage) will assist in pin-pointing the trouble.

One type of audio distortion is regeneration due to low capacity filters or high resistance joints. Such trouble was found in early production RCA 7-BT-9 models.

A few cases of audio distortion have also appeared in RCA 8-BT-10, the result of resistor R_{13} increasing in resistance value. This resistor, rated at 3600 ohms ± 10%, is in the bias circuit of the output transistors. Because the output transistors are in a class *B* circuit, even a small change in bias may result in distortion. For best results, a selected resistor should be used for replacement. The no-signal emitter or collector current of each of the output transistors in RCA 8-BT-10 should be 1.5 to 2 ma with a new battery. A bias voltage of −.13 is required at that current drain. On RCA 8-BT-9 the current will be approximately the same with a bias of −.1 volt. The difference in bias will show a great effect on comparative currents when large signal inputs are applied.

On RCA models 9-BT-9, 8-BT-9, 8-BT-10 and late production of model 7-BT-10, negative feedback was used to reduce distortion. It can be applied to any other model having push-pull output. On 8-BT-10 the feedback resistor is 33,000 ohms; on 8-BT-9 it is 82,000 ohms.

A case of low output and distortion was found to be due to one pin of one output transistor being bent at right angles and not in its socket; the other two pins held the transistor in place.

In factory production of models having push-pull output, selected pairs of 2N109 transistors are used for output. Mismatched transistors will result in some distortion, this may or may not be noticeable during listening. Transistors may be matched by injecting an audio signal at the volume control and measuring the audio signal from each collector to *ground*.

Low-Sensitivity Cures

IN ALL CASES of low sensitivity *rf/if* in transistor radios, one should first check terminal voltages. Although voltages may vary widely without greatly affecting stage gain, the voltages should all have the same proportion of variation. The bias voltages are the most difficult to measure, but must not be neglected. A transistor having a normal *forward* bias of .15 *v* will have a slight decrease in gain when operating with a bias of .12 *v*, but may have a great decrease in gain when operated with a bias of .10 *v*. If a large voltage discrepancy is found it will be necessary to remove transistors before making resistance measurements in localizing the trouble.

Where a transistor stage shows low gain, each bypass capacitor in that stage should be shunted with another capacitor to detect open capacitors.

Alignment also should be checked in all cases of low *rf/if* sensitivity. There is only one core to each *if* transformer in RCA models, but in some cases two peaks may be reached, one peak being higher than the other. If a transformer cannot be peaked, it may have to be replaced, but first check transformer terminal connections.

If the transformer will not peak at 455 kc (may be either defect in transformer or defective transistor — *if* or converter) you should try replacing transistor before changing transformer. An open bypass capacitor in the circuit of that transformer could produce an unsatisfactory peaking condition.

Other possibilities of low *rf/if* sensitivity are:

Incorrect transistor. If type 2N139 is used in place of specified type 2N140, conversion gain will be down and oscillator section may fail to operate when battery voltage is down slightly.

Resistor value change in oscillator or converter stage. Oscillator *ac* voltage at Q_1 base should be .20 to .70 *v* p-p. The *dc* voltages should also be measured. Transistors should be removed and resistors in the converter circuit should be checked. If transistors are soldered in, unsolder one end of suspected resistor and measure without removing transistors.

Detector diode reversed and output is down slightly. This can be checked by noting polarity of *agc* voltage at the diode source. On RCA 7-BT-9 and 7-BT-10 the *agc* line voltage at the diode will become more negative (or less positive) in respect to circuit ground with signal increase. On all models using type 2N139 and type 2N140 transistors, the polarity will be reversed.

‡*Based on information prepared by the commercial service department of RCA Service Co.*

(Left)
ELECTRONICALLY-CONTROLLED fusion chamber, receiving 3,000 individual diamonds resting in sockets atop 3,000 steel pins, in a bonding process which results in joining steel to diamonds. (Walco Products, Inc., East Orange, N. J.)

(Left)

AUDIO CABLES developed for speaker extension lines from 16 to 500 ohms and distances from 200′ to 2000′. Have 18 gage, stranded, tinned, copper conductors, vinyl insulation, and two conductors cabled; one cable is manufactured without a tubed jacket, while another has a tubed chrome vinyl jacket. Where shields are not called for, 16-gage stranded cables with tinned-copper conductors and vinyl insulation are available; also two conductors cabled; one type has no outer tubed jacket, while another has a tubed chrome vinyl jacket. These cables can be used in open areas in 300′ to 3000′ lengths. (Types 8460, 8461, 8470, 8471, 8779 and 8780; Belden Manufacturing Co., Chicago, Ill.)

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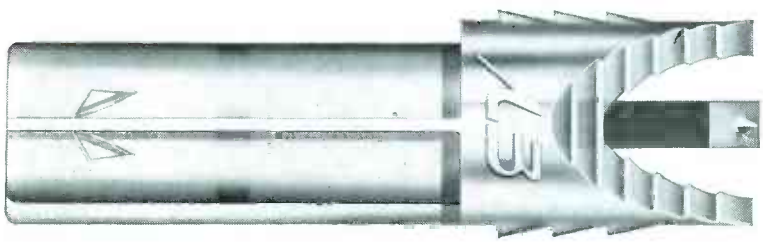
Here's How ONE Service Job Creates Continuing Profit!

Electro-Voice POWER-POINT

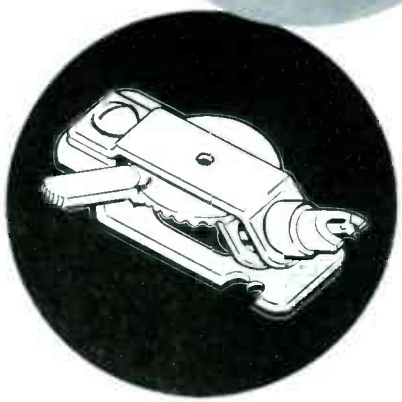


Here's the answer to a serviceman's problem—a way to end cartridge-replacement headaches for all time and still look good on the profit report! Power-Point Mounts fit virtually all phonographs!

YOU install Power-Point Mounts just ONCE and after that, just keep on profiting. Without strain you'll still get the replacement business selling Power-Points—cartridge plus needles in a single unit. You or YOUR CUSTOMER can install a Power-Point in seconds! Strictly profit for you through and through!

What's more, Power-Points end your inventory problems. They're color-coded. You stock just three styles of mounting mechanisms and seven types of Power-Points to service ALL popular-brand phonographs!

Your customers will love you for it! Point out that they'll never need to leave their unit for cartridge/needle service; that THEY install needle and cartridge in seconds once you've attached the mount; that they pay less for a fresh Power-Point cartridge with two needles than they're used to paying for the needles alone! And the color is all they need to remember to get an exact replacement! *Push Power-Points — it's good business!*



Ask your E-V Distributor about Power-Point Mounts

3 POWER-POINT MOUNTS

Model PFT-1, fixed mount, 50c list
Model PT-1, turnover mount, $1 list
Model PT-2, turnunder mount, $1 list

E-V POWER POINTS

Model 51-1 (red) two 1-mil sapphire tips, $3.95 list
Model 52-2 (green) two 2-mil sapphire tips, $3.95 list
Model 53-3 (black) two 3-mil sapphire tips, $3.95 list
Model 56 (blue) one 1-mil, one 3-mil sapphire tip, $3.95 list
Model 56DS (orange) one 1-mil diamond, one 3-mil sapphire tip, $21.50 list
Model 76S (white) one 1-mil, one 3-mil sapphire tip, $4.20 list
Model 76DS (pink) one 1-mil diamond, one 3-mil sapphire tip, $21.50 list

Electro-Voice®

ELECTRO-VOICE, INC. BUCHANAN, MICHIGAN

Export: 13 East 40th Street, New York 16, U.S.A. Cables: ARLAB

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"Mother. He . . . he loves the phonograph more than he does me . . . since we got the JENSEN NEEDLES!"

TEST INSTRUMENTS

CLAMP-ON AMMETER ADAPTER

AN AMMETER, 10, which can plug into model 310 miniature *vom* to convert it to an *ac* clamp-on ammeter, for measuring *ac* amps without cutting or opening current-carrying wires, has been developed by the Triplett Electrical Instrument Co., Bluffton, Ohio.

Split transformer yoke opens to fit around a single conductor or bus bar when lever at side is pressed and gives direct reading of *ac* amps from 6 to 300 in six steps. Adapter can also be used with any model *vom* having a 3-*v ac* scale at 5000 ohms/volt by means of a long lead attachment.

* * *

TRANSISTORIZED BROAD-BAND RF PROBE

A TRANSISTORIZED BROAD-BAND, low capacity *rf* probe, *Transiprobe,* said to have unity gain held constant by a feedback amplifier, has been introduced by Kay Electric Co., 14 Maple Ave., Pine Brook, N. J.

Unit is powered by mercury cell batteries. Can be used as a 'scope-isolation amplifier. Frequency response is 20 cps to 15 mc, 1 db down at 50 cps and 12 mc; 3 db down at 20 cps and 15 mc.

* * *

BATTERY ELIMINATOR KIT

A BATTERY-ELIMINATOR kit, *BE*-5, incorporating a low-ripple filter circuit for use in powering transistor type circuits requiring from 0 to 12 *v dc* and *hybrid* auto radios, has been developed by Heath Co., Benton Harbor 11, Mich.

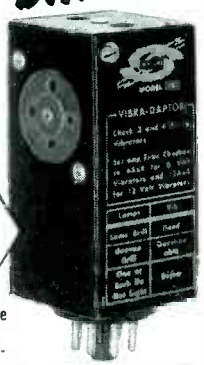
DC output, at either 6 or 12 *v*, is said to contain less than .3% *ac* ripple. Unit has a pair of terminals for output with a normal amount of filtering for use as a battery eliminator on conventional-type auto radios; from these the unit will supply up to 15 amps on 6-*v* range or up to 7 amps on the 12-*v* range.

NOW . . . Check Vibrators In ANY Tube Checker

Another Sencore Time-Saver

SENCORE "VIBRA-DAPTOR"

MODEL VB-2



2 ADAPTORS IN 1

Checks Both Three and Four Prong Vibrators

- Merely plug into any tube checker. Set for 6AX4 (or 6SN7) for 6 Volt Vibrators and 12AX4 (or 12SN7) for 12 Volt Vibrators.
- Two lamps viewed through top of adaptor indicate whether or not Vibrator needs replacing. • Rugged — Made of steel. • Replaceable but unbreakable #51 indicating Lamps. • Operates easily with Sencore LC2 Leakage Checker. • Complete instructions screened on front.

ONLY $2.75 DEALER NET

At leading distributors everywhere

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SERVICE INSTRUMENTS CORP.

171 OFFICIAL RD. ADDISON, ILL.

POPULAR SENCORE PRODUCTS
- Transistor Tester
- Leakage Checker
- Filament Tester
- Handy "36"
- Vibra-Daptor

anchor

SANDY SAYS! Tests and Repairs ALL CRT Tube Elements for Opens and Shorts.

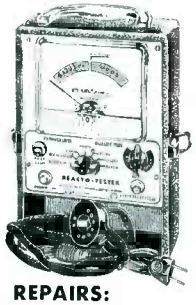
New and Improved

REACTO-TESTER

Model T-401
Tests and repairs ALL picture tubes.

Only $39.95 *with Case and Cover*

FACTORY TESTED AND FULLY WARRANTED



TESTS FOR:
- Open Connections
- Open Elements
- Useful Life
- Shorted Elements
- Cathode Emission
- Gaseous Tube

REPAIRS:
- Open Elements
- Corrects Shorts
- Reactivates Low Emission Tubes
- Restores Brightness

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ELECTRONIC COMPONENTS
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Co-operation with Parts Jobbers makes possible a "ONE STOP" source from nearby stocks, for Appliance and Electronic Repair Parts—Cords and Cord Sleeves, Plugs; Iron, Percolator, Toaster and Water Heater Elements; Cements and Insulators, Special Tools, Switches, Repair Tags; Testing Equipment, includes Tube Testers and Ohmmeters.

New RW58 Catalog available from your parts jobber, or if he cannot supply, write us with name and address of your parts jobber.

WAAGE MFG. CO. 632R N. ALBANY AVE. CHICAGO 12, ILL.

FOOLPROOF COIN VAULTMETER

- Maximum Coin Security
- Shake-Proof
- Trouble-Free Coin Chute
- Simplicity in Mounting
- Variable Timing
- Unique Design

25¢ Coin Meter for automatically timing appliances. Made of 14" gauge steel—all internal parts cadmium plated.

Solves installation problem by having the back panel removable to speed up and simplify mounting. No die cast parts, drive gears, or knobs to wear out. Being 14" gauge steel throughout entire case, makes it as burglar-proof as is possible.

Can be used on all 220-volt model dryers.

Available with 60 or 45 min. clocks—timing cycles may be halved. Timing will service most all automatic washers, dryers, wringer washers, as well as TV programs of 30 min. duration.

Will automatically throw out any undersized coins by a patented coin arrestor and slot, assuring owners of all monies due them.

Overall dimensions: 3¾" x 8¼".

Model 400 with Coin Vault, list price $26.25
Model 500 with Cash Receptacle only, list price $22.80
Model 700 (available for 72 or 90 minutes) —New Improved Model with Light— with Cash Receptacle only, list price $25.70

Some distributorships still available.

The DEPENDABLE APPLIANCE PARTS CO.
4502 Hough Ave., Cleveland 3, Ohio

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ADVERTISERS IN SERVICE

AUGUST, 1957

COMPONENTS

SUBMINIATURE 1/10-WATT RESISTORS

SUBMINIATURE MOLDED composition 1/10-*w* resistors, *Little Devil*, .067" in diameter and .14" long, have been introduced by Ohmite Manufacturing Co., 3631 Howard St., Skokie, Ill.

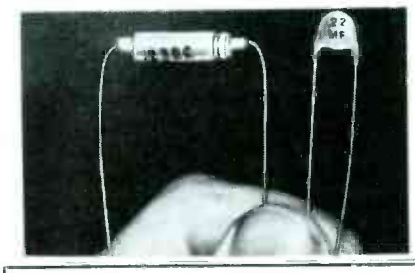
Lead wires are molded into resistance material and are hot solder coated to facilitate soldering. Available in RETMA values from 100 ohms to 1 megohm, + 10% tolerance. Further information in bulletin 150.

* * *

MICRO-MINIATURE DISC CAPACITORS

MICRO-MINIATURE DISC capacitors, *Ultra-Kap*, designed to meet the small size, high-capacitance demands of transistor circuitry in bypass and coupling applications, have been developed by Centralab, 900 E. Keefe Ave., Milwaukee 1, Wis.

Capacitors are said to have low power factors.



BEWARE OF IMITATIONS

There Is Only One Original, Dependable

NO-NOISE TUNER-TONIC with PERMA-FILM

Cleans, lubricates, restores all tuners, including wafer type. Won't change or affect capacities, inductance or resistance. Won't harm insulations or precious metals, nor attack plastics. Eliminates all noise, oxidation and dirt indefinitely. For television, radio and FM. Non-toxic, non-inflammable, insures trouble-free performance. Extra economical because a small amount does the job!

6 oz. Aerosol Can. Net to servicemen. **$3.25**

Cleans, lubricates, protects . . . NOT A CARBON-TET SOLUTION. Still available in the new 6 oz. spray can. Net to servicemen. **$2.25**

Volume Control and Contact Restorer with Perma-Film

2 oz. bottle. Net to servicemen. **$1.00**

"NO NOISE"

Also available in 8 oz. bottles and quart cans. *At Your Nearest Distributor*

ELECTRONIC CHEMICAL CORP.

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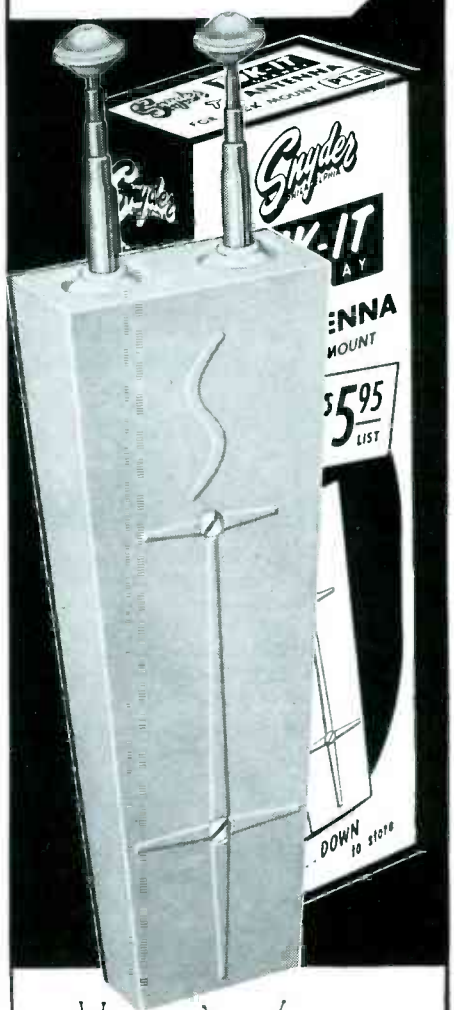
ANOTHER Snyder PHILADELPHIA

SALES-MAKER

TUK-IT HIDEAWAY INDOOR TV ANTENNA

FOR BACK MOUNT



UP SPREAD DOWN

SNYDER MANUFACTURING CO.

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EXPORT: ROBURN AGENCIES, N.Y.

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YOU CAN STOP A FLUCTUATING VOLTAGE CONDITION

WITH THIS ACME ELECTRIC AUTOMATIC VOLTAGE STABILIZER

If you're harassed with a television or other electronic equipment installation that just won't operate right, chances are that a fluctuating voltage condition exists and prevents tubes and other components from functioning properly.

One sure way of making voltage behave is with the Acme Electric automatic voltage stabilizer. Regardless whether the input voltage ranges from 95 to 130 volts, the output voltage will automatically be corrected to 115 volts ± 3%.

Another feature to remember, this unit uses no current unless the TV set is in operation. An automatic relay disconnects primary circuit under "no load" conditions and automatically connects circuit when load is applied to the secondary circuit. Secondary voltage is indicated on voltmeter while unit is in operation. Furnished complete, ready to plug-in. See this Acme Electric Automatic Voltage Stabilizer at your dealer.

ACME ELECTRIC CORPORATION
478 WATER STREET CUBA, NEW YORK

Acme ACME Electric
TRANSFORMERS

PERSONNEL

ALLEN S. JOHNSON has joined Cletron, Inc., 1974 E. 61st St., Cleveland 3, Ohio, as sales manager.

Johnson

Petrusky

ALFRED P. PETRUSKY has been named manager of marketing research, electronic products, of Sylvania Electric Products, Inc., 1740 Broadway, New York 19, N. Y.

* * *

IRVING TJOMSLAND has been appointed director of the television component renewal sales department of Triad Transformer Corp., 4055 Redwood Ave., Venice, Calif.

Tjomsland

Attschuler

WILLIAM H. ATTSCHULER has joined Jensen Industries, Inc., 7333 W. Harrison St., Forest Park, Ill., as vice president of manufacturing.

* * *

ROBERT M. REED has been named assistant national sales manager of Winston Electronics, Inc., 4312 Main Street, Philadelphia 27, Pa.

* * *

ROBERT ARANY has been promoted to sales manager of the power factor capacitor division of Cornell-Dubilier Electric Corp., South Plainfield, N. J.

* * *

DONALD H. KUNZMAN has been named vice president and operations manager of RCA Service Co., Inc., Cherry Hill, Camden 8, N. J. . . . Other new appointments are: *R. N. Baggs,* vice president and general sales manager; *Anthony L. Conrad,* vice president government service; *Gerald W. Pfister,* vice president, consumer products service; and *Edgar H. Griffiths,* treasurer and controller.

* * *

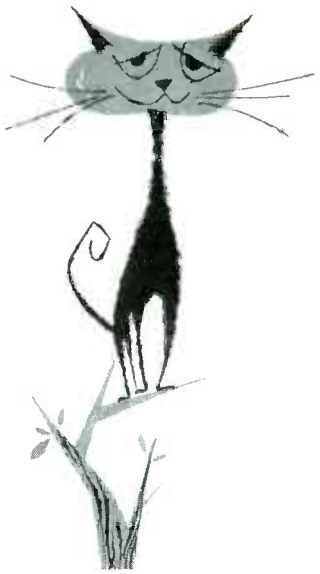
ARTHUR M. LIEBSCHUTZ is now with the semiconductor division, RCA, Somerville, N. J., as administrator, planning—entertainment.

* * *

CHARLES M. ODORIZZI, executive vice president, sales and service, RCA, 30 Rockefeller Plaza, New York 20, N. Y. has been elected a member of the RCA board of directors.

* * *

H. F. BERSCHE has been named manager, merchandising, distributor products of the electron tube division, RCA, Harrison, N. J.



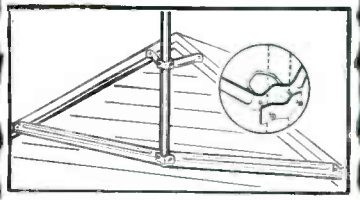
UP A TREE?

Don't be a crazy cat—come down and get a Merit *exact replacement.* Our engineering and production keep your parts jobber supplied with parts, superior to the original, that drop into place without mechanical or electrical change in set chassis.

MERIT

MERIT COIL AND TRANSFORMER CORP.
4427 N. CLARK ST., CHICAGO 40, ILLINOIS

ask the "Man-on-the-Roof" why he prefers South River



EAVE MOUNT model EM-48

One piece construction of heavy gauge, embossed steel. Hot-Dip galvanized to prevent corrosion. Unique design of lower bracket give extra strength and rigidity. Extended lip supports mast during installation. 48" spread permits generous spacing between brackets for excellent mechanical mast support. Both 3" embossed steel upper bracket and lower bracket have new "reversed" U bolt and clamp feature for Spintite fastening. *Also available with 60" spread: EM-6C*

Write for New 1957 Catalog

SOUTH RIVER METAL PRODUCTS CO., INC.
South River, New Jersey

pioneer & outstanding producer of finest line of antenna mounts

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Mr. Service Dealer...

PHILCO is the Best Buy in Color Servicing

PHILCO 7100A—Newest Philco Universal Color and Dot Bar Generator

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

BUILT-IN QUALITY FEATURES

- 4 crystals for maximum accuracy.
- Crystal controlled sound carrier, picture carrier, sync circuitry and color display.
- Visual marker signal to identify color bars.
- Regulated power supply.
- Separate R.F. and video attenuators.
- Positive and negative video signals for localizing trouble.
- Complete with R.F. and video cables.
- Tube complement of 14 tubes: 7-12AT7, 1-12AU7, 2-6CS7, 1-6CL6, 1-513, 2-OD3.

For Sure Success in Color Servicing

Philco Test Equipment is designed to help your profits grow by being faster and more accurate in solving every service problem. This latest Philco Universal Color Bar and Dot Bar Generator combining both services in one compact, lightweight case eliminates the nuisance of using separate instruments. Improved convergence signals are provided and a "white-raster" display is included to speed up accurate "color-purity" adjustments.

Now, it's no longer necessary to disable the set by removing a tube or changing circuit to obtain the "quiet", snow-free raster required. Halves the work time and eliminates old-fashioned methods requiring you to handle hot tubes. Front panel of etched aluminum with black knobs and easy-to-read etched markings. 18 lbs. light. Dimensions: 13⅜" wide, 11⅛" high, 9¾" deep.

Get the full story from your local PHILCO DISTRIBUTOR on how the Philco Universal Color Bar and Dot Bar Generator can streamline color servicing.

PHILCO®

Accessory Division • Philadelphia 34, Penna.

OR MAIL THIS COUPON TO

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Please send me information on Philco Universal Color Bar and Dot Bar Generator with superior accuracy and speed.

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FOR PROFITABLE PICTURE TUBE SALES

IT TAKES TWO—RCA and YOU!

Silverama Picture Tube sales are zooming, because you're recommending and installing Silverama replacement Picture Tubes. Sales are zooming, too, because we're making RCA Picture Tubes better than ever, and telling your customers so—in ads like these. Have you seen these week-after-week ads in LIFE, SATURDAY EVENING POST, TV GUIDE? They reach over 40 million people every insertion.

Take a selling tip from RCA's advertising! Don't sell your customers a picture tube. Sell them *"A BETTER PICTURE"* —with an RCA Silverama Picture Tube, naturally.

RCA® **PICTURE TUBES**

RADIO CORPORATION OF AMERICA

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RCA ELECTRON TUBES
Authorized Dealer
TV-RADIO SERVICE

Cash in on RCA's Silverama advertising by displaying this sign. Your RCA distributor will tell you how to qualify.

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