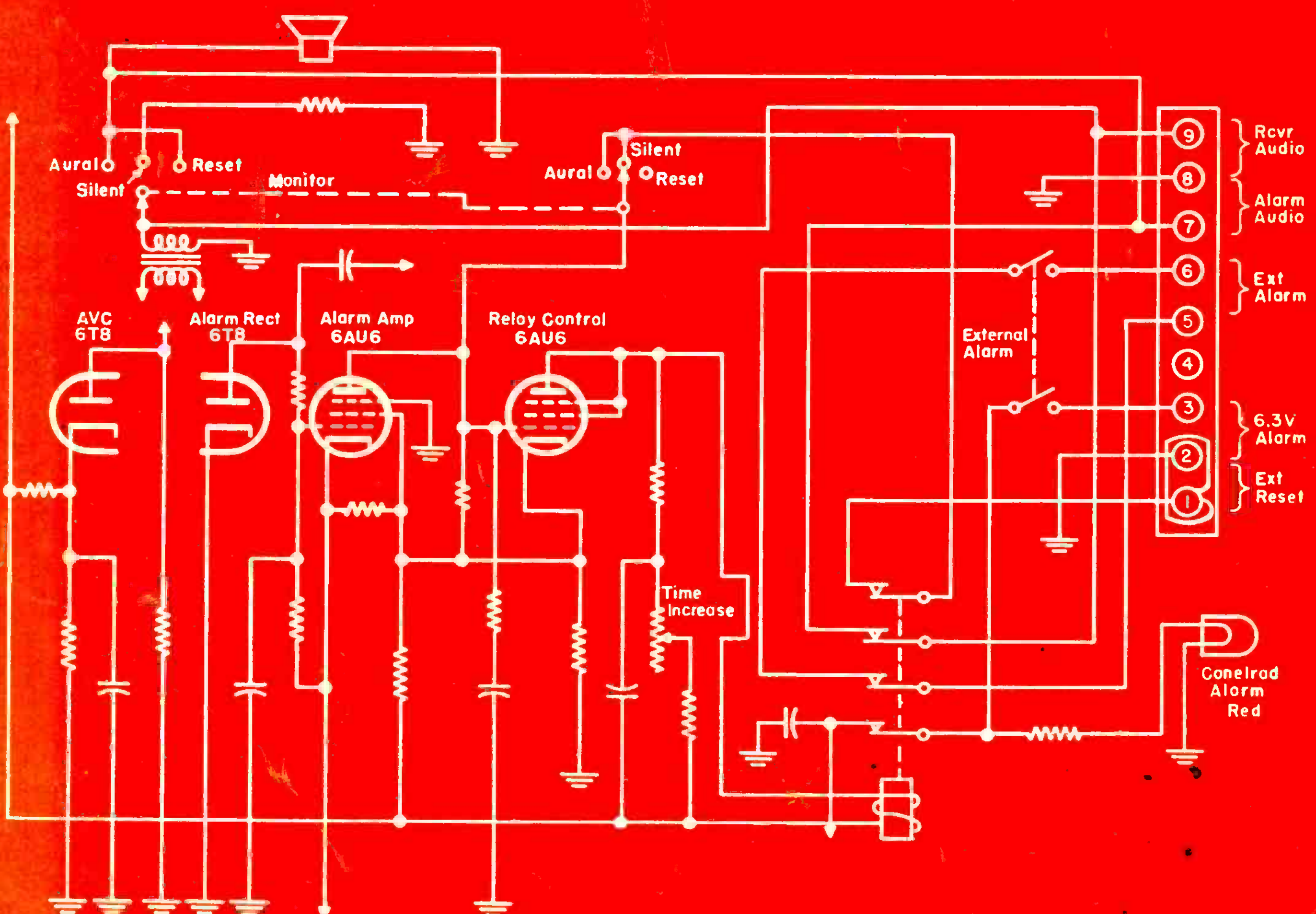
DECEMBER, 1956

SERVICE

THE TECHNICAL JOURNAL OF THE TELEVISION-RADIO TRADE



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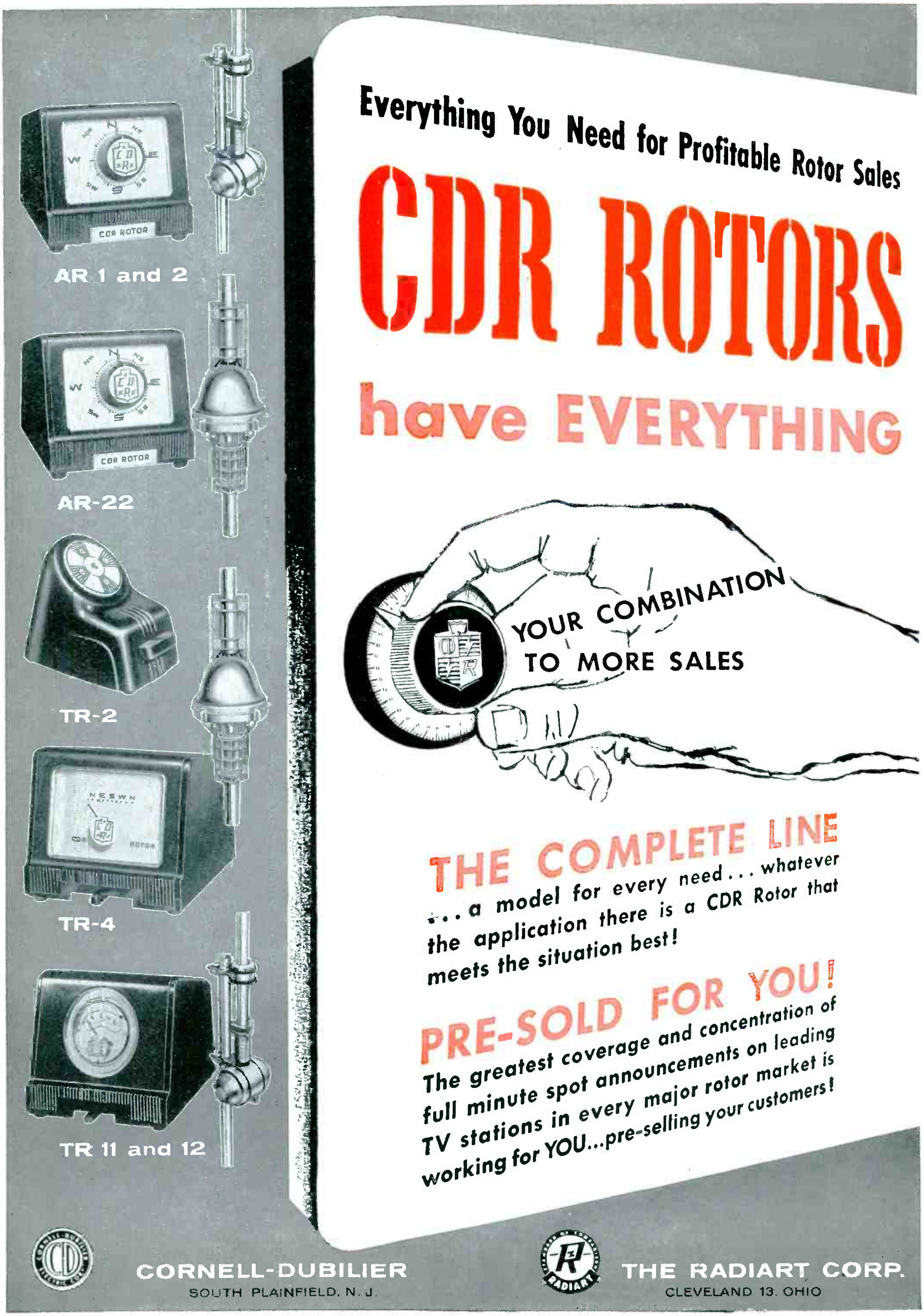
See circuit analysis, this issue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COVER CIRCUIT

FEATURES

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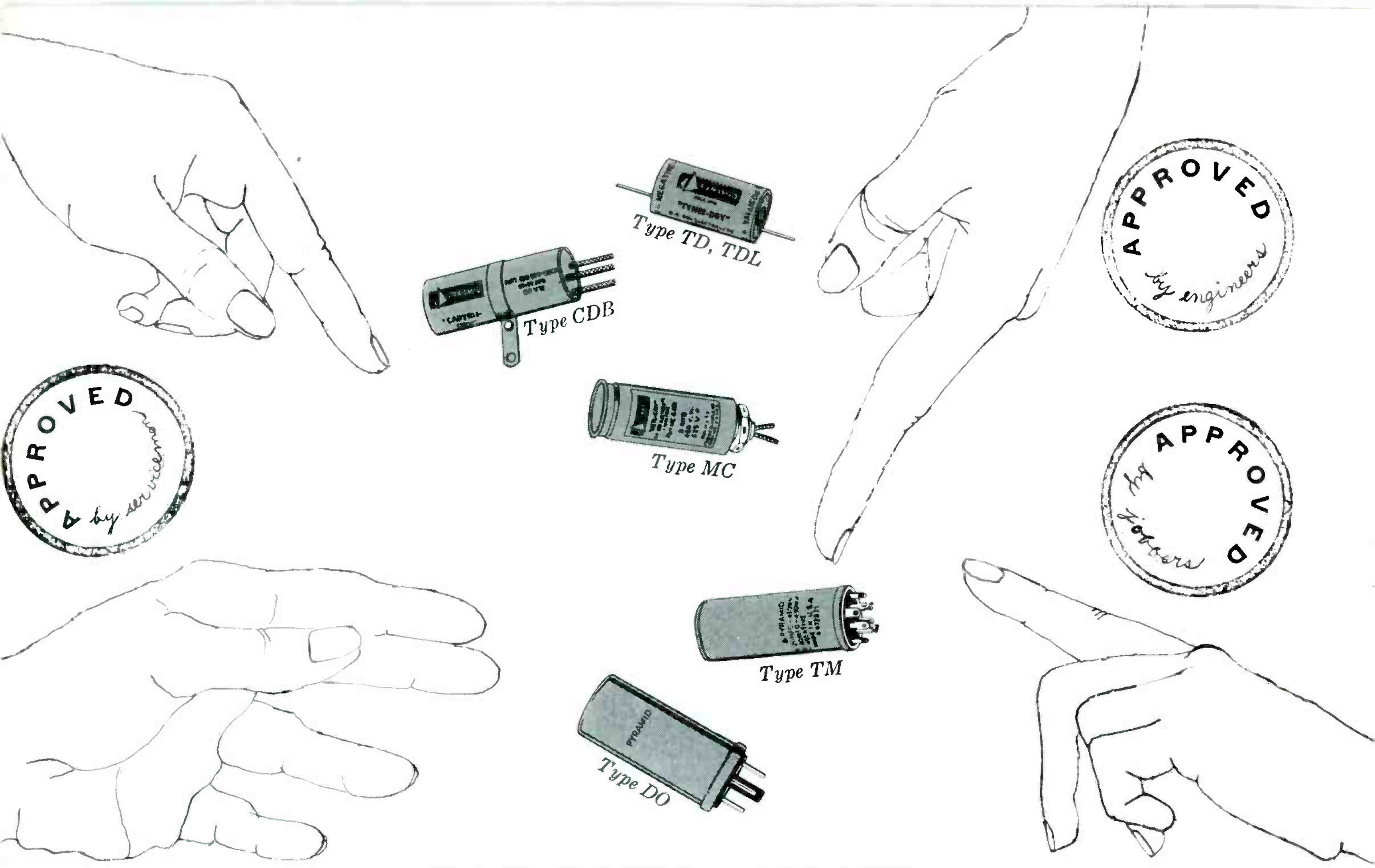

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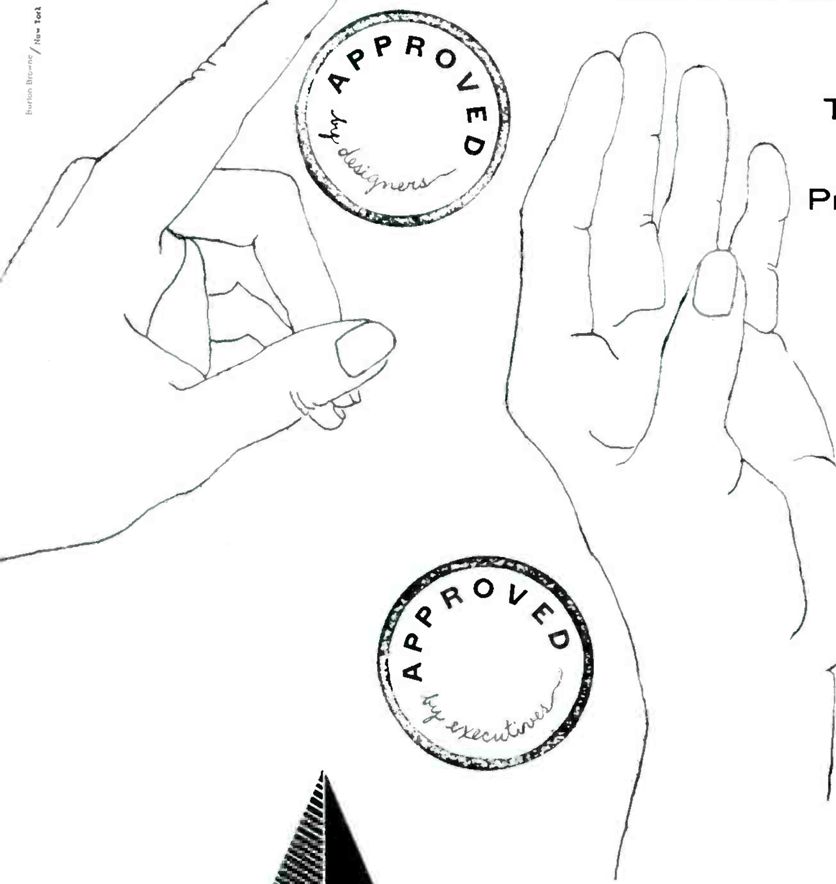

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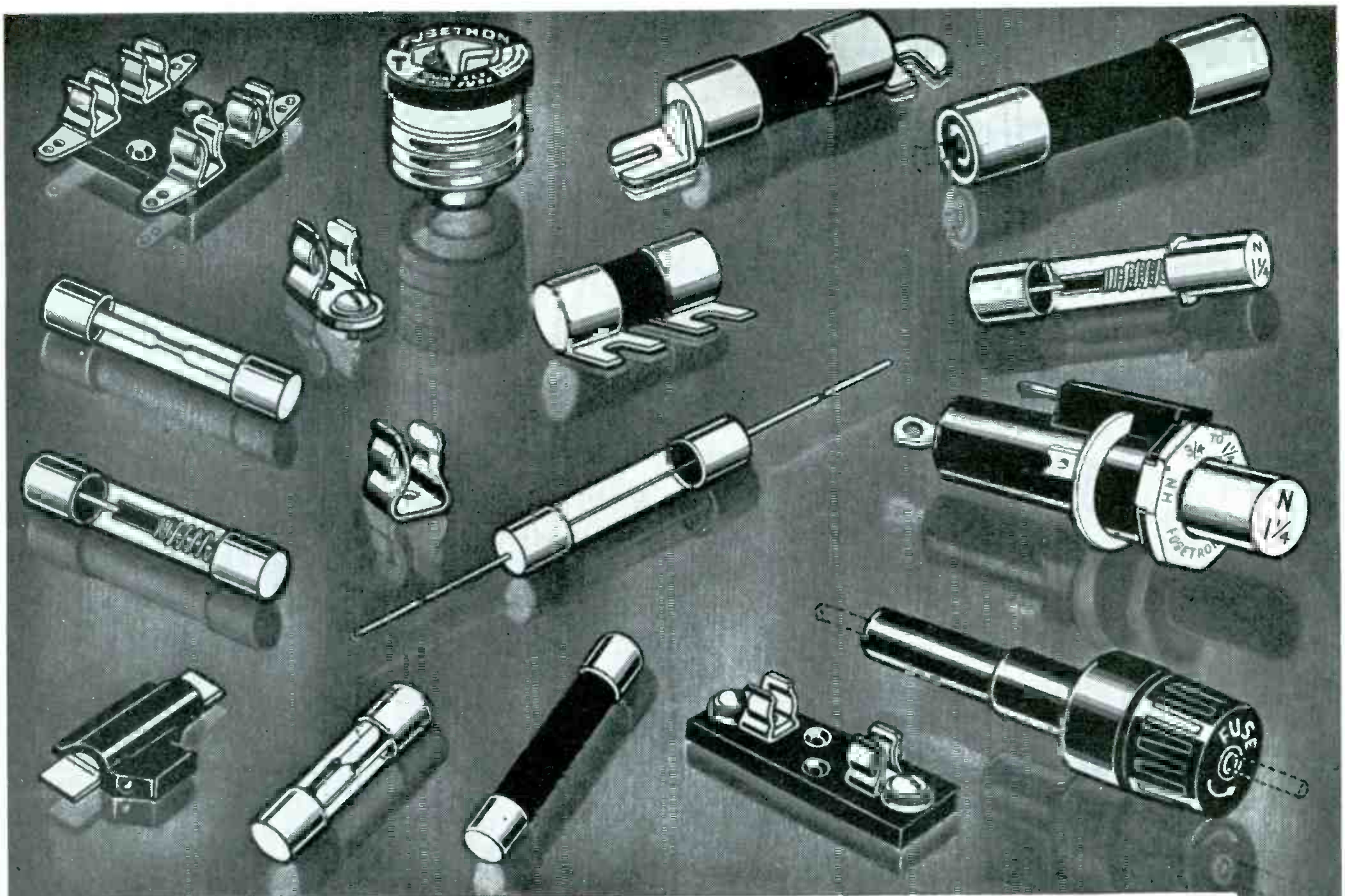

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The Technical Journal of the Television-Radio Trade

1956 in Review

THIS HAS BEEN a year of outstanding achievements that swelled opportunities for Service Men.

The semi-conductor field flourished with the development of new types of highly-efficient transistors and the arrival of two new members to the family; selenium and silicon diodes.

An experimental item for years, the transistor attained a record production of 13-million units this year, compared with 3.6-million in '55. Transistor-equipped portables were produced in quantity for the first time, numbering about 900,000. A growing number of phono manufacturers began using transistorized amplifiers. The introduction of power transistors, capable of handling large loads, made it possible to include them not only in push-pull amplifiers, but in B supplies for auto radios.

The increased use of transistors brought about significant changes in not only components and chassis, but in test equipment and installation and repair tools. Parts shrunk in size, printed-wiring designs were evolved for practically all chassis and completely new teams of tools and instruments were created to service the miniaturized models.

The advent of the selenium diode permitted the design of improved horizontal *afc* circuits, involving a balanced phase detector with a pair of diodes. With the arrival of the silicon diode, it became possible to build new types of high-voltage circuits for series connections, since no special matching of inverse characteristics was found to be required.

ENORMOUS STRIDES were also made on the tube front. For the 12-volt auto radios, there appeared tubes that can operate directly off the battery for both *A* and *B* power, some types working in conjunction with power transistors. Elsewhere, new types of series-string subminiaturized tubes were developed for the increasingly popular compacted TV chassis used in table and portable models. For the extremely shallow and wider-angle picture tubes (110° types being the latest on deck), tubes were designed to provide the required increased deflection.

THE PLATED-BOARD not only became a feature of transistor radios, but b-w and color-TV models, too. Most of the major manufacturers announced lines with printed wiring throughout, and as in the transistorized equipment, reduced-size parts became a prominent factor. In all instances, it was found necessary not only to design special components to fit the p-w miniaturized pattern, but to note that it would now be necessary to use new-type tools that could be maneuvered in tight areas that prevail in the small p-w chassis.

Recognizing the repair difficulties that could obtain in these condensed chassis, if certain circuit-mechanical precautions were not taken, engineers studied the problem carefully and came up with many solutions. Tuners were located topside and large openings were made around the tuner shaft to facilitate local oscillator adjustments. In vertical chassis, the window and mask were made removable from the front. Circuit components were grouped in sections. All major test points, tube types and socket numbers were stamped directly on each p-w board. And in several models, the printed boards were made of translucent material to provide a clear tracing of the wiring, without removal of the chassis. These unique repair speed-up features were also worked into quite a few radio and phono models.

One set maker introduced a p-w TV chassis with a number of packaged electronic circuits in not only the audio, but in the video and h-v sections. The repair and test techniques required for this new type of construction are detailed for the first time in this issue.*

COMMERCIAL SOUND also set quite a pace during the year. More mobile and fixed installations were made by more Service Men specializing in sound.

Alert to this trend, manufacturers developed a wide assortment of amplifiers, speakers, cables and microphones for every type of indoor and outdoor activity. Both phonos and tape shared the spotlight in the sound drive.

ALSO IN THE 1956 LIMELIGHT were packaged closed-circuit TV systems. Service Men found a solid market for these chains among schools, banks, industry and local merchants. All applauded the simplified manner in which on-the-scene live activities could be piped over coax using a small camera, control unit and monitor.**

COLOR-TV became firmly entrenched during the year, thanks not only to extensive programming, but circuit simplification.

Color chassis no longer demand hours and hours of attention during an installation. In most cases, the only item on the agenda is convergence, and with the streamlined procedures now available, using the proper instruments, this is now a simple operation.

INDUSTRY DOCKETED an enviable record of accomplishments during the year; a sparkling record that will be a boon to Service Men during 1957.—L. W.

**See page 18.*

***See page 28, this issue, for an exclusive report on the use of closed-circuit lines in a community-TV system.*

COLOR-TV Picture-Tube Adjustments

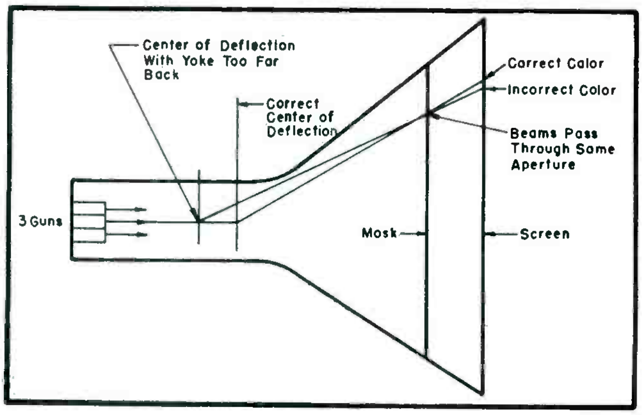


FIG. 1: **WRONG POSITION of yoke in a color-TV tube. When the yoke is not correctly positioned, a beam near the edge of the screen will not strike the correct color dot.**

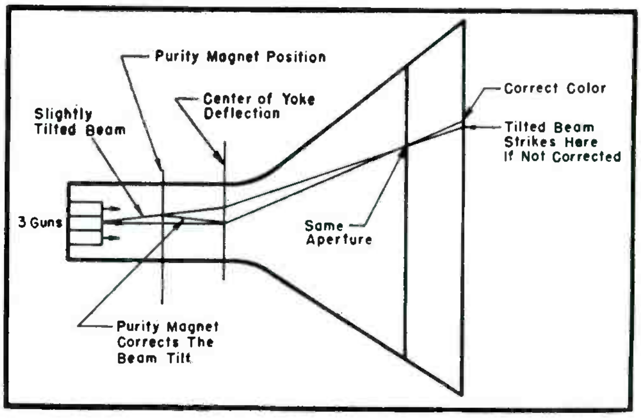


FIG. 2: EFFECT of the purity magnet in a color tube; magnet serves to correct tilt of the beam.

To ANY THOROUGHLY-GROUNDED TV Service Man, the color-TV receiver should give no fear. The transition from monochrome to color-TV is not nearly as great as it was from radio to TV several years ago. The already-familiar sections of a color receiver highlight this fact: Tuner, *if*, sound, video amplifier, sync, scan and high voltage. Ten years ago when most Service Men first had to deal with TV, the only circuits that looked familiar were the power supply and audio amplifier.

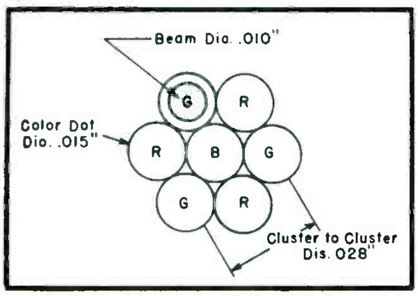
The new circuits in color-TV are mainly the color-processing circuits. Here one will find a number of critical alignment adjustments that require skill, the proper equipment, and experience to make.

Analyzing these factors, we find that while there is a familiar look to the scan circuits, they operate under considerably higher stress, because all color picture tubes in use today operate at anode voltages much higher (20-30 *kv*) than the 15-18 *kv* used in b-w receivers. Therefore, the horizontal-scan circuit must supply not only 50% higher anode voltage, but a correspondingly greater deflection yoke power to scan the color picture tube with such a high anode voltage. Additionally, most color receivers use the shadow-mask three-gun color picture tube which requires a 2" *i-d* yoke taking greater deflection power than a standard monochrome yoke. As a result, the Service Man can expect some scan-circuit trouble. Most of the components are of recent development and therefore subject to possible design failures, in addition to the failures brought on by the extreme power requirements. Servicing these circuits should be relatively easy, however, as the operation is identical to b-w, with only the physical size of the components being different.

All color-TV receivers using the shadow-mask color tube have a characteristic that, while not properly classified as a failure, does greatly influence the picture and therefore the customer's satisfaction with his receiver and with the Service Man's work. That characteristic is: The picture tube must be properly adjusted if a satisfactory picture in either monochrome or color is to be obtained. This cannot be stressed too much. Proper set up is all-important. A color picture tube is not difficult to set up, but it does require patience and practice. An improperly-adjusted color receiver will not only cause customer dissatisfaction, but will completely nullify the effects of a well-made circuit repair and an otherwise perfect-operating receiver.

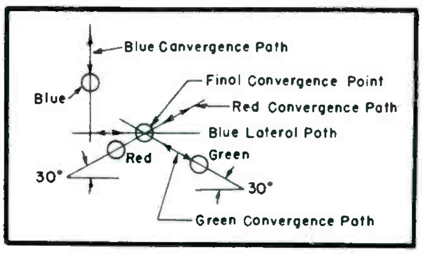
One should spend the greatest effort on a color-TV receiver where the greatest apparent improvement in the receiver operation will be found; that is, the setup and adjustment of the color picture tube itself. The set owner wants a satisfactory picture in both monochrome and color. On a color receiver, a satisfactory picture can only be produced when all the many controls and adjustments are properly set. Therefore it is essential for the Service Man to acquire a thorough knowledge of each control and adjustment on the color receiver. Such a knowledge can be developed through study, supplemented by actual experience.

On a typical 21" color receiver, some of the adjustments necessary on the picture tube itself are: yoke positioning, purity, static convergence, dynamic convergence, rim magnets and field neutralizing coil. These



(Left)

FIG. 3: GEOMETRY of a color tube showing that a raster shift of 1" in any direction shifts the beam on the spots .0075", enough to cause color impurity. Mathematically, we have the off-center distance AB = 4.24 × raster shift/19.24; the spot shift = .53 × distance AB/15; and the spot shift = 4.24 × .53/15 × 19.24 × raster shift = .0078 × raster shift.



RIGHT. FIG. 4: ADJUSTMENT of permanent convergence magnets located in each convergence coil; one can move spots of any given color as shown in this illustration.

And Their Relation to Chassis Circuitry

How to Position and Check Yoke, Purity, Static and Dynamic Convergence Controls And the Rim Magnet and Field Neutralizing Coils to Obtain Best Color Reproduction

by JOHN T. JANS, *Applications Engineer*
TV Picture-Tube Division, Sylvania Electric Products, Inc.

make it possible to obtain a white or color blank raster.

In making all of the adjustments, a blank field of a particular color is necessary. To obtain such a field it it necessary to increase the G_1 (or brightness control) for the desired color and decrease the brightness of the other two colors. Often the brightness controls do not have enough range to produce a bright raster of a single color, so the G_2 voltage controls may be decreased on the undesired colors and increased on the color to be observed. Red is the best color to observe when adjusting for purity, as green or blue impurities show more readily as an impurity in red.

Importance of Correct Yoke Position

Because of the geometry of the shadow-mask tube, absolutely correct yoke positioning is necessary for the proper beam to strike the proper color dot. In Fig. 1 is illustrated the fact that when the yoke is too far back, the beams are deflected too far from the face so they do not strike the correct colors. The correct position allows the beam to strike the correct color dot. Lateral yoke motion and tilt must also be correct so that each beam is deflected through relatively the same angle. To position the yoke properly, it should be slid forward and back on the tube neck and tilted until the largest area of a single color raster is one pure color at the center of the tube. Purity adjustment is made next. The purity magnet is very similar to the familiar centering magnet and, in effect, centers the beams so that they all pass through the center of deflection at the correct point to be deflected and then pass through the mask at the exact angle necessary to strike in the center of a dot. Fig. 2 shows the effect of the purity magnet.

The yoke position and purity adjustment both move the raster on the face of the picture tube as they improve the purity. From the geometry of the tube (Fig. 3) it can be seen that a raster shift of 1″ in any direction shifts the beam on the spots .0075″. This shift is enough to move the spot from the center of one color, halfway into the next color and cause color impurity.

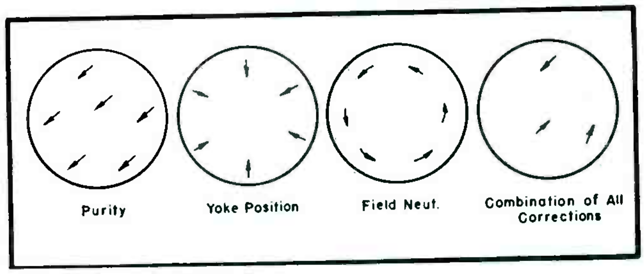


FIG. 5: RELATIVE POSITION of the electron beam, with respect to a color dot for purity adjustment for field-neutralizing coil, and for yoke-position adjustment. Arrows show direction the beam must be moved to strike a single color dot at various points on the screen.

Static Convergence Adjustment

Another picture tube component that shifts the raster and with it the spot is the static convergence adjustment. On the yoke position and purity adjustments, the three beams are acted on together, and the rasters of all three beams are moved about the same amount. The guns of the shadow-mask color tube are so made that the convergence-magnet assembly fits over a portion of the mount, where the magnetic fields to each gun are isolated from each other. Therefore, the static convergence magnet on each gun can be adjusted to move the raster of that gun alone. Convergence is necessary, because the three separate beams are each acted on differently by the yoke and the three rasters will not overlap in perfect registration, unless some means is taken to adjust each raster position to do so. There is some interaction between guns on convergence, with the red and green moving about 10% of the distance the blue moves when using the blue magnet alone.

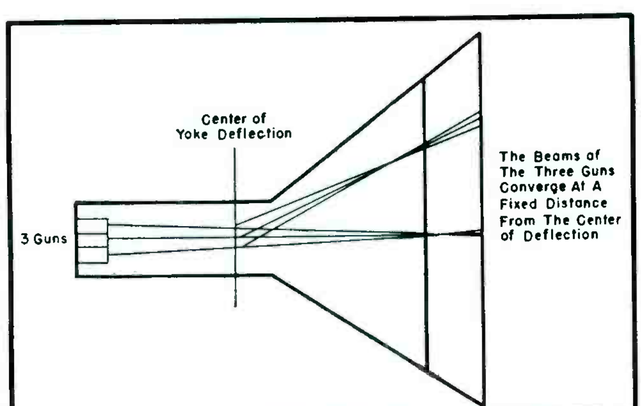
Use of Dot Generator

To make the convergence adjustment easier it is necessary to use a dot generator. Additional color test equipment required are a color-bar generator and 'scope capable of observing the color burst signal with full frequency response.

With the dot generator, a pattern of white dots is shown on the picture tube screen. If the convergence adjustment is not correct, the dots will be clusters of three colors. By adjusting the permanent convergence magnets located in each convergence coil, the spots of any given color can be moved in the direction shown in Fig. 4. With three spots moving in three given directions, it is impossible to make them always come to one position. Therefore, it is necessary to add another convergence adjustment, a blue lateral magnet located near the base between the red and the blue gun. This magnet supplies

(*Continued on page 37*)

FIG. 6: NEED FOR dynamic convergence is illustrated in this drawing. Because the distance from the center of deflection to the screen is not constant, the beam convergence must vary as the beam moves over the face of the screen.



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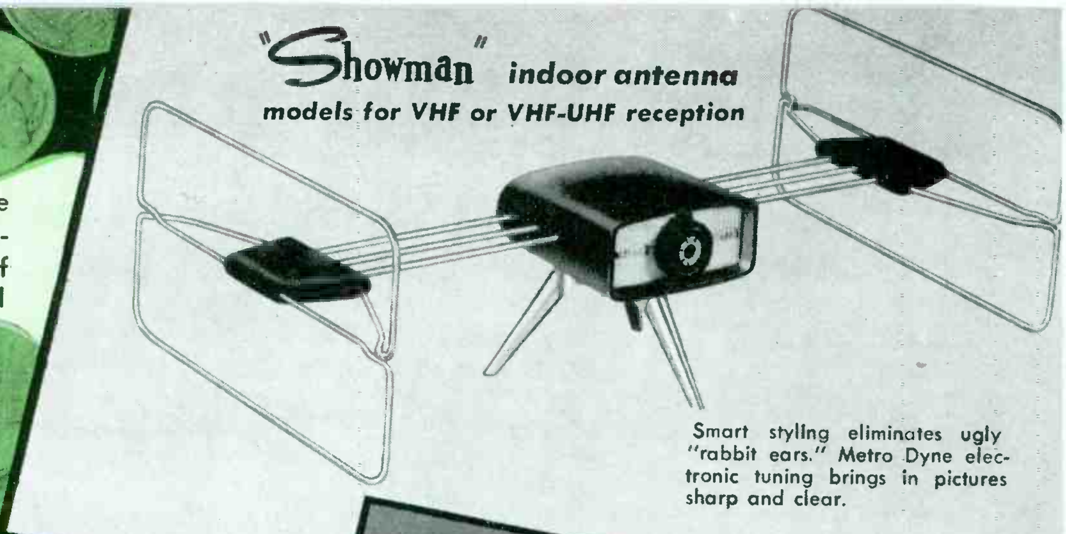

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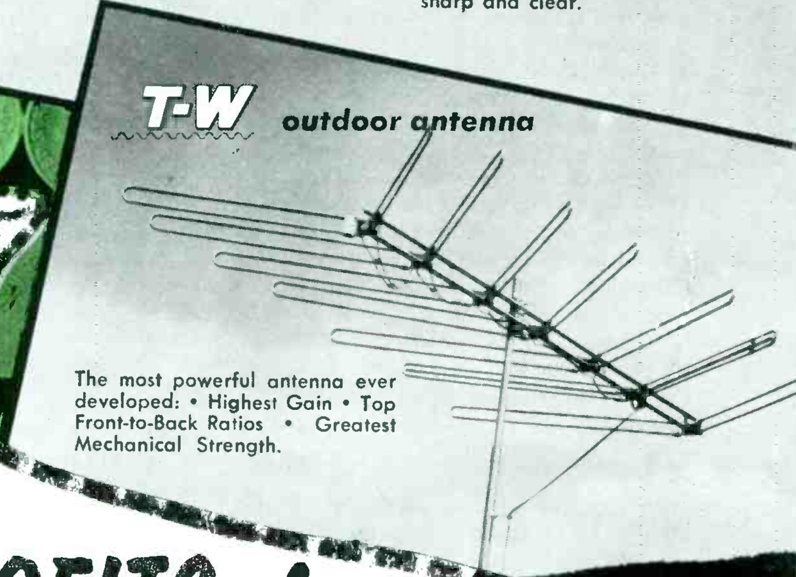

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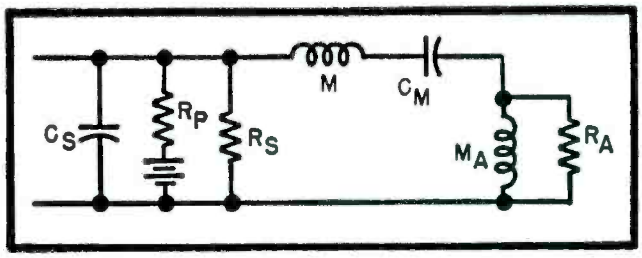
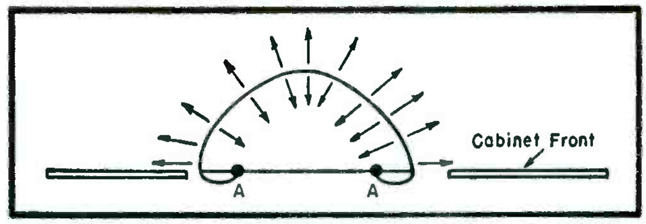




FIGS. 1-2 (above, right): Fig. 1 illustrates equivalent circuit for speaker where: C_S = internal capacity (.016 mfd) of speaker (aluminum conductor to backplate); R_P = polarizing isolation resistor (4.7 megohms); R_S = leakage resistance of aluminum conductor to back plate; M = mass of diaphragm, C_M = compliance of diaphragm; M_A = mass of air load; and R_A = radiation resistance. Radiation of speaker when mounted in cabinet front is shown in Fig. 2. Arrows represent sound waves which move normal to the diaphragm surface, both front and back.

Design—Application Factors...Amplification-Crossover Network Requirements of

Electrostatic Speakers

by M. E. SWIFT, *Engineer, Radio Div., Philco Corporation*

THE FREQUENCY RANGE of an electrostatic speaker is determined by its area, the spacing between the diaphragm and the back plate, the tension on the diaphragm and the amount of power the speaker must deliver to the air. In an effort to extend the effective range of such a speaker engineers in our lab developed a number of prototypes. The model accepted for final design[1], a semi-cylindrical radiator 14½″ in diameter by 11½″ long, has been found to cover the range from 2000 cps up.[2] An aluminium coated *Mylar* diaphragm was stretched over an aluminium back plate, and uniform tension maintained on the diaphragm by means of springs and tension bars.

Back Plate Design

The back plate, ¼ hard 3S aluminum, .032″ thick, was perforated; perforations being round holes, .045″ in diameter, 225 holes per square inch. Every fourth row of perforations was omitted. Where the perforations were omitted, a pip (ridge) was embossed into the back plate. It was found that height and shape of the pip must be accurately maintained, since this has a direct bearing on the sensitivity and power handling capacity of the speaker. In the model accepted for production, pips .0035″ high, were spaced approximately 9/32″ apart; spacing is determined by the hole pattern and actually is .273″.

The diaphragm, consisting of a sheet of .0005″ *Mylar* polyester resin on which a thin layer of .000002″, aluminium is deposited, must be covered with a protective coating to prevent corrosion.

The speaker is given mechanical stability by two end plates made of steel. These are insulated from the back plate by an extruded plastic bead. The end plates are at the same electrical potential as the diaphragm.

In assembly the diaphragm is clamped to the end plates. Tension is applied to the diaphragm through two tension bars and four springs. The spring tension can be adjusted so that small variations in the length of the diaphragm can be compensated. The spring tension is correctly adjusted at the factory; no adjustment must be made in the field.

An enlarged section, through part of the speaker, is shown in Fig. 3. This illustrates the relation between the membrane and the back plate. It will be noted that the diaphragm is stretched over the pips. These, in turn, support the diaphragm so that it is free to move in the space between the pips.

The aluminium conducting layer is insulated from the pips by the *Mylar* which is coated only on one side. A *dc* polarizing voltage is applied between the aluminium conducting layer and the perforated back plate. This causes the aluminium layer to be attracted toward the back plate. The diaphragm motion is limited by the tension. The speaker was designed so that the minimum clearance with polarizing voltage, but no *ac* signal, is .0017″. An *ac* (signal) voltage is then superimposed on the polarizing voltage; this changes the attracting force and causes the membrane to vibrate in phase with the signal voltage. This vibration sets the air molecules in motion and produces a sound wave.

The equivalent circuit for the speaker is shown in Fig. 1. The mass of the diaphragm (*M*) is small and at low frequencies its effect may be neglected. The radiation resistance can also be neglected at low frequencies. The low-frequency response of the speaker is determined primarily by the compliance of the diaphragm and mass of air load. In the model now being made, these have been designed to be resonant at 2500 *cps;* at frequencies below 2500 *cps* the speaker is stiffness controlled. At frequencies above 2500 *cps* the air load radiation resistance becomes sufficiently large so that it controls the mechanical impedance. At higher frequencies the reactance due to the

(*Continued on page* 42)

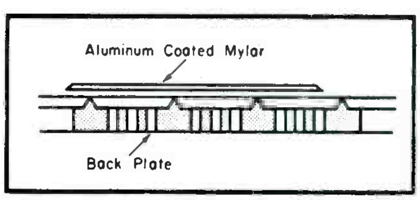


FIG. 3: ENLARGED SECTION, through part of electrostatic speaker, illustrating relation between membrane and back plate.

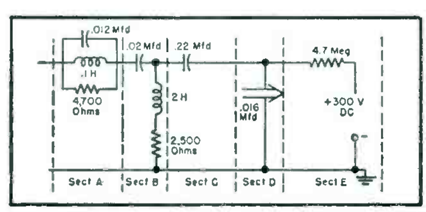


FIG. 4: CROSSOVER NETWORK used in Philco 1766 phono to permit use of electrostatic speaker.

[1]*Type LS.* [2]*Up has been defined as in excess of 20,000 cps.*

TUBE TESTS Plants Use to Gage

THE SCIENCE of servicing electronic equipment has reached the point where the Service Man needs to know, as part of his background of technical knowledge, precisely how a chain of tests not only gives birth to a specific tube type, but also insures uniformity in production.

In this push-button age, too many tend to over-simplify the problem of testing. It is all too easy in the rush of modern life to assume that a few simple tests, without due regard for the precise applications, will tell all that need be known about an electronic tube. However, a slight variation in circuitry, usually not reproduced in a simple test can produce a wide variation in operation.

The many intricate parts and the numerous operations involved in the assembly, sealing, exhausting, and seasoning of a vacuum tube multiply the odds against uniformity of a tube type made in mass lots. Yet, this uniformity must be maintained. It is maintained by an extensive series of tests.

The development of test specifications for an electron tube type is integral with the development of the type. Tests are conceived to define the desired characteristics of the tube type. Other tests must be found to define further the characteristics and guarantee the operation of the tube in the applications for which it is intended.

To keep abreast of the constantly changing application problems involving the use of electron tubes, an engineering section of our receiving tube department has been detailed to monitor tube usages and keep the factory supplied with the requirements that must be met in order to satisfy the needs of the industry.

How Tubes Are Developed

A new tube type is brought into being when a set of characteristics is needed that cannot be found in existing tube types. The process by which the tube evolves from a set of desired characteristics to a finished product ready for shipment is, briefly, as follows:

(*1*) A tube is needed to fill the requirements of a newly developed circuit. The requirements are written into a *Technical Objective* as a guide for the design of the new type.

(*2*) Design engineers transform the desired characteristics into actual tubes. Samples are made using several variations in design. Due to the many parameters involved in vacuum tubes, almost any set of characteristics may be obtained in several different designs. These designs can exhibit all the desired characteristics to a marvelous degree and still be unacceptable in actual operation due to seemingly minor differences.

(*3*) One sample lot is accepted by the manufacturer as meet-

LAB TEST set operator testing a 12AX7 miniature twin triode for af noise, microphonics and hum. With this test, spurious signals generated by automatic or hand tapping, and hum originating within tube, can be measured for amplitude by output meter, and analyzed by ear with speaker.

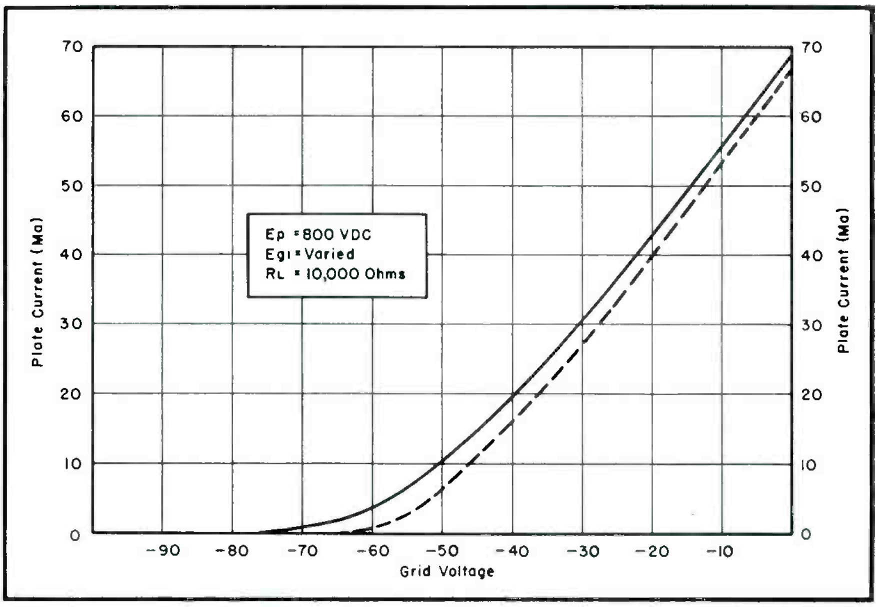


FIG. 1: TRANSFER curves of two sample tubes checked in a specific vertical-sweep application. Although the tubes show very small differences at certain test points, one tube was found to give a linear sweep, while the other produced a top compression that made it unacceptable. Tube whose transfer curve is represented by the solid line was found acceptable.

Performance in Critical TV Applications

Special Checks Developed by Factory Specialists to Insure Maximum Efficiency in Vertical Output and Blocking Oscillator Circuits

by EARL G. BOND, *Application Engineer*

Receiving Tube Department, General Electric Company

ing the requirements of his developmental circuit and that design is then ready for production in the factory.

All tube types must pass a number of tests regardless of the intended application. These are the tests that guarantee that the tube will operate as a normal tube. Tests for shorts, opens, leakage, and gas are included in the group. Other tests will fail a tube if the pin strength is not within specified limits, if the glass shows stresses or strains that will cause cracking during the life cycle of the tube, or if the appearance of the tube is spoiled by some blemish even though the tube may be perfect electrically.

To insure the proper operation of a tube, the electrical characteristics must be guaranteed within tight limits. Test specifications will call for the reading of plate current, transconductance, plate resistance, amplification factor, emission, and any test that may be needed to assure acceptance of the tube. It is with the electrical tests that the application engineer is primarily concerned. The questions that must be answered are:

(*1*) What characteristics are most pertinent to a specific application, and what limits must be placed upon them?

(2) What are the test conditions that will result in the optimum level of assurance that all tubes will operate satisfactorily?

The answers to these questions may be found in the analysis of the circuits involved.

Vertical-Output Tubes

One application requiring special handling is that of the vertical-output stage. The function of the vertical-output stage is to provide the magnetic field necessary to deflect the electron beam in the picture tube from the top of the screen to the bottom at a rate of 60 cps. This magnetic field is produced by a sawtooth waveform of current through the yoke. For a given circuit the tube must be able to supply enough current to give full sweep. In addition, the tube must supply this current in such a manner that the sweep will be linear. To utilize the tube at maximum efficiency, it will have to be driven from cutoff to zero bias.

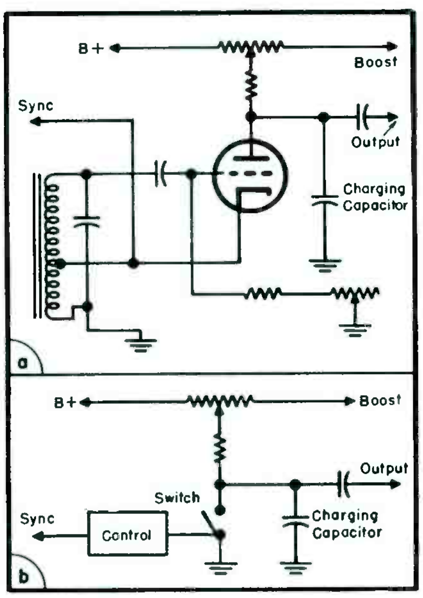
In the past it has been common practice to use, as drive voltage for the vertical output stage, the voltage taken across a capacitor charging from *B+* or *Boost*, and discharging through the blocking-oscillator tube or through the normally-off section of a multivibrator. The output stage may be an integral of the multivibrator circuit.

Once the driving voltage waveform has been defined, the amplitude and shape can be made variable within limits, which are set by the values of the height and linearity controls. We must have tests that will define the transfer curve of the tube. We must guarantee that the curve does not vary (beyond certain limits) from tube to tube, to insure the interchangeability that is required in mass production techniques employed today. Transfer curves of two sample tubes checked in a specific vertical sweep application are shown in Fig. 1. At certain test points the tubes showed very small differences, yet one tube gave a linear sweep while the other produced a top compression that made it unacceptable. The linearity control cannot compensate for the compression at the sweep level required. Test points must then be found that will provide tubes that are acceptable. In the case cited the tube whose transfer curve is represented by the solid line was accepted.

When the tube type has been accepted by a manufacturer for a particular circuit, it is then registered with RETMA and goes into production. New circuits may be made to utilize the characteristics of the tube, but the tube must not stray from the limits that were published.

Let us now analyze the two curves in Fig. 1 to determine why one is acceptable, while the other is not. It must be remembered that these are two triodes submitted as samples for a new circuit. Certainly a circuit can be developed that can use either tube, but the circuit has been designed with an eye toward lower costs, no patent infringements, and perhaps even with the thought that

(*Continued on page* 37)



(Right)

FIG. 2: TYPICAL BLOCKING oscillator circuit appears in (a); while (b) offers an operational analogy using a switch as the tube and box marked control, that acts in the same manner as sync and feedback in the oscillator circuit.

THIS MONTH IN SERVICE

BUSIEST SERVICE YEAR ON RECORD PREDICTED FOR '57--Radio-TV replacement parts sales, which rose to $850-million in '56, are expected to rise to over $1-billion in '57, a RETMA spokesman forecast recently during a talk before the U. S. Chamber of Commerce in Washington. . . . Radio-TV set servicing costs, estimated at close to $1-billion for the year, it was said, will also soar during the coming year to a record high of nearly $1,250,000,000.

SERVICE MEN CALLED KEY TO COMMUNITY-TV FUTURE--The future of community antenna TV depends largely on the availability of trained Service Men who can install and maintain increasingly complex equipment, NCTA members were told at the recent Portland, Oregon, conference. . . . It was pointed out that there is an urgent need for Service Men who will advance themselves sufficiently to do a proper job in making the wide assortment of cable gear work. TV Service Men will only be able to carry this added responsibility, conferees were told, if they keep themselves up-to-date in the many specialized skills required; they must expand their knowledge and efficiency by keeping up with current developments. . . . In a report on the growth of closed-circuit TV, it was noted that there will be a continuing need for community-TV which cannot be fulfilled by the booster type of operation. The booster and translator operations were described as being developed on an unsound economic base, and as a result, their use will be limited to very small areas, where only a cohesive community spirit exists. Added to this, it was said, there are technical difficulties involving ultrahigh operations in the top 13 channels presently allocated to this service. Only when these difficulties are overcome will full use of the translators be achieved.

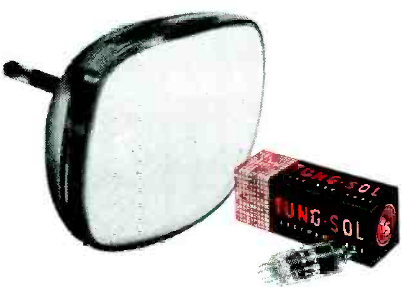
1-TUBE CRYSTAL-FILTER COLOR-TV REFERENCE GENERATOR DEVELOPED--At a recent receiver conference in Syracuse, two color experts disclosed that they had designed a single-tube crystal filter circuit for color-TV in which a dual-purpose tube (6AU8 triode-pentode) serves to provide burst gating and amplification. . . . The triode section was said to act as the burst gate device and the pentode as the amplifier. By keying the triode grid with a pulse shaped from the horizontal-flyback pulse and feeding its cathode with chroma from a low-impedance tap on the chroma bandpass filter, which drives the color demodulators, burst gating was said to be accomplished. The stage operates a grounded-grid amplifier for the burst and as such offers a small amount of gain. The pentode, used as the high-gain amplifier following the crystal filter, was noted as giving a gain as high as 175 for weak signals and providing a slight limiting action at normal levels. . . . Commenting on circuit performance, the engineers said that no observable hue errors were noted when burst frequency was varied ± 11 cps from its correct frequency. Tests showing this were made with a lab color scanner using a burst generator whose frequency was counted with a digital frequency counter. . . . Also, it was noted, spurious responses of the crystal have been controlled so that no colored striations on the picture tube screen are observable. . . . Reference amplitude variations were said to be rendered harmless by providing a means for accurately adjusting each synchronous detector to a dc balance.

REPLACEMENT NEEDS FOR TV SETS NO LONGER BEING MADE UNDER STUDY--A concerted study is now underway to determine the quantities of replacement parts and accessories that will be required for eventual use in TV models made by companies who are no longer in business. . . . The problem of supply for these lines has been found to be acute. . . . Original replacement stocks of many of the retired manufacturers that were transferred to depots have been depleted and new sources must be built up. Those working on the project believe that it might be necessary to set up a coordinated industry plan to maintain an adequate cross-section inventory of special parts for these halted-production receivers.

The Tung-Sol Distribution Policy

Tung-Sol's resale policy is—and has always been—firmly based on distribution exclusively through parts wholesalers who supply the independent dealer and serviceman.

L. E. COTSEN,
Manager, Renewal Sales



TUNG-SOL ELECTRIC INC.

MAKERS OF BLUE CHIP QUALITY TUBES FOR AMERICA'S INDEPENDENT SERVICEMEN

The Care and Feeding of

Basic PEC Types . . . Testing and

(Left)
FINAL TEST stage for packaged electronic components.

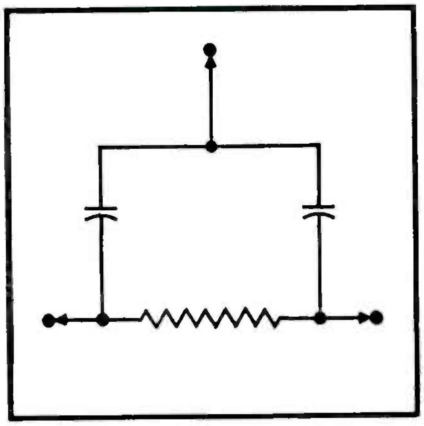
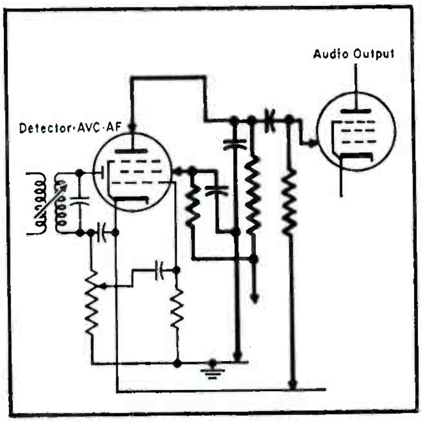
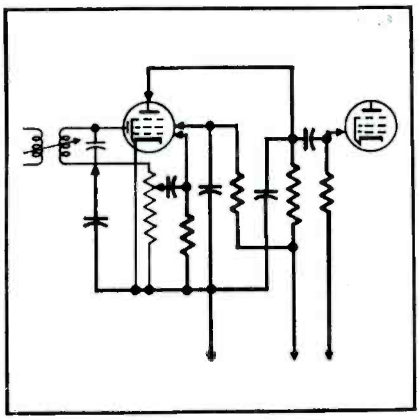


FIG. 1: TYPICAL diode filter packaged electronic circuit.





IN THE FIELD of TV and radio the packaged resistor-capacitor network, known variously as the *pec*°, packaged electronic circuit or printed circuit, has become a vital member of the component family.

In the months and years to come, Service Men will encounter more and more of these units in their work. One major manufacturer[1] already has developed a TV chassis whose circuitry consists almost entirely of packaged electronic circuit plates; seventeen have been included. Many other set makers have similar chassis in design or production. Advantages such as space and weight saving, reduction in the number of solder joints, reliability and uniformity, and reduction of costs, are such that the long-term outlook is for an ever-increasing use of these components.

Because of this situation, there is a growing need for information about troubleshooting and replacement of these units.

Basically, these units consist of a ceramic or titanate base plate, with resistors, capacitors and wiring printed or mounted thereon, and the whole units protected by a coat or coats of some protective resin. Connection to the rest of the circuitry is made by means of several wire or tab leads.

The packaged electronic components in current use can be divided into six groups; simple resistance-capacitance combinations, triode and pentode couplates, audio detector and pentode detector couplates, vertical integrators, sync takeoff couplates and special circuits.

The simple resistance—capacitance combinations represent the earliest types of *pec*'s produced, and are still widely used today. They usually consist of a simple circuit of two or three resistors and capacitors, in series or parallel; resistance and capacitance measurements can be made between available terminals. These units are commonly found in *rf* filter applications, such as the widely used diode filter in AM receivers. A typical diode filter is shown in Fig. 1.

The triode and pentode couplates contain the basic coupling circuitry between the detector—*avc-af* tube, (either triode or pentode) and the following audio output tube. This circuit is widely found in TV receivers manufactured since '50. The triode couplate incorporates two resistors and three capacitors, and the pentode couplate incorporates three resistors and three capacitors, as shown in Fig. 2.

In the audio detector and pentode detector couplates we have the same circuitry as the triode and pentode couplates, plus some additional circuitry associated with the detector—*avc-af* tube. An example of a pen-

°*CRL trade name.* [1]*Motorola.*

FIG. 2 (left, center): **PENTODE couplate** pec **that serves as a means of coupling the detector**—avc-af **and** af **output in TV chassis.**

FIG. 3 (left): **PENTODE detector couplate circuitry.**

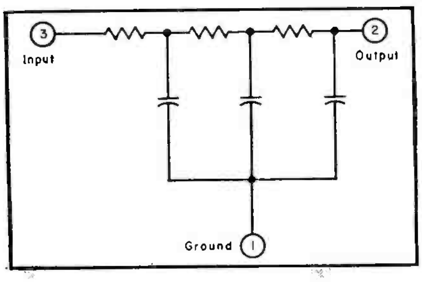
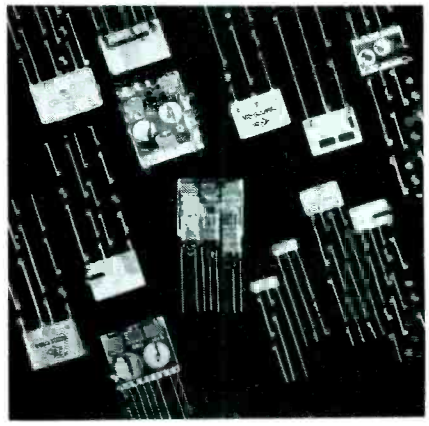


FIG. 4: VERTICAL integrator pec **used to couple the final sync stage to the vertical oscillator in TV receivers.**

PACKAGED ELECTRONIC CIRCUITS



Replacement Techniques Used For Each Type

by **BRUCE E. VINKEMULDER**

Centralab

tode detector couplate is illustrated in Fig. 3. Comparison of this circuit with Fig. 2, reveals the presence of an additional capacitor and resistor in the control-grid circuit of the pentode, and an additional filter capacitor in the diode circuit of this tube.

Vertical integrators couple the final sync stage to the vertical oscillator stage in TV receivers. The composite sync pulse at the input to this *pec* is actually a series of about six narrow vertical sync pulses, broken up by horizontal sync pulses of opposite polarity. The purpose of this circuit is to integrate the composite pulse into a single wide vertical pulse of correct polarity. A typical vertical integrator circuit appears in Fig. 4.

The fifth type of *pec*, the *sync takeoff couplate*, serves to couple the sync signal, from the point of takeoff in the video amplifier circuit, to the input of the sync amplifier circuit. In addition to the coupling action, these components act as broad bandpass filters, passing the horizontal and vertical sync pulses, and attenuating random signals outside this frequency range which might otherwise trigger the sync circuits. Fig. 5 illustrates a typical sync takeoff circuit.

In addition to the foregoing *pec*'s there are several units which have been designed for special applications, and which do not lend themselves to application groupings at present.

How to Test for a Defective Unit

As in any troubleshooting procedure, the first step is a stage-by-stage check to isolate the defective stage. This can be done either by use of a signal from a strong local station, or by use of a signal generator, with the antenna disconnected or shorted out.

When the defective stage is located, it is usually best to check the

(*Continued on page* 46)

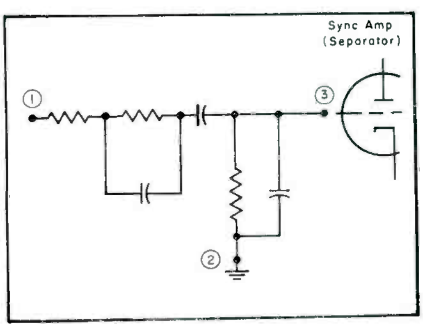
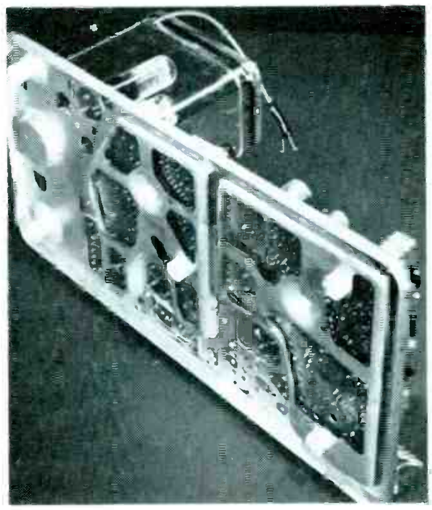
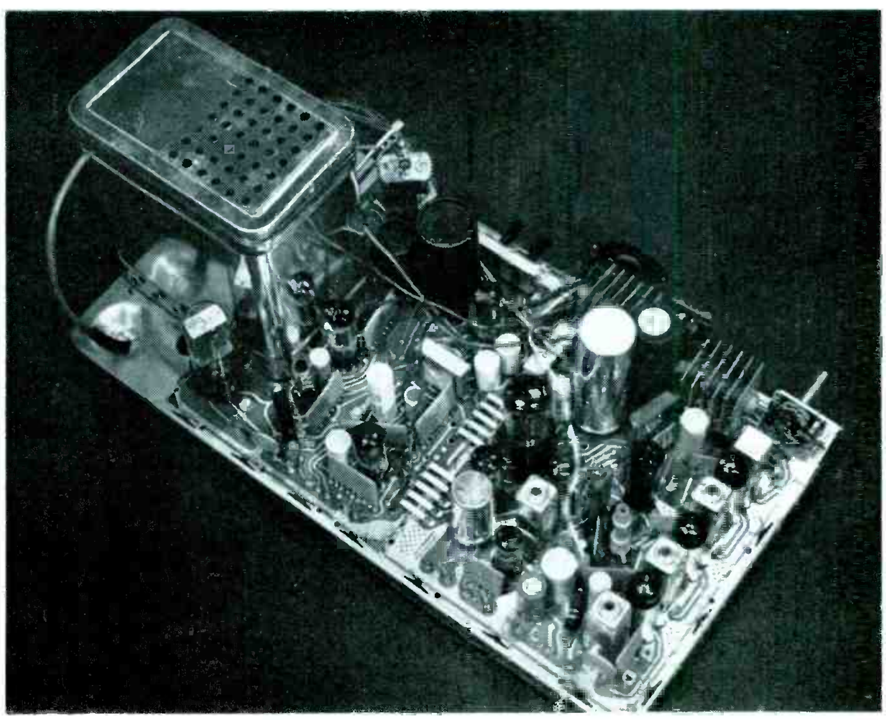


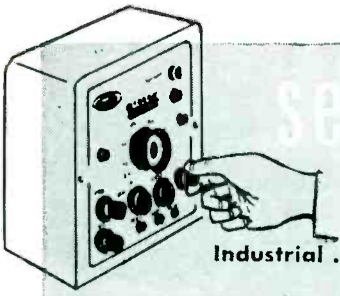
FIG. 5: SYNC TAKEOFF couplate designed to couple the sync signal, from the point of takeoff in the video amplifier circuit, to the input of the sync amplifier circuit.



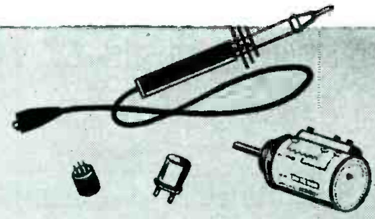
(Above and Below)

TV CHASSIS in which 17 packaged electronic circuits have been included. (Motorola)





service engineering



FIELD AND SHOP NOTES

Industrial . . . Commercial . . . Institutional

Communications . . . Audio . . . Television   Installation . . . Maintenance . . . Repair

CONELRAD Radio-Alert Receiving Systems Required by FCC: How Equipment Operates . . Installation-Service Procedures

by NORMAN C. HELWIG

Kaar Engineering Corp.

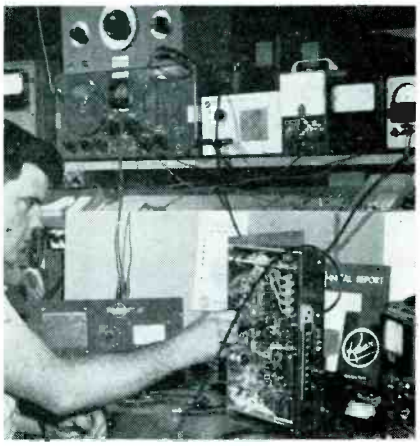
[See Front Cover]

If you service two-way mobile radio systems and are responsible for the proper technical operation of one or more radiotelephone systems, then it is your added responsibility to see to it that your customers comply with the new FCC regulations concerning *Conelrad*,[1] the defense technique concerning the *CONtrol of ELectromagnetic RADiations*. In the event of the initiation of an alert, all radio stations operating at frequencies below 890 mc will be required to cease regular transmissions. Certain broadcasting stations will return to the air on either 640 or 1240 kc and will be operated in such a manner as to render their transmissions ineffectual for navigation or homing by hostile aircraft or missiles.

Although there is some variance in the exact manner in which each class of radio station must comply, the same basic principles apply to all radio stations. It is required and it is also the patriotic duty of every radio station licensee to equip his stations with facilities for the reception of *Conelrad* radio alerts.

Some classes of radio stations may be permitted to make short duration emergency transmissions during an alert in a manner specifically outlined in applicable FCC rules. No transmitter should be operated during an alert unless the operator abides by FCC rules which permit him to do so. Under no circumstances should superfluous transmissions be made even if any transmission is permitted.

Compliance with the requirement for providing acceptable facilities for



Aligning Conelrad monitor with conventional AM broadcast receiver test equipment.

(Photo by Cyril Glunk)

the reception of *Conelrad* alerts may be effected in several manners. Some of the telephone companies offer a *Conelrad* warning service. The subscriber is provided with bell and light signals which are activated from a defense center. However, to receive civil defense information during the alert it will be necessary to provide also a radio receiver which can be tuned to 640 or 1240 kc.

An ordinary AM broadcast receiver may be used as a *Conelrad* monitor if it is left turned *on* during the hours that the radio transmitter is used. Such monitoring must be *continuous*. Before each transmission, the operator in charge must determine by listening to the radio set that an alert is not in effect. However, home radio sets were not designed for 24-hour per day operation and continuous aural monitoring of a radio program can become tedious, and because of the human element, unreliable.

An outboard alarm circuit, which will obviate the requirement for continuous aural monitoring and which will provide an automatic alarm in case of a *Conelrad* alert, can be purchased or built, which can be wired to a conventional AM broadcast receiver.

The trend at the present time, however, is to install a complete, single-package automatic *Conelrad* monitor, which provides both an automatic alarm as well as means for reception of civil defense information. The circuit of such a monitor is shown, in part, on the *cover* and, in complete form, in Fig. 1.*

This monitor contains a superhet receiver which can be set by means of a 5-position channel selector switch to monitor any of three selected AM broadcasting stations or to provide reception on either 640 or 1240 kc. The receiver contains an integral *avc*-operated alarm circuit which responds to failure to receive the carrier of the station it is monitoring. It is also designed to fail safe and thus actuates the alarm in the event of any possible failure within the equipment itself.

When the alarm circuit is actuated, a red warning lamp on the front panel of the instrument is lighted. A built-in loudspeaker, which is normally silent, is automatically turned *on*. A pair of relay contacts, electrically

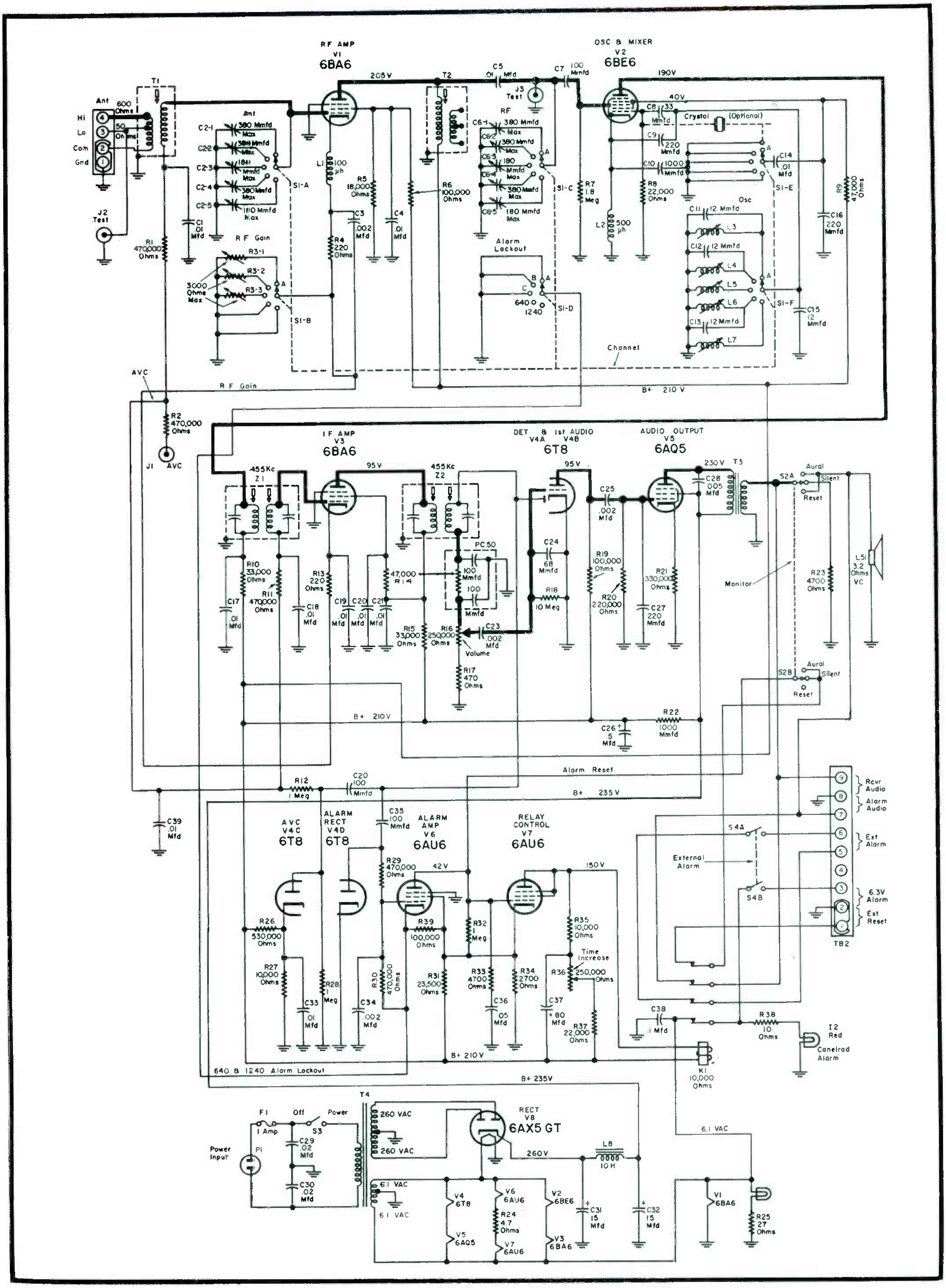
(Continued on page 22)

[1]***The FCC has requested radio station licensees to comply with these regulations on a voluntary basis immediately. Compliance by January 2, 1957 will be mandatory.***

Service Men engaged in maintaining two-way equipment should acquaint themselves immediately with the FCC rules and regulations governing the specific classes of radio stations under their supervision. Copies of the rules may be obtained from the Federal Communications Commission, Washington 25, D. C.

**Kaar Conalert*

Complete Circuit Diagram of Conelrad Radio-Alert Monitor



Conelard Radio-Alert Receiving Systems

(*Continued from page* 20)

accessible at the rear termnial strip, may be used to actuate auxilliary and remote alarms such as lamps, bells, horns, etc. The external alarm is turned off by turning a knob on the panel. The closing of another pair of relay contacts causes 6.3 *v* to be made available at the terminal strip for operation of an external relay, lamp or other signal.

A 2½-second delay has been incorporated in the alarm circuit to reduce the number of false alarms which could be caused by short failures of the station being monitored. If the received carrier is interrupted for more than 2½ seconds, the alarm circuit is tripped. A 250,000-ohm potentiometer, R_{30}, is provided on the chassis for adjustment of the amount of time delay. However, this adjustment should never be touched unless it has been determined that the time delay circuit is faulty or improperly set.

The external alarm circuits are important since they widen the scope of the applications for such equipment. In a typical taxicab radio station, for example, where the operator and the transmitter are in the same room, the monitor may be set on the operator's desk or on a shelf. Normally, the instrument is silent. It is set to monitor a specific key broadcasting station. It may be necessary to switch from one to another of the three channel switch settings at certain times to conform with the operating hours of the desired stations.

Although the instrument does its monitoring job silently, the operator can flip a switch and listen to the program being broadcast over the monitored station. The monitor must be left *on* all the time during the hours that the radio station is operated.

In the event of a *Conelrad* alert, the red warning lamp automatically lights, and after a few seconds, a 1000-cycle tone of 15-seconds duration is heard. The red lamp and the loudspeaker go on automatically and simultaneously; also the external alarm if one is used. After the tone, the broadcasting station will announce the existence of an alert and instruct listeners to tune their radio receivers to 640 or 1240 kc. The radio station operator then would set the channel selector knob on the monitor to either of the two *Conelrad* frequencies; also the external alarm would be shut off by turning the *External Alarm* knob to *off* position.

Of course, the operator must cease radio transmission immediately when the red warning lamp goes *on*, after advising his mobile units to stay off the air until he advises otherwise. The operators of mobile units are permitted to operate their radio transmitters only as directed by the base station operator, who is in responsible charge of a specific radiotelephone communications system. Radio silence must be maintained until it has been determined that the alert is over or was a false alarm. As mentioned earlier, some radio stations may be permitted to make short radio transmissions during an alert under some conditions.

To be on the really safe side, it is possible to wire the monitor alarm circuit to the transmitter in such a manner as to disable the transmitter whenever the red lamp glows, thus automatically preventing possible unlawful transmissions.

If the red lamp goes on and the 1000-cycle tone and *Conelrad* alert announcements are *not* heard, but instead the regular program of the monitored station is heard, it can be assumed that an alert does not exist and that the alarm was actuated by an interruption of the carrier of 2½ seconds or more in duration or by an intermittent failure in the monitor. However, if the red lamp lights and no sound comes from the loudspeaker within approximately 15 seconds, the operator should set the channel selector to another station to determine if an alert exists or if the alarm was tripped inadvertently.

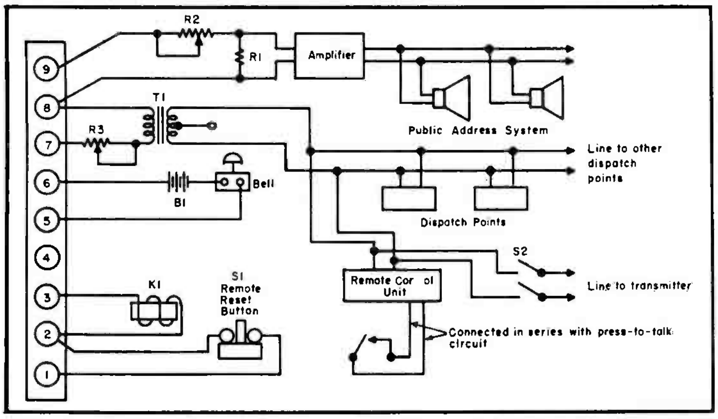
To return to monitoring, once the alarm has been tripped, it is necessary to operate a *reset* switch (S_2) which turns off the alarm and silences the loudspeaker. An external reset switch can be connected to terminals *1* and *2* on the terminal board (TB_2) through a pair of wires connected at the other end to a normally closed push-button or spring return switch.

In a more elaborate radio station, the monitor can be used to operate an audible alarm, as well as alarms at other points. For example, where a radio station has a remote control point plus one or more dispatch points, the audio output of the monitor may be connected so that it will be heard over the radio station control unit loudspeakers at all of the dispatch points when the alarm circuit is tripped. By means of suitable circuits, alarms may be set off at these remote points by the auxilliary alarm relay contacts of the monitor.

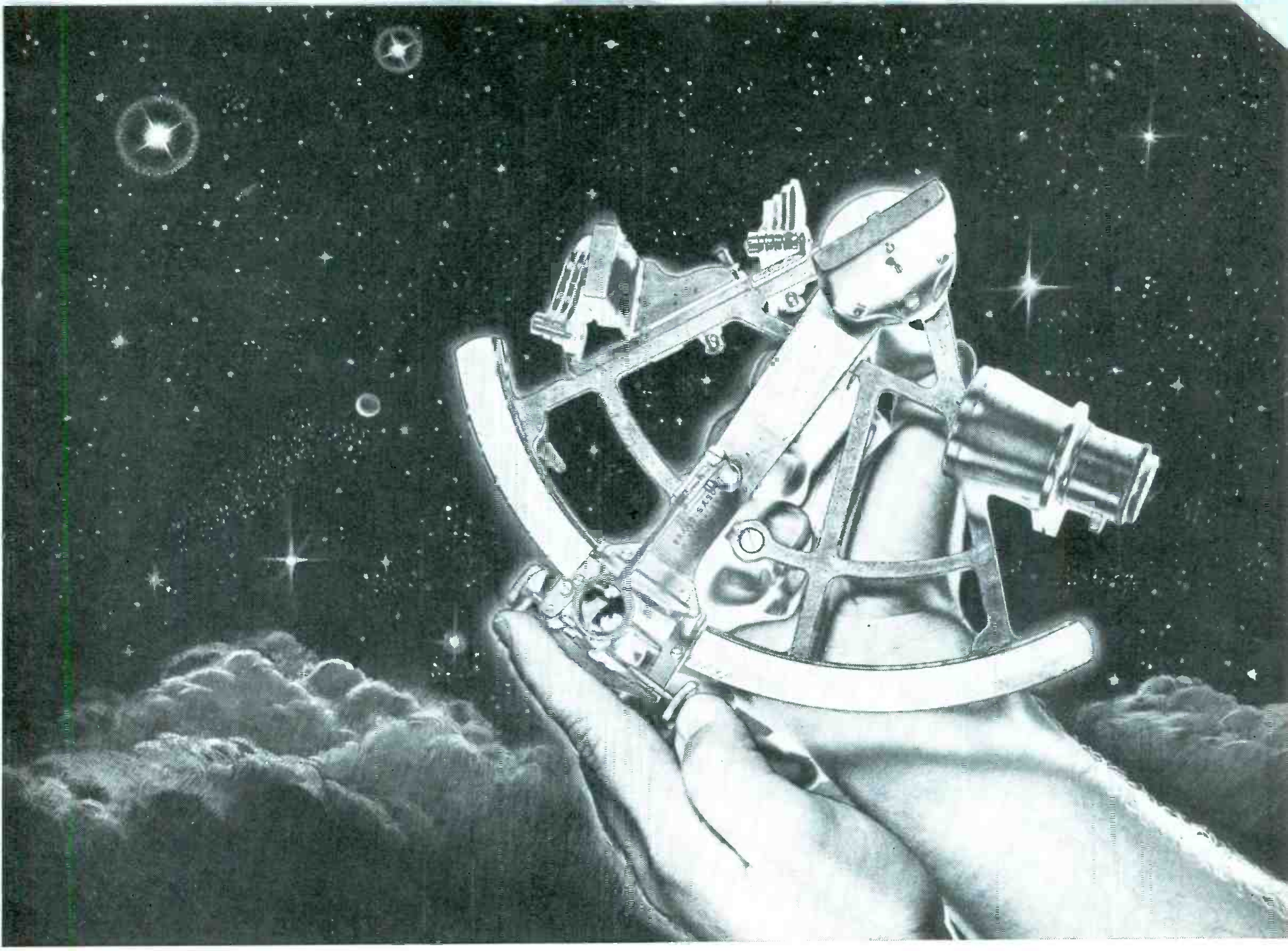
FCC regulations require that the operator at the location designated as the *remote control point* must be able to cut his transmitter off the air and disable all associated *dispatch points*. Hence, the monitor should normally be installed at the designated remote control point, where the operator in charge will be able to prevent illegal operation of the transmitter during an alert. However, the existence of an alert should be made known to all dispatch point operators too, and the reception of civil defense information during such an emergency should be extended to all persons whose lives or property may be in jeopardy.

Schools, hospitals, hotels, theatres, police and fire departments, civil defense organizations, disaster groups and all places where groups of people assemble should be provided with means for being apprised of a *Conelrad* alert and for reception of civil defense information in case of an alert. In many communities, Service Men will be consulted in regard to means for providing *Conelrad* warnings and reception of emergency information. Many organizations will buy *Conelrad* monitoring equipment from local service shops who will in-

(*Continued on page* 41)



PLANT MUSIC system network designed to accommodate a Conelrad monitor.



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Associations

TSDA, San Mateo County, Calif.

Presentation of an exclusive course in color-TV, developed by San Mateo College, to members of the Television Service Dealers Association, San Mateo County, Calif., has been proposed by the association's training committee.

Plans call for a dual-category course, with classes to begin in January and continue to May. Meetings would be held two nights weekly, with three-hour sessions.

To defray costs to the college, it will be necessary for at least 25 participants to sign up for the course. Those who sign up will be expected to follow through on the training.

ARTS, Chicago, Ill.

A series of technical talks by industry specialists has been announced by the educational committee of Associated Radio and Television Servicemen, Ill.

In a recent lecture on transformers, Robert F. Hodges, Merit sales engineer covered their design, what causes failures, what methods should be used in repairing, replacing, or making a good substitution when you cannot get the original.

The ARTS color-TV course, conducted during the summer for members, will be resumed in January.

RTSA, Greenville, S. C.

Floyd Winchester has been elected president of the recently formed Radio and TV Service Association in Greenville, South Carolina.

J. B. Cothran, was named vice-president, and *R. E. Heath*, secretary-treasurer.

As a prerequisite to membership, the new group announced, applicants will have to pass a technical exam now being drawn up.

A grievance committee, which includes a representative of the Chamber of Commerce's Better Business Bureau has been set up.

TRT, Kansas City, Mo.

At a recent meeting of the Television and Radio Technician Association, Kansas City, Mo., held in classroom facilities of Central Technical Institute, *L. A. Betros* of the Institute presented a talk on the theory, application, and construction of rainbow generators and gray scale indicators.

TEN YEARS AGO IN SERVICE

Boom markets were predicted for TV and FM by government experts. FCC chairman Charles R. Denny noted that nationwide telecasts, which should be possible within the forthcoming year, would give TV a giant push. . . Commenting on FM, Denny declared that the Commission's long-range program also called for coast-to-coast networking. FM's future looked excellent, he said. . . This enthusiasm from official sources boosted national interest among associations in TV and FM and prompted the development of large-scale clinic and lecture programs by industry specialists on all phases of these new fields. . . Vacuum tube probes with subminiature tubes were introduced. . . . *Fred D. Wilson* became general sales manager of Operadio Manufacturing Co. . . . The DeMambro Radio Supply Co., Inc., opened a branch in Manchester, N. H. . . . *Frank Folsom*, executive vice president of RCA, received a certificate of appreciation from the War Department. . . . A listing of exact duplicate controls appeared in the November issue of the *Centralab Jobber Outlook*.

Servicing Helps

How to Service Printed-Wiring Boards in Spartan TV Chassis...

Printed wiring boards, now being used in the Spartan 19 series portable TV chassis, are basically laminated plastic sheets with thin copper foil bonded to one side. To form the necessary wiring, some of the copper foil is removed by a photographic and etching process. Holes are punched in the board through which various component leads are inserted. The leads of standard size components are cut and bent over the copper foil wiring. The wiring side of the board is then dipped in molten solder to make all solder connections at once. The copper foil wiring also picks up solder, thus increasing its ability to carry current. Finally a coat of silicone resin varnish is applied to the wiring side of the board to prevent dust or moisture from causing short circuits.

Tools-Materials Required

Although the electrical characteristics are the same as conventional wiring, special techniques are required in servicing these boards. The following tools and material have been found helpful in the repair of the *pw* boards:

(*1*) A low-wattage pencil-type soldering iron or soldering gun with a small tip. Soldering guns for this work have special angled tips .

(2) A small wire brush, to brush the solder away from a component to be removed or to brush away the excess solder from a component being soldered. Excessive solder can cause shorts or intermittent troubles to occur at a later date.

(3) Low-temperature solder with a rosin core consisting of 60 per cent tin and 40 per cent lead should be used for all solder connections. This solder is fast melting and will provide good conections with little heat.

(4) Diagonal wire cutters and long-nosed pliers to remove defective circuit components.

(5) A thin-bladed knife for prying bent connections when it is necessary to remove the entire component instead of cutting it off at the ends.

(6) A small wire pick or any object that can be used as a soldering aid.

(7) Clear lacquer and brush as a coat of lacquer, to be applied over any repaired area to prevent dust or moisture from causing short circuits.

(8) A solvent for removal of the silicone resin when effecting the repair of any part of the printed wiring.

**Items* 2, 5, 6, 7 *and* 8 *are contained in a printed-wiring repair kit marketed by General Cement.*

Replacing P-W Resistors-Capacitors

If the leads from the defective part are long enough, one should cut the leads where they enter the component. Then a small loop should be made in each lead of the replacement component. The leads remaining from the defective component should be cleaned, the loops slid over the leads left from the original defective component and soldered.

When soldering, as little solder and heat as possible should be used; too much heat may cause the original lead to break loose at the printed wiring point.

If the original component does not present sufficient lead length as described, the defective component should be cut in half. After this, each half should be cut away from the lead and usually enough lead length will be obtained to permit a secure connection to the replacement part.

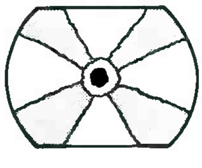
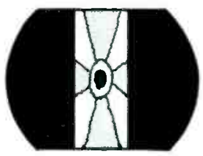
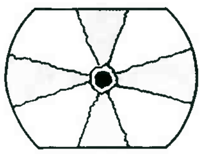
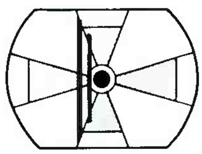
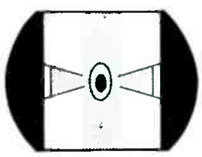
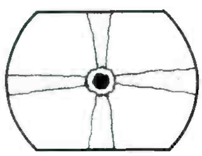
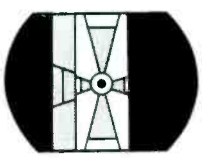
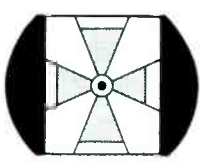
After removal of the defective component, small particles of solder may be imbedded in the silicone resin. It is necessary to remove these by wiping the board with a clean cloth dipped in the solvent.

Replacing P-W IF Transformers

Soldering iron should be applied to each of the connecting lugs and

(*Continued on page* 42)

Flyback Transformer-Width Coil-AGC

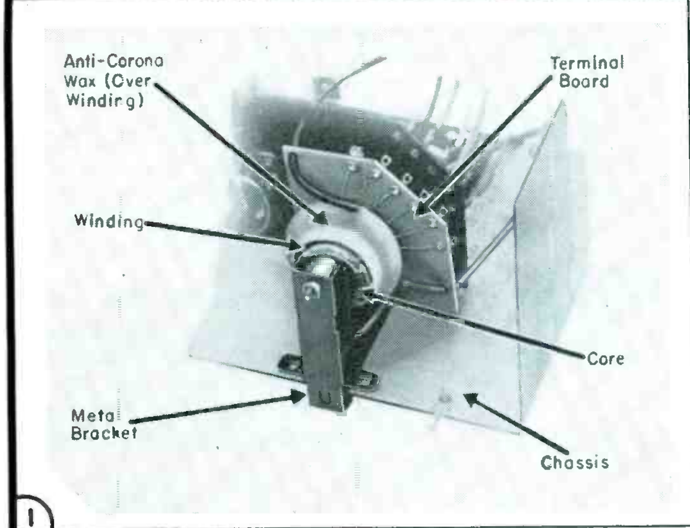
Picture Trouble	*Visual Indication*	*Cause*	*Remedy*
Blooming (excessive height and width, low brightness, poor focusing) or complete disappearance of raster. **(1)**		Hv section of horizontal sweep system checks okeh, but flyback transformer winding is partially or completely shorted and there is corona or arcing in flyback. ***(See Fig. 1 and circle 1; Fig. 3, right‡)***	Flyback transformer should be replaced.
Vertical line; or very narrow picture with blooming, or no picture. **(2)**		Open, short, or partial-short in low-impedance winding section of flyback transformer. ***(See circle 2; Fig. 6, right‡)***	Flyback transformer should be replaced.
Flyback overheats and burns. If trouble is left uncorrected picture blooms. **(3-4)**		Short in flyback-transformer coil generates excessive heat causing anti-corona wax to melt. ***(See Fig. 1 and circle 4; Fig. 5, right‡)***	Flyback transformer or defective component should be replaced.
Ringing; one or a few vertical white lines appearing anywhere on raster. **(5)**		Flyback transformer likely cause, especially if mismatched or improper air gap is used. Trouble can also be due to low drive, B+ or boost voltages or width coil shocked into oscillation. ***(See circle 5; Fig. 3, right‡)***	One should check for improper operating voltages and faulty part. A 1000-ohm resistor should be placed across width or linearity coils.
Narrow picture width with drive line (or black bar) in center. **(6)**		Faulty or improperly-matched width coil. ***(See circle 6; Fig. 6, right‡)***	One should check for faulty component in flyback circuit.
Width coil overheats and burns; if trouble is left uncorrected, picture will bloom. **(7)**		Defective width coil or flyback transformer; width coil slug all the way out; width coil with lower-than-normal inductance used. ***(See Fig. 2 and circle 7; Fig. 6, right)***	Width coil slug should be readjusted. Defective, or improperly-matched width coil or flyback transformer should be replaced.
No picture, narrow picture, or narrow picture with foldover on left. **(8)**		Shorted (or partially-shorted) width coil or section of flyback transformer connected to width coil; can also be due to defective capacitor connected across width coil. ***(See Fig. 2 and circle 8; Fig. 3, right‡)***	Defective width coil, flyback transformer or capacitor should be replaced.
Reduced picture width; width coil overheats and burns if fault is left uncorrected. **(9)**		Width coil with lower-than-normal inductance used; core missing from width coil; improperly-matched width coil or flyback transformer; capacitor across width coil is leaky. ***(See Fig. 2 and circle 9; Fig. 3, right)***	Width coil setting should be readjusted, inserting slug, if necessary. Defective width coil or flyback transformer should be replaced; capacitor across width coil should also be replaced.

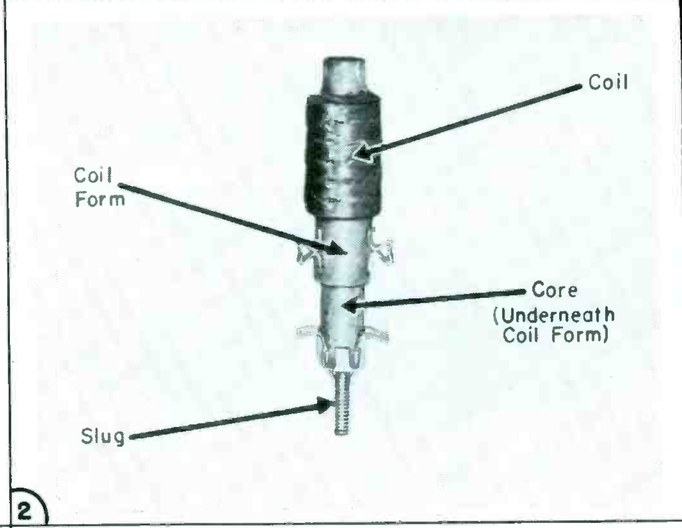
‡Practically any fault or improperly-matched component in the flyback circuit could cause these difficulties; only the likely troubles are detailed. Excessive width, negative pix, split pix and picture hook, caused by troubles in Figs. 4, 5 and 6 circuits (circles 10, 11, 12 and 13) will be analyzed in a subsequent report. **Author of* ***Servicing TV Sweep Systems.***

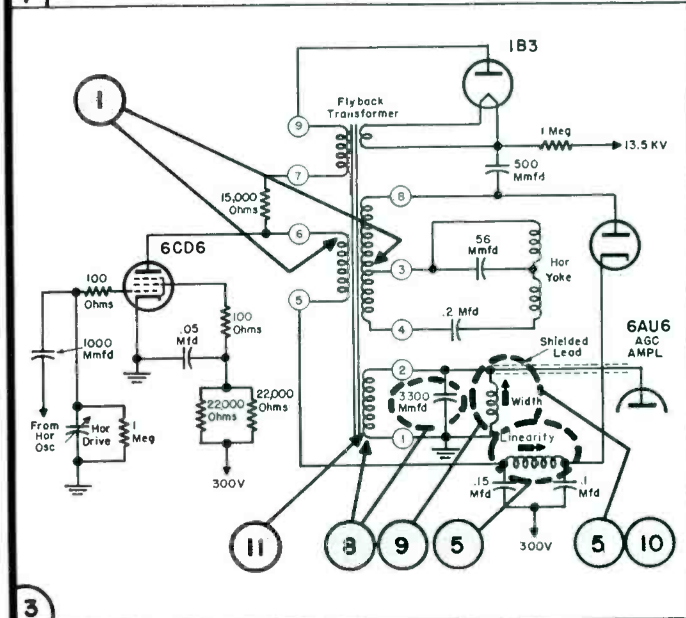
FIGS. 1-6 (right): A TYPICAL flyback transformer is illustrated in Fig. 1, and a width coil in Fig. 2. Horizontal sweep circuit used in Crosley 390 chassis is shown in Fig. 3, while Fig. 4 shows agc and horizontal sweep circuits used in RCA KCS97 chassis. In Figs. 5 and 6 are the horizontal sweep circuits used in Admiral 17XP3 and Magnavox 650 chassis. (Figs. 1 and 2, courtesy Ram.)

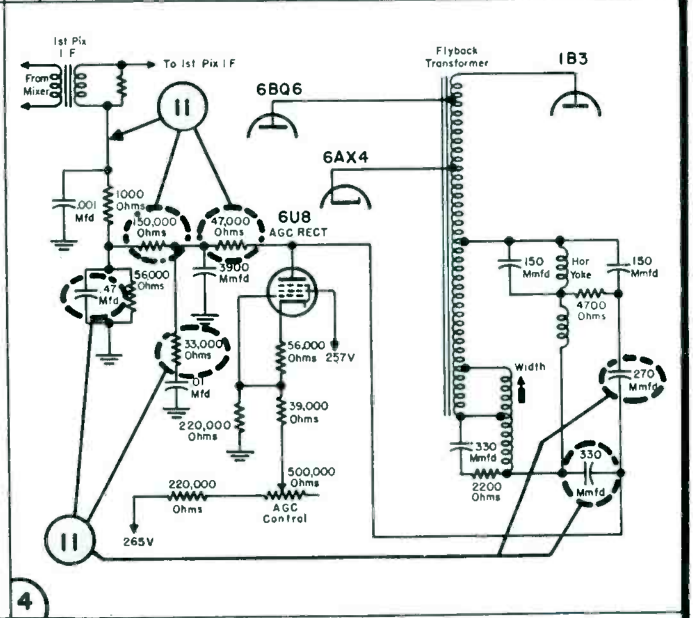
-AFC Troubleshooting Chart

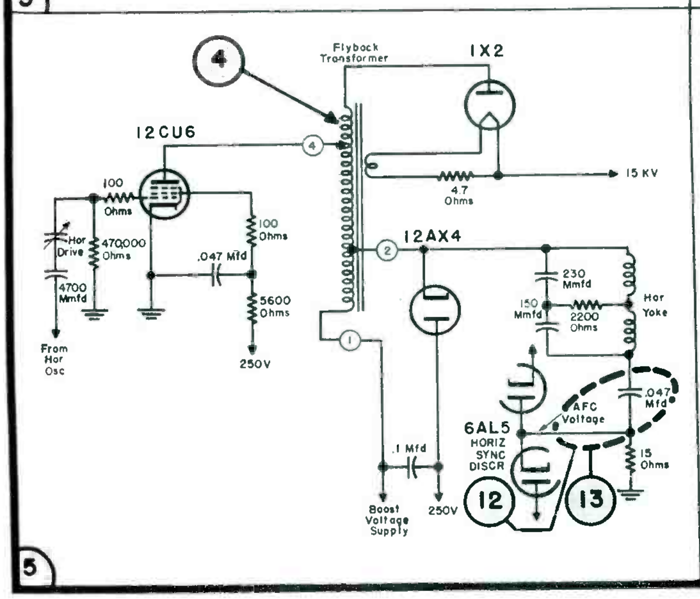
by JESSE DINES*

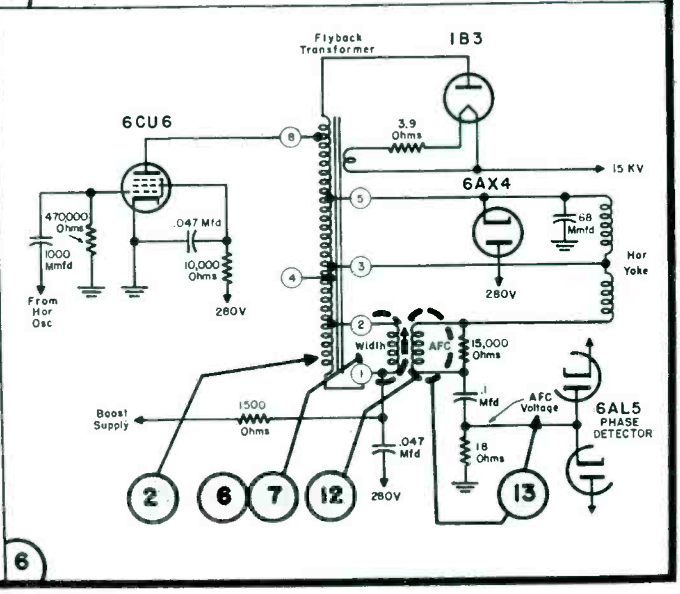




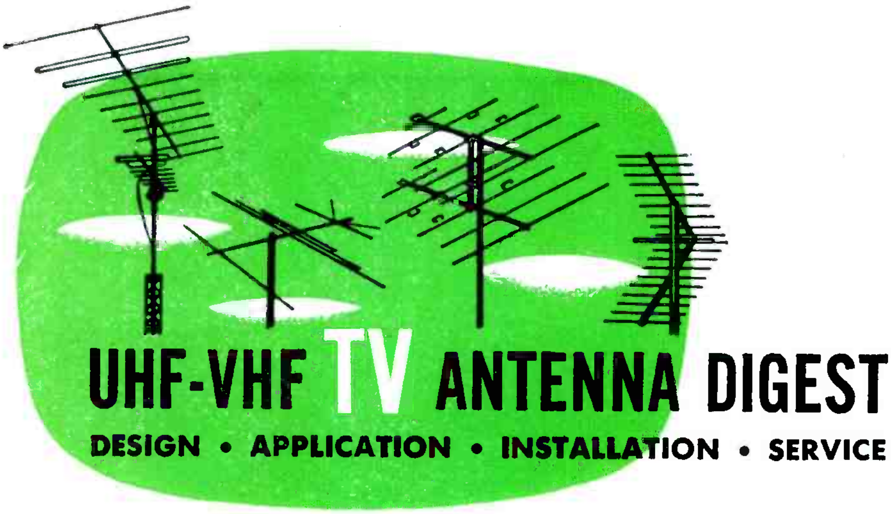








Closed-Circuit Applications Using Community-TV Systems



Community television, often described as an audio-video communications system, with a given bandwidth of frequencies and power-handling ability, is not only unique in its technical makeup, but in the varied services it can offer.

Commenting on these unique properties at the recent western NCTA meeting, Fitzroy Kennedy[1] said that in the community-TV system, we have a cable running throughout a community that is useful over the bandwidth of frequencies of from *dc* to about 500 mc; an astonishing increase in facility actually installed on poles in many communities over the telephone and telegraph wires whose usefulness extends only to about 3000 cycles.

One might question this broad coverage, conferees were told, since there are components of a community-antenna system that put a limitation on this type of thinking. There are amplifiers and tapoff devices that are frequency limiting; some have 6-mc bandwidths and others 200-mc bandwidths. Neither, it was noted, now have enough bandwidth to take full advantage of the cable. But, in tapoff devices, many have a much greater frequency range than that of the *vhf* bands.

However, a look into the future reveals that amplifiers with 330-mc bandwidths will be available. And in a few years, it was disclosed, amplifiers of 750 to 1000-mc bandwidths should be on the scene. Again, one might say that the replacement of amplifiers in existing systems would be prohibitive in cost and defeat the whole idea. There is a solution to this problem. Kennedy said we can parallel wide-band amplifiers with existing ones and extend the bandwidth of the system without ripping out the exisiting equipment. It is true that such equipment is not yet available, but it is feasible to design it because of advances in tube and transistor developments.

Accordingly, we find that the 500-mc bandwidth system is within the realm of existing techniques, and with almost existing equipment at what appears to be, at this stage, not a prohibitive cost.

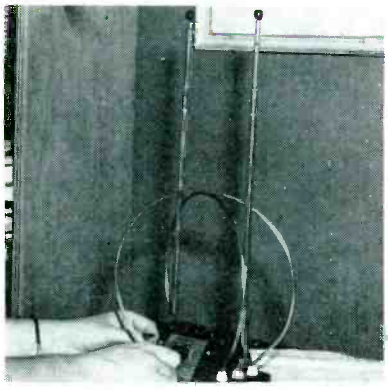
Reviewing the possibilities of community systems from not only an entertainment, but an educational and industrial point of view, the community-TV specialist said that the coax line network is ideal for teaching purposes.

Through television teaching large bodies of students can be taught by one teacher, (relieving the teacher shortage—and raising the quality of teaching, because more time can be spent preparing for class) and demonstrations can be put on where it was impossible before, because of the cost per class.

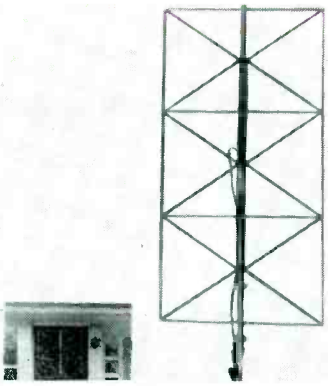
Community television fits into this picture, Kennedy said, because community systems are the only economic existing medium that can handle the transmission of educational television information from the originating camera to the classroom. It was noted that every community that has a community antenna system has potentially the means of connecting all school buildings together, so that programs may be originated in one place and transmitted to all other classrooms in the school system. Thus, television has a real contribution to make in in-

(*Continued on page* 36)

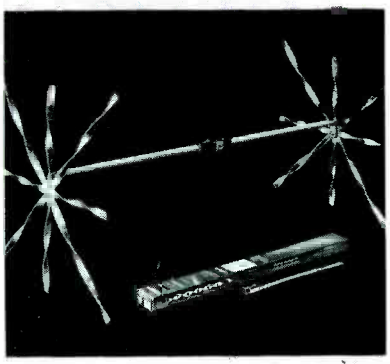
[1]*Chairman of the Board, Spencer-Kennedy Laboratories, Inc.*



Indoor TV antenna said to feature brass crossed circular phasing bars. (Picasso Directronic model 8-D; Snyder Manufacturing Co., Philadelphia, Pa.)



Aluminum trellis-type TV antenna that, it is claimed, is not affected by interference from metal sheathing, insulation, wire screens and appliances. Overall size is 36″ wide by 72″ high. (Ground-Master; Trio Manufacturing Co., Griggsville, Ill.)



Antenna using eight twisted aluminum elements arranged in a star pattern on each end of a 34″, two-piece aluminum beam. May be used inside, as in attic, or outside. (Starbeam Company, Box 5087, Waco, Texas.)

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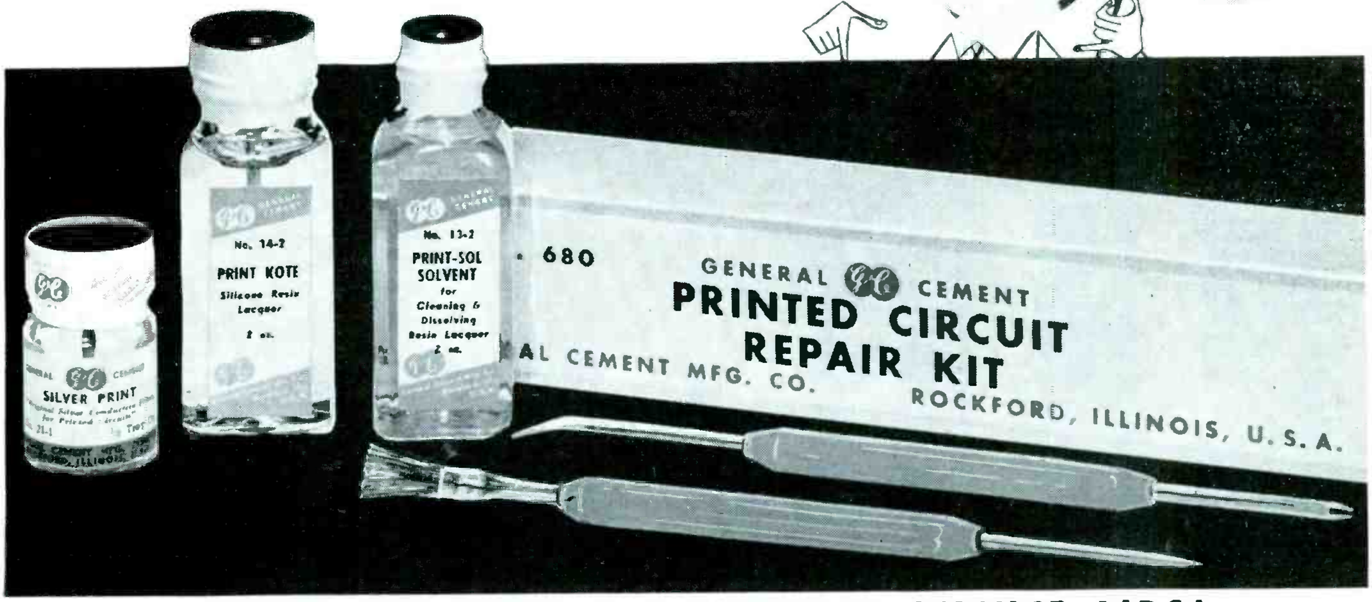

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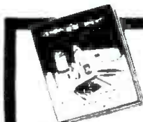

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ANNUAL INDEX January-December, 1956

ASSOCIATIONS

AUDIO*

AUTO RADIO

BLACK-AND-WHITE TV*

CIRCUIT DIAGRAMS WITH ANALYSES

COLOR-TV*

COMMERCIAL SOUND

*See *Circuit Diagrams, Test Equipment, Tubes.*

COMMUNITY-TV

MONTHLY NEWS REPORTS

SERVICING HELPS

SERVICE ENGINEERING

(*Continued on page 34*)

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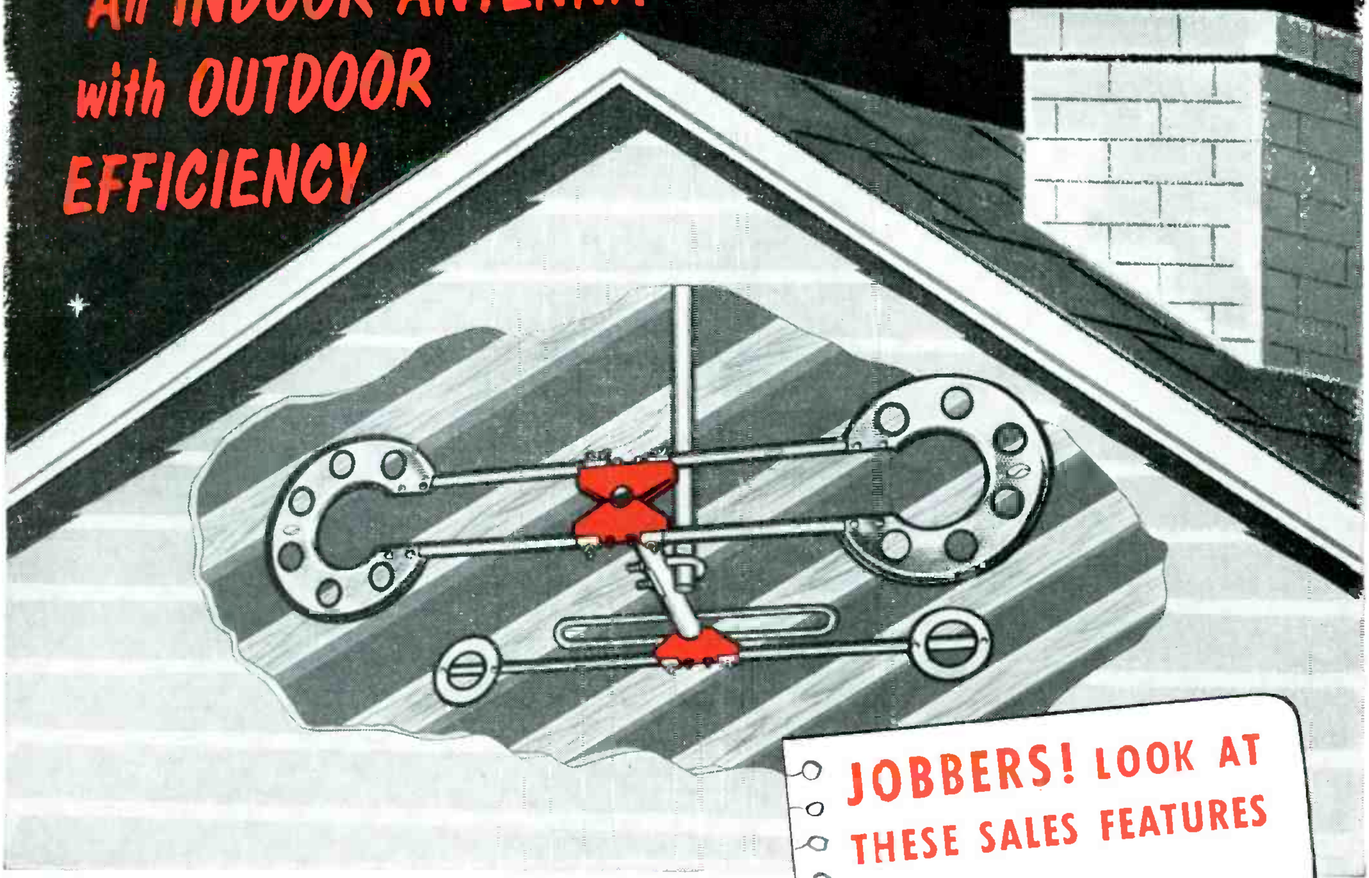

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Sound System Acoustic Efficiency Checks . . . Stepping Up Output in 1 and 2-Tube Phono Amps

BEFORE A SOUND system is put in, it is good practice to determine the acoustical efficiency of the area in which the installation is to be made. The resultant information provides a valuable guide to speaker and microphone placement and the types and quantity that will be required.

An interesting example of what such tests can reveal appeared in a recent report prepared by a group of audio engineers who checked the acoustics of the Cleveland Public Auditorium.

First the team ran a series of articulation tests by placing several persons in various locations throughout the auditorium and reading to them a list of 100 disconnected syllables. The listeners then recorded the syllables they heard, or thought they heard, and their lists were then compared to the master. The results of the articulation tests revealed that the hall fell well below the accepted criteria.

According to the sound experts, the most important test conducted was that of reverberation.[1] This test indicated the length of time required for various sounds to fall off, thus determining whether the sound lingered long enough for its vibrations to become intermingled with later sounds.

The reverberation problem in the hall was found to be the predominant element in its bad acoustics. Once this problem has been eliminated, it was felt, it will reduce greatly any other difficulties arising from echo, frequency of response and loudness.

The tests showed that sounds in the frequencies of 125 to 250 cps had a falloff time of 6½ seconds. It was found that approximately 37,000 square feet of the auditorium's walls, ceiling or floor will have to be treated acoustically to shorten this extended falloff time to acceptable periods.

Examination Steps

Each area of the wall, ceiling and floor space of the hall was examined to determine what treatment could be applied, and how much of that area was available for treatment. This was necessary since events which are housed in the auditorium are varied and on many occasions the sound does not emanate from the stage. In those events where the center of the hall is the focal point, the reverberation as the sound is repeatedly reflected from the ceiling and floor is such that sound is indistinguishable.

Slow Speed Cure

IF A MAGNAVOX-COLLARO changer appears to run slow, one should first remove turntable and check position of neoprene washer inside turntable hub. Slow speed will result if the washer is distorted or is not properly positioned in the groove provided in the turntable hub. Then the turntable shaft should be lubricated with light machine oil.

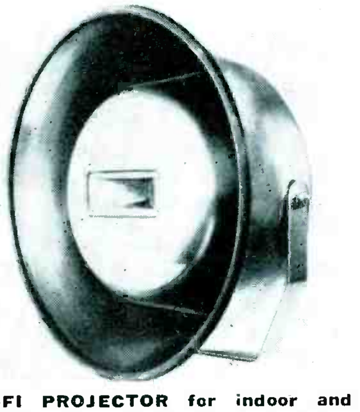
Tension of idler spring should then be checked. If the turntable can be stopped by hand and the motor continues to run, the tension on the idler spring should be increased. If the changer is slightly slow on all speeds it may be necessary to use a larger motor pulley.

Spindle Adapter for 45

A DESIGN CHANGE has been incorporated in the Magnavox-Collaro 45

(*Continued on page 44*)

[1]*These tests were conducted with the aid of a Brush af spectrometer, a high-speed level recorder, a beat-frequency oscillator with a warble tone attachment, a condenser microphone and an automatic reverberation time switch.*



HI-FI PROJECTOR for indoor and outdoor use. Unit is a two-way divided system, coaxially arranged. In action, an 8" speaker reproduces the frequency range below 2,000 cps. This unit drives a single-fold horn (front loaded design) with a phase inverter bass reflex port near the horn throat. (HF-100 projector; Jensen Mfg. Co., 6601 S. Laramie Ave., Chicago 38, Ill.)

PHONO REPLACEMENT pickup ceramic cartridge with minimum needle force of 2½ grams and a response to 12,000 cps for the Chrysler car phono system. Cartridge, it is said, features a .003" sapphire stylus. (WC20; Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.)

Annual Index

(*Continued from page* 31)

SERVICE SHOP FIELD REPORTS

TEST EQUIPMENT . . . PROCEDURES

TRANSISTORS—TRANSISTORIZED EQUIPMENT

TUBES*

TV ANTENNAS—SYSTEMS

**See Circuit Diagrams, B-W/Color-TV.*

TV Antennas

(*Continued from page 28*)

creasing the effectiveness of the educational system; community antenna system participation in this aspect of education is, therefore, a very real opportunity right now. There is one limiting factor to the present community operator; he must determine if the bandwidth of his system allows the addition of several educational channels, and if not, how will the cost of additional equipment affect the income potential.

In a description of a grammar school network recently installed, it was revealed that 15 schools in Hagerstown, Maryland, were connected together through 11 miles of community antenna system equipment and cable. A five-channel television system was installed here to provide initially three educational channels.

Educators were said to feel that, although this number of channels is sufficient now, in the future a total of 15 to 24 channels of transmission, with much of it requiring two-way operation, will be needed.

The additional channels will be necessary to permit coverage of not only a full complement of subjects, but for different types of students; those who can take instruction rapidly and others who require more time.

Not only could the community system be used for elementary schools, but at universities and colleges, technical schools, military installations and large corporations, all having a number of buildings to tie together via a community network.

Analyzing the prospects of community TV as a means of advertising and promotion of industrial products, Kennedy said that the community antenna system can do as good a job on this score as a TV station and at less cost. Furthermore, he added, it can do a better job potentially for a very good reason; unlike a TV station it can tap into its line at almost any point in a city quickly and easily and make pickups at a cost that a TV station with its necessary cumbersome and expensive microwave relay equipment for remote pickup can't do.

For a manufacturer with many plants scattered around the city a community-TV tie would be very helpful. It would enable him to transmit information of all kinds, such as letters, bookkeeping records, pay roll records, blue prints, etc., at much less cost than carrying all this information around by hand. Many channels would be required, Kennedy noted, but once this manufacturer had the facility it would generate its own increase in size by demonstrating its advantages. One only needs to let one's imagination dwell on this one example, Kennedy continued and then expand it to service industries for example, such as milk companies with their many depots, banks, and department stores with branches, stock brokerage houses with branches, to confirm the formidable place a community antenna system could have in the mercantile world.

Color-TV

(*Continued from page* 11)

a blue raster motion perpendicular to that given by the main blue convergence magnet. With this additional motion it is possible to superimpose first the green and red dots, and then with the two degrees of motion move the blue dots to superimpose all three.

After the convergence adjustment has been made for best dot convergence at the center, a blank raster of some color is again turned on and the yoke position and purity adjustments rechecked since the convergence adjustment, if appreciable, tends to change purity. A handy device for checking purity is a magnifying glass or pocket microscope (10X or 20X power) to look at the color dots on the screen through the receiver safety glass. The relative position of the electron beam, with respect to a color dot for purity adjustment for field-neutralizing-coil adjustment and for yoke position adjustment, is illustrated in Fig. 5 (p. 11). By checking several places on the screen with the magnifier and overall by eye, one can make the best purity adjustment so all three colors red, blue and green are completely pure over the face of the tube.

[Additional information on adjustments for convergence and purity, positioning of the yoke, rim magnet and field-neutralizing coil, and how white balance is obtained will appear in the concluding installment in the January, 1957, issue of SERVICE.]

•

Plant Tube Tests

(*Continued from page* 14)

standardization of components is necessary to keep parts inventories at a minimum.

The tube represented by the dotted curve has almost the same sweep potentialities as the acceptable tube, represented by the solid transfer curve, since sweep is from zero current (cutoff) to zero bias current. We know top compression must occur at cutoff or close to cutoff, so we must have a check point to guarantee that the tube does not cut off too quickly.

The cutoff voltage at which top compression takes place is then one of the points on the curve that must be controlled. The two curves are not similar in the 2-5 milliampere range. The dotted curve has a more pronounced curvature in this region. This dissimilarity can also cause a region of compression and stretch in the upper portion of the sweep. A test for plate current with appropriate limits at $E_{g1} = -60$ was found to provide a guarantee that the curve will not slump in this region.

We now lack one test to insure the proper operation of the tube in the region near cutoff. We must eliminate the possibility of top stretch. Top stretch can be caused by grid emission or leakage, but we have already specified tests for these two items. Stretch can also be caused by cutoff being too remote. Improper flow of current during retrace will effectively damp the transformer, causing short sweep or stretch at full sweep. The amount of current that is detrimental to normal sweep establishes the maximum limit for current close to cutoff. Currents measured in microamperes can be critical at remote cutoff voltages.

Since a curve cannot be defined by two points, other points along the transfer curve must be checked to guarantee sufficient sweep and linearity. One point that can be readily checked is plate current at zero bias. A plate-current test at this point will, with proper limits, define the range of sweep that can be obtained. Plate current and transconductance are also read at the *Class A* operating point which is most often published in tube manuals and other specs.

[Circuit performance in oscillator systems and its relation to tube selection and testing will be covered in a report that will be published in January, 1957, SERVICE.]

COMPONENTS

CAPACITOR SERVICE KITS

Two capacitor service kits, *CUB* and *BLUE BEAVER*, have been introduced by Cornell-Dubilier Electric Corp., South Plainfield, N. J.

The *CUB* kit contains 76 molded tubular capacitors of assorted ratings; *BLUE BEAVER* kit features 22 of the most widely used electrolytic types. Each kit also contains a location chart, ratings and prices of each capacitor and a guide listing complete lines.

Kits are flat, clear plastic, hinged cover (11" x 6½" x 1⅞") cases divided into compartments.

* * *

WALL-CARD RESISTOR ASSORTMENTS

Wall-card *Greenohm* power-resistor assortments, including six different selections, *GK-1* through *GK-6*, of 2, 5 and 10-watt sizes, ranging from 5 to 50,000 ohms, have been introduced by Clarostat Manufacturing Co., Inc., Dover, N. H.

* * *

TRANSISTOR PORTABLE RADIO COMPONENT KIT

A 6-transistor portable-radio component kit, *IF-KIT 5000,* containing three miniature 455-kc *if* transformers and one 455-kc oscillator coil, has been developed by Vokar Corp., Dexter, Mich.

Units are said to be impedance matched to transistors made by GE, Raytheon, RCA and General Transistor.

* * *

CERAMIC CAPACITOR REPLACEMENT KIT

A universal ceramic capacitor replacement kit, *CK-4*, featuring four units said to replace 42 conventional ceramics valued from 400 mmfd to .015 mfd, and a number of paper tubulars and mica capacitors, has been announced by Sprague Products Co., 67 Marshall St., North Adams, Mass.

Tables packed with the capacitors and printed on the kit detail which unit to use for desired capacitance, which leads to use as terminals and which leads to solder together or clip off.

Types *UGA-1* and *UGA-2* are general application types with tolerances of +20%. Types *UHK-1* and *UHK-2* are high-K universals for use where rated capacitance is minimum value permissible. *UGA-1* may be wired for 12 values of capacitance; *UGA-2* for 15 values; *UHK-1* for 7 values; and *UHK-2* for 8 values. Three of each of the four types are included in the kit.

* * *

VOLTAGE DROPPING RESISTORS

Two voltage-dropping resistors, *5225* and *5226*, for adapting 6-*v* car radios and accessories to 12-*v* systems found in most new autos, have been developed by G-C Electronics Manufacturing Co., 400 S. Wyman St., Rockford, Ill.

Type *5225* is for car radios; *5226* is for wider voltage-dropping requirements for accessories using 2½ to 9 amps in 12-*v* systems.

INSTRUMENTS

DIODE AND TRANSISTOR TESTER

A battery-powered diode and transistor tester, for measuring and testing characteristics of diodes, *pnp* and *npn* transistors, has been announced by Fretco, Inc., 406 N. Craig St., Pittsburgh 13, Pa.

* * *

SUBSTITUTION BOX

A substitution box, *X-Checker*, with a continuously-variable resistor and capacitor which may be inserted alone or in series combination in an electronic circuit, has been developed by Ram Electronics, Irvington, N. Y.

Resistance substitution range is 0 to 2500 ohms; capacitance substitution range, 20 to 450 mmfd. Values are read directly from scale calibration.

Checker is said to be useful in TV servicing where applications include elimination of sound bars due to insufficient filtering action of 4.5-mc trap; correction of lack of picture detail, improper horizontal linearity, brightness or width; correction of raster width; correction of *agc* magnitude or *afc* pulse; or elimination of yoke ringing.

* * *

TV TUBE BOOSTER

A TV tube booster, *DeRO-Juvenator RPS-2*, for use on both series and parallel filament circuits, has been developed by DeRO Electronics, 134 Nassau Rd., Roosevelt, N. Y.

Also available are models *RP-1* for parallel circuits only; *RS-1* for series circuits only; and *RU-5* for universal use in parallel, series, isolation, electrostatic and electromagnetic circuits.

* * *

UNIVERSAL POWER SUPPLY

A universal power supply, *NFA*, said to have less than a ¾% ripple at top load, has been introduced by Electro Products Laboratories, 4500 N. Ravenswood Ave., Chicago 40, Ill.

Unit has been designed for testing and servicing radios and electronic equipment in aircraft, autos, marine, transistor circuits, relays and solenoids.

* * *

TV-FM SWEEP GENERATOR AND MARKER

A TV-FM sweep generator and marker, *368*, (kit or wired) for alignment of FM, *b-w* and color TV, has been introduced by Electronic Instrument Co., Inc., 84 Withers St., Brooklyn 11, N. Y.

Sweep range is from 3 to 216 mc in 5 overlapping fundamental bands. Sweep width is continuously variable from 0 to 3 mc (lowest maximum deviation) to 0-30 mc (highest maximum deviation). Marker range is from 2 to 75 mc in 3 fundamental bands plus a calibrated harmonic band (60-225 mc). Variable marker is calibrated with an internal crystal marker generator; 4.5-mc crystal is included. Provision has been made for an external marker.

CATALOGS—BOOKS

Sprague Products Co., 231 Marshall St., North Adams, Mass., has compiled a catalog (*C-455*) in a wall-calendar style for hanging near telephone or work bench. Covers capacitors needed for radio-TV replacements. Copies are available free from Sprague distributors, or by sending 10c to Sprague.

° ° °

Electro Products Laboratories, 4500 N. Ravenswood Ave., Chicago 40, Ill., has released a four-page folder describing the D612T filtered *dc* power supply designed to operate, test, and service transistor and 12/6 *v* auto radios from ac lines.

° ° °

Rogers Electronic Corp., 49 Bleecker St., N. Y. 12, N. Y., has published a catalog supplement sheet cross-referencing exact yoke, flyback, transformer and coil replacements for Bendix TV receivers.

° ° °

Howard W. Sams & Co., Inc., 2201 East 46th St., Indianapolis 5, Ind., has announced publication of volume 6 of the *Tube Location Guide* series. Guides show the chassis layout of TV receivers, types of tubes used, and function of each tube. Also included with each diagram is a *tube failure check chart* which lists the tubes which are to be suspected when the indicated trouble is experienced. Contains 194 diagrams which cover TV receivers produced in '55 and '56. Price, $2.00.

° ° °

PERSONNEL

Walter E. Peek has been appointed general sales manager of Centralab. Peek has been with Centralab since January, '53, as sales manager of electronic mechanical products.

Wright

Peek

Joseph J. Wright, Jr., has been appointed to the sales staff of Vokar Corp., Dexter, Mich.

° ° °

Lawrence J. Epstein has been named director of sales and merchandising, and Charles Ray, jobber sales manager, of University Loudspeakers, Inc., 80 South Kensico Ave., White Plains, N. Y.

° ° °

William J. Nagy has been appointed ad and promotion manager of the Accessory division of Philco Corp. Nagy, formerly electronic district manager for the southeast division, succeeds *William J. Horn*, recently named ad manager of Philco's appliance division.

Service Engineering

(*Continued from page 22*)

stall and maintain this equipment. Therefore, Service Men should become familiar with how *Conelrad* works and how it can be used to safeguard life and property.

An example of how the monitor may be integrated into a fairly complex radio station setup is illustrated on page 22. In this case, a plant music system is involved, as would be found in a factory employing an industrial or plant protection mobile radio system. The audio output of the receiver is available continuously at terminals 8 and 9 at the back of the monitor. Normally, the builtin loudspeaker in the instrument is disconnected with the monitor switch in *silent* position and the audio output is loaded by a 4.7-ohm resistor. To feed this signal into an audio amplifier, a series resistor may be used to reduce the signal level to the proper value required by the amplifier. The 470,000-ohm series resistor, R_2, may be a potentiometer. Its value depends upon the input impedance of the amplifier and may be adjusted by measuring the signal level at the input of the amplifier with a *vtvm* or a 'scope. The value of R_1, another 470,000-ohm series resistor, also depends upon the input characteristics of the amplifier and might be omitted when the amplifier input is already loaded down internally by a resistor. By application of Ohm's law, the correct resistance values can be determined when the amplifier input impedance and signal level requirements are known.

The circuits shown connected to the other terminals are not affected until the monitor's alarm circuit is tripped. When this happens, the audio output of the receiever continues to reach the music system, but it now is also fed into the telephone line which links the base station transmitter, the remote control point and several dispatch points. The audio level must now be reduced so that a 0 dbm signal is applied to the telephone line. This could be done with a T-pad made up of three fixed resistors, if the telephone line were not balanced to ground and the receiver audio output did not have one side grounded. Therefore, to offset this problem, a transformer, T_1, is required. This may be a voice coil to a balanced line transformer. It is not critical. A 3000-ohm potentiometer (R_3) in the *rf* gain circuit, which is also connected as a rheostat, can be adjusted

(*Continued on page 43*)

Electrostatic Speakers

(*Continued from page* 13)

mass of the diaphragm becomes important, and the output starts to fall off somewhat.

A speaker mounted in a cabinet front is illustrated in Fig. 2 (p. 13). The arrows represent sound waves which move normal to the diaphragm surface, both front and back; the back plate is transparent acoustically.

If the cabinet front is not to cast an acoustic shadow, the center of the speaker must be close to the front of the cabinet. Minimum overall depth results when the output from the back of the diaphragm is used. The polar distribution is the same from either side of the diaphragm.

When the sound is taken from the back of the diaphragm, the non-radiating sections (marked *AA*) are normally in the useful sound field. These sections are necessary mechanically in order that the diaphragm can be held under uniform tension. Their presence in the sound field causes undesirable absorptions at frequencies where they are resonant. To eliminate these absorptions they are removed from the radiating sound field by two pieces of impregnated fibre and two pieces of tape which cover the last three diaphragm sections on either side.

Vertically the speaker has been found to be flat within 3 db over an angle of 15°; in the phono with this model, the speaker has been tilted upward at an angle of 15°, so that the full listening space can be covered at ear levels.

In this speaker the spacing between the diaphragm and the back plate must be carefully controlled. Spacing must be large enough so that the diaphragm will not strike at maximum excursion, yet not so far as to reduce the sensitivity unnecessarily. It was found that a favorable compromise on spacing can be obtained by restricting the low frequency energy fed the diaphragm. This is part of the function of the crossover network which must be used with this speaker.

The crossover network used in our phono is shown in Fig. 4 (p. 13). In this network, section *A* compensates for the rise in the speaker output which centers at 6000 *cps*. A 4700-ohm resistor is used to broaden the loss curve so that the compensated response is almost flat. Section *B* attenuates frequencies below 2000 *cps*. The inductance resonates with the capacity of the speaker to increase the output of the system in the 2000-2500 *cps* range. Here a 2500-ohm resistor is used to broaden the resonance curve. Section *C*, consisting of a .22-mfd capacitor, blocks the *dc* path through the choke and 2500-ohm resistor.

Section *D* is the electrostatic speaker. Electrically, the reflected mechanical impedance is so small that it may be neglected. The speaker acts like a .016-mfd capacity. The polarizing supply and 4.7-megohm isolating resistor are in section *E*.

•

Servicing Helps

(*Continued from page* 25)

excess solder brushed away; this should be repeated until the lugs are entirely free of solder.

Then the lugs should be cut from the transformer as close to the board as possible, and the transformer removed.

Any small particles of solder imbedded in the resin should then be removed.

The replacement transformer should now be inserted and the connections soldered.

Finally a coat of lacquer should be applied to the connections.

P-W Tube Socket Replacement

Wafer type socket should be broken with pliers and all pieces removed so that the pins are exposed individually. One must be careful not to apply excessive pressure or twist the pin during this process or the foil wiring on the board will be damaged.

Now heat should be applied to the bottom of each pin, which should be removed individually by pulling straight up.

In the final step, all excess solder should be brushed away and a new socket installed.

Service Engineering

(*Continued from page* 41)

so that the signal level measured across the high impedance side of T_1 is 0 db or approximately one volt.

Normally, program material flows from the monitor to the public address system. When an alert is received, the bell rings, the transmitter is disabled and the monitor warning tone may be heard over the public-address system, as well as through the loudspeakers in the transmitter remote control and dispatch units.

The operator may disconnect all of the control units from the transmitter by opening switch S_2, but may continue to communicate with the dispatch points over wire lines. When he switches the monitor to 640 or 1240 kc he, as well as personnel at dispatch points, plus all of those within hearing range of the public-address system, may listen to civil defense information.

Not all radio stations are located in areas close to a key broadcasting station which must be monitored. Therefore, the monitor employs a sensitive receiver circuit enabling it to operate on very weak signals. When used in areas of high signal strength, receiver sensitivity may be reduced by adjustment of the *rf* gain control, accessible from the rear of the chassis. One or all of the channels may be crystal controlled by adding a suitable crystal in the local oscillator circuit for each channel to be controlled. This may be desirable in areas of very weak signals.

The monitor has been designed to be used with various types of antennas as dictated by local conditions. In areas of low noise and high signal strength, a ten foot piece of wire connected to the *HI* antenna terminal will usually suffice. In remote areas, a conventional horizontal *T* or inverted *L* antenna may be more satisfactory. In very noisy areas, a vertical whip antenna, at least 10′ long, may be installed high above the vincinity of interference sources. A 50 or 75-ohm coax cable may be used as the leadin. A *LO*-impedance antenna terminal is provided for this purpose.

When replacing components which are not identical to the original, it is important to determine that the replacement parts are also designed for 24-hour per day, year around operation. Care should be exercised not to damage the relay contacts or to disturb spring tension when burnishing relay contacts or making adjustments to the relay. When any doubt exists, and since this instrument is concerned with safety, it may be wiser to replace the relay assembly.

A great opportunity awaits the enterprising Service Man who goes out after *Conelrad* monitoring business now. There are thousands of radio station operators who have not yet voluntarily complied with the FCC requirement and who have made no definite plans for compliance. The sale and installation of *Conelrad* warning systems can bring in revenue now and the maintenance of these systems will provide income in the future.

Audio

(*Continued from page* 33)

spindle adapter to increase operational reliability.

The newer adapter has only one lug in the bottom opening, while the earlier model had two.

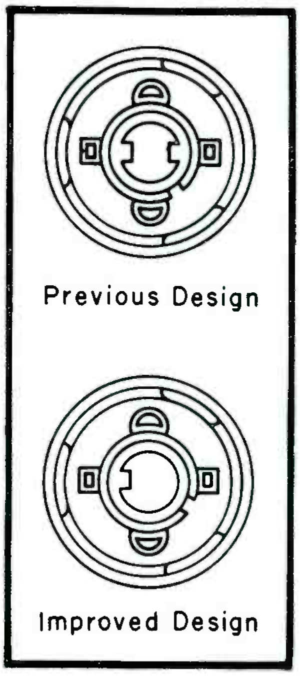
In some cases even the new type 45 adapter may not function properly, due to insufficient lateral motion of the record spindle pawl.

To remedy, the lock nut should first be loosened and stop screw turned in about 3 or 4 turns. Then, the record dropping slide should be pushed to the extreme of spindle pawl travel without forcing. While holding the slide in this position, the stop screw should be adjusted so that it just touches the spindle pawl. The lock nut can then be tightened.

Now, the roller adjust screw should be loosened and the changer run through cycle by hand, until the roller has given the record dropping lever maximum travel. The main gear should be held in this position and the roller adjust screw tightened.

To operate the changer by hand, the *ac* line should be removed and the operating knob turned to reject position. The main cam can now be rotated by hand in a counter-clockwise direction looking at the bottom of the changer. One should not rotate the opening knob in the *stop* direction as the record-dropping lever will not engage the roller.

Changer should then be checked with the 45 spindle. Also, one should check operation with a single record



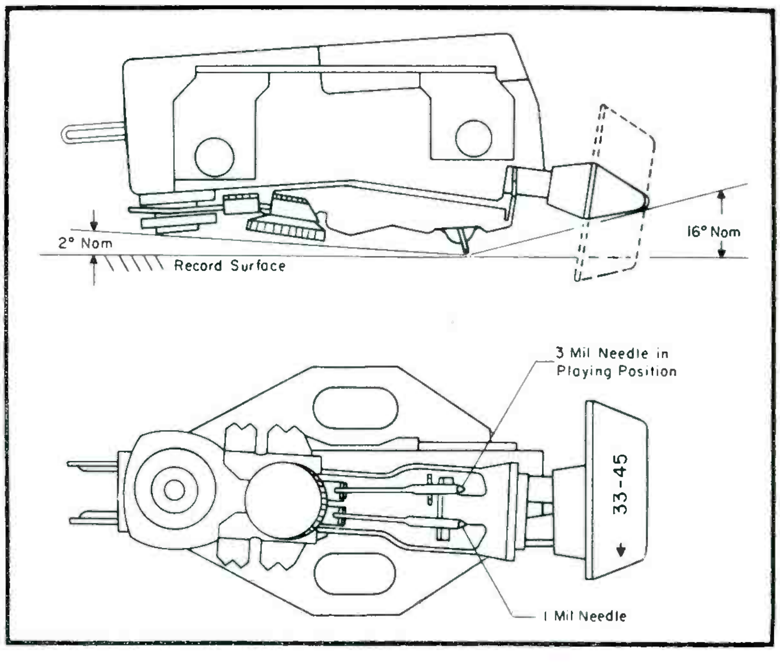
IMPROVED (bottom) **and early** (top) **design of 45 spindle adapter for Magnavox-Collaro changer.**

on the spindle after the changer has shut off automatically. If the changer drops the record, but the tone arm returns to its rest, it will be necessary to adjust the roller slightly in the direction opposing the spring tension.

Phono Output Step Up

Service Men are frequently confronted with requests to improve the performance of old one or two-tube amplifier-turntable combinations. Substantial improvement usually obtains

FIG. 1: CROSS-SECTIONAL view of lever-type cartridge. (Courtesy Shure)



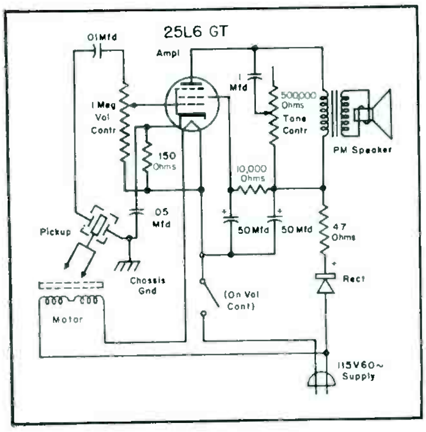


FIG. 2: TYPICAL AMPLIFIER used in portable record player, whose output can be increased through use of high-gain cartridges. (RCA RS-153)

when the normal complement of tube and component replacements are installed, but a tremendous boost in quality and volume can result when a new high-gain cartridge is included in the replacement package.

For such replacement applications there has been developed a dual-needle twin-lever cartridge that, it is said, can provide a 5-volt output and with extended range.* The needles (either a 3-mil for 78 or a 1-mil for 45 and 33-1/3) are installed in a shift mechanism which eliminates cartridge rotation for needle selection.

The 5 *v* output, obtained at 1000 cps for 78 records, has been found to provide enough drive to a 25L6 one-tube amplifier to produce 1½ watts; a two-tube amplifier could develop better than two watts.

The high output voltage is obtained, the design engineers say, because of the use of a system of second-order levers. The crystal element, which produces voltage when bending stress is applied, is held firmly between two elastomer pads at one end. The other end is attached to a coupler lever, held at one end in an elastic pivot. The other end of this lever is bifurcated, forming a saddle which receives the needle. The needle forms the second lever, having one end flattened in the verticle plane to provide a flexible pivot; whereas the other end has a stylus which is in contact with the record groove. It is possible to select the lever ratios to provide an impedance match between the record groove and the element as required. For example, if the element is mounted close to the pivot point of the coupler, the coupling lever provides a high lever ratio resulting in a high lateral compliance and a relatively low output voltage. This condition might be chosen if fidelity is the primary requirement. In low-gain amplifiers, a compromise must be made to obtain higher output voltage. This is accomplished by locating the crystal element further from the pivot point.

The use of separate needles has important advantages. Since 78 records have a greater groove modulation than the fine groove records, it is necessary to re-adjust the volume control of the record player when switching from 78 to fine groove records or vice-versa. By adjusting the voltage sensitivity of the pickup so that it is less with a 1-mil needle, nearly equal output is possible from the standard *lp* records. Conversely, 78 discs require a greater compliance for a given needle load than do the fine groove records, and this is also compensated by the use of two needles.

The cartridge mounting ears have been so designed that they will fit arms having standard ½" mounting centers.

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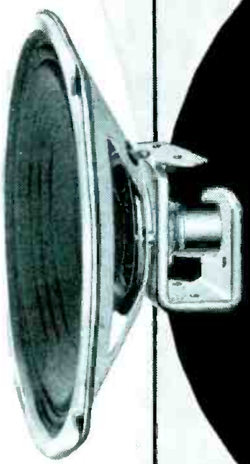
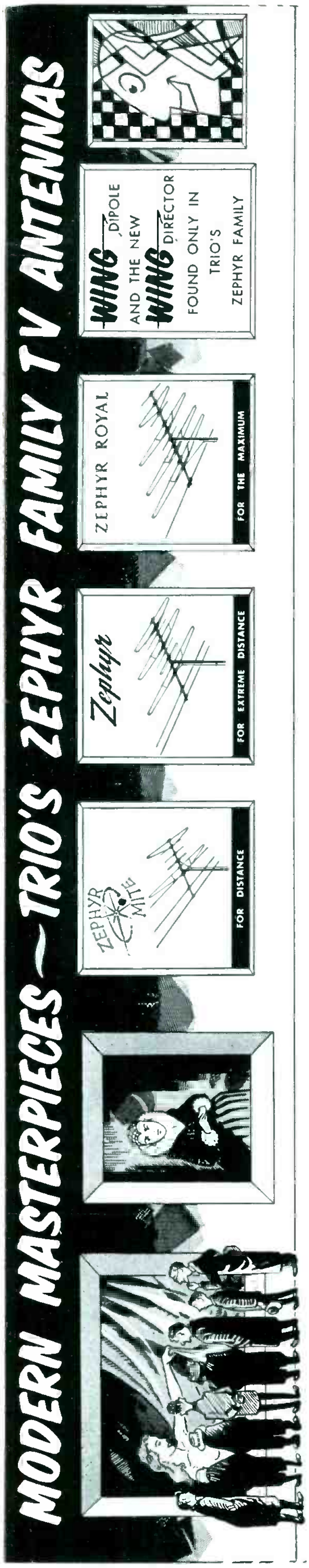
*Shure W9





Packaged Electronic Circuits

(*Continued from page* 19)

other components in the stage, *before* checking the *pec*. If a visual check of the *pec* shows that it is not cracked or burned, and the solder joints are good, you will usually find that the trouble lies elsewhere.

In the event that tests of the surrounding components do not disclose the trouble, then the packaged components should be checked in the following manner.

If the simple resistance-capacitance network is suspected one should first disconnect the leads and make resistance and capacitance checks at the terminals available. If these tests indicate normal resistance and capacitance values then troubleshooting should be expanded to the remainder of the chassis.

To check the triode and pentode couplates, a signal and waveform check should be run from the input of the preceding tube (detector—*avc-af*) to the output of the *pec*, and another check from the input of the *pec* to the output of the following tube; audio output. If in *both* checks, the waveform-signal information is in order, the *pec* must be good; if in *either* test a defect is revealed, the *pec* should be replaced.

The audio detector and pentode detector units should be checked by the same procedure as detailed for the triode and pentode couplates.

The vertical integrator test involves several checks in the circuit. The input to this network is the composite sync signal, consisting of both horizontal and vertical sync pulses. The purpose of the circuit is to collect and integrate the vertical pulse, which in the composite signal is a series of narrow pulses, interrupted by narrower horizontal sync pulses of opposite polarity. The output of the vertical integrator is a broad sync pulse of correct polarity, and roughly triangular in shape. This pulse can best be checked by removing the vertical oscillator tube, since the large pulse fed by the vertical oscillator may mask the vertical sync pulse so that it can hardly be seen. With the oscillator operating, a large negative spike is normally present, just following the vertical sync signal.

To check the *sync takeoff units* a strong local station should be tuned in, and then the input and output waveforms should be observed. The input waveform should display both vertical and horizontal sync pulses, and also video signal modulation. The sync takeoff unit acts as a broad band-pass filter, passing both the vertical and horizontal sync pulses, and attenuating random pulses outside this frequency range which might otherwise trigger the sync units. The effect of this attenuation is not detectable on the average 'scope, however, and therefore the output waveform should be approximately the same as the input waveform in appearance and amplitude. If both input and output waveforms are okeh, the *pec* is good. If *either* waveform is not correct, the *pec* may be at fault and should be replaced.

In many instances special circuit units can be checked by signal and

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waveform measurements. The exact nature of the waveforms to be expected will vary depending on the application, and service literature sources should be consulted for detailed information. Where this information is not available, a simple check can be made by disconnecting the *pec* leads and checking resistance and capacitance between available terminals.

Selecting the Replacement Unit

When a defective *pec* is found, the correct replacement unit can be located from service literature. But, a word of caution is in order here. One must not attempt to replace a *pec* with individual components, because the basic construction of these packaged elements incorporate factors (such as distributed capacity) which in many cases cannot be duplicated by individual components. On the other hand, it is usually possible to replace individual components with *pec*'s.This is particularly true in the case of vertical integrators, sync take-off units, and couplates.

Installation Techniques

Practically all *pec* replacement units available today are wire-lead type. These will replace either wire-lead or tab type units. When installing a *pec* replacement one must be certain that the right leads are in the right locations. Some *pec* replacements have the lead location in a different sequence than the *pec* unit which was removed. Therefore, one should trace the circuit diagram carefully when installing a new unit. It is also desirable to install the replacement unit in the same location, and with the same lead dress, as for the removed unit.

Today many chassis use etched wiring or plated wiring boards.[2] Special care must be taken with these chassis because of the fragile nature of the wiring. When removing the old unit, it is best to clip the leads or tabs close to the body of the *pec* and remove the cut-off leads one at a time. A pencil type soldering iron, approximately 25-watt size, should be used here. One should not use a high-voltage soldering gun or iron. Heat in excess of that required to melt the solder may damage the board, or the bond between the wiring and the board.

The increased usage of *pec*'s makes it desirable for the TV repair shop to carry a basic replacement assortment in stock.

An average inventory could consist of a standard couplate, pentode couplate and two audio detector couplates; two midget couplates and seven vertical integrators. This stock represents the most popular triode and pentode couplates, audio detector couplates, and vertical integrators.

[2]*See Servicing Helps, this issue, p. 25.*

Tube News

A LINE of eight auto-radio miniatures designed to operate at 12-volts is now available.[1]

Included is a 12J8, a 9-pin miniature detector-driver, said to produce high current at low plate voltage for optimum power coupling to an output transistor. Other types include 7-pin miniature pentode *rf* amplifiers, 12AC6 and 12AF6; a 7-pin miniature pentagrid converter, 12AD6; a multi-unit 9-pin miniature containing two diodes and a remote cutoff pentode, type 12F8; a 7-pin miniature space charge tetrode driver, 12K5; 9-pin miniature audio amplifier, 12AE6, and medium mu 9-pin miniature double triode, 12U7.

Type 12J8 has a 12.6-*v*, 350-ma heater; type 12K5 has a 12.6-*v*, 400-ma heater. The remaining six types have 12.6-*v*, 150-ma heaters.

TV Tubes

For vertical-deflection amplifier service in TV receivers utilizing picture tubes having diagonal deflection angles of 110°, a 6CZ5 beam-power tube[2] has been developed.

The tube, a high perveance type, utilizes a T-6½ miniature envelope and has a 6.3 *v*/.45 ampere heater. It has a maximum peak positive-pulse plate voltage of 2,200 (absolute), a maximum peak cathode current of 140 ma, and a maximum plate dissipation of 10 watts.

Because of its sensitivity, the tube is said to be useful also in the audio output stages of TV and radio receivers. When used in push-pull class *AB1* service, the tube under fixed bias conditions can deliver a maximum signal power output of 21.5 watts with, it is claimed, a total harmonic distortion of 1 per cent.

Fifteen replacement tubes[2] for 450-ma series-heater string TV chassis also have been announced.

Types include: 4AU6, 4CB6, and 4DT6 (sharp-cutoff pentodes); 5BQ7A (medium-mu twin triode); 6AM8A (diode–sharp-cutoff pentode); 6AQ5A (beam power tube); 6AT8A, 6CG8A, 6U8A (triode-pentode converters); 8AW8A (high-mu triode–sharp-cutoff pentode); 8CG7 (medium-mu twin triode); 8CM7 (medium-mu dual triode); 17AX4GT (half-wave rectifier); 17BQ6GTB and 17DQ6A (beam power tubes).

AC/DC Tube Development

A beam-power pentode miniature[1], type 25C5, for use as a power amplifier in the output stage of *ac/dc* receivers has been designed and is now available for the renewal market.

---

[1]*Sylvania* [2]*RCA*

. . . another
MALLORY
service-engineered
product

FP CAPACITORS take high ripple currents

(all FP's are Mallory)

No need to worry about ripple currents, when you choose Mallory FP (fabricated plate) capacitors for replacement. They're built to handle the toughest ripple . . . even the values you find in the latest color TV sets.

FP's, in fact, will stand 50 to 100% higher ripple current than usual industry expectation for a given rating. And this superior performance . . . proved by tests at 85° C ambient . . . can be expected of *all* FP capacitors, for they are manufactured to highest standards of uniformity. Mallory's unique FP construction makes this possible. It puts more electrolyte and more anode area into a smaller case . . . to give better heat dissipating qualities.

Be sure to specify Mallory FP's by name, not only for high ripple applications, but for all your electrolytic capacitor replacements. See your local Mallory distributor today!

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"Low Background Noise...Long Life...Electrical Uniformity" are technical terms your service customers may not appreciate when talking to you about set troubles. But they do know when you have restored their sets to "like new" performance.

When the trouble is tube failure, you certainly want to minimize "tube juggling" and circuit realigning... to complete the service job quickly, confidently, profitably—*with full customer satisfaction.*

RCA enables you to *give full customer satisfaction* by controlling the quality of your replacement tubes. RCA's "don't spare the quality" selection of raw materials, stringent control of all manufacturing processes and techniques, second-to-none final inspection and testing methods are your assurance of tubes with low background noise, long life, electrical uniformity—your assurance that RCA RECEIVING TUBES are your *most dependable replacement tubes!*

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