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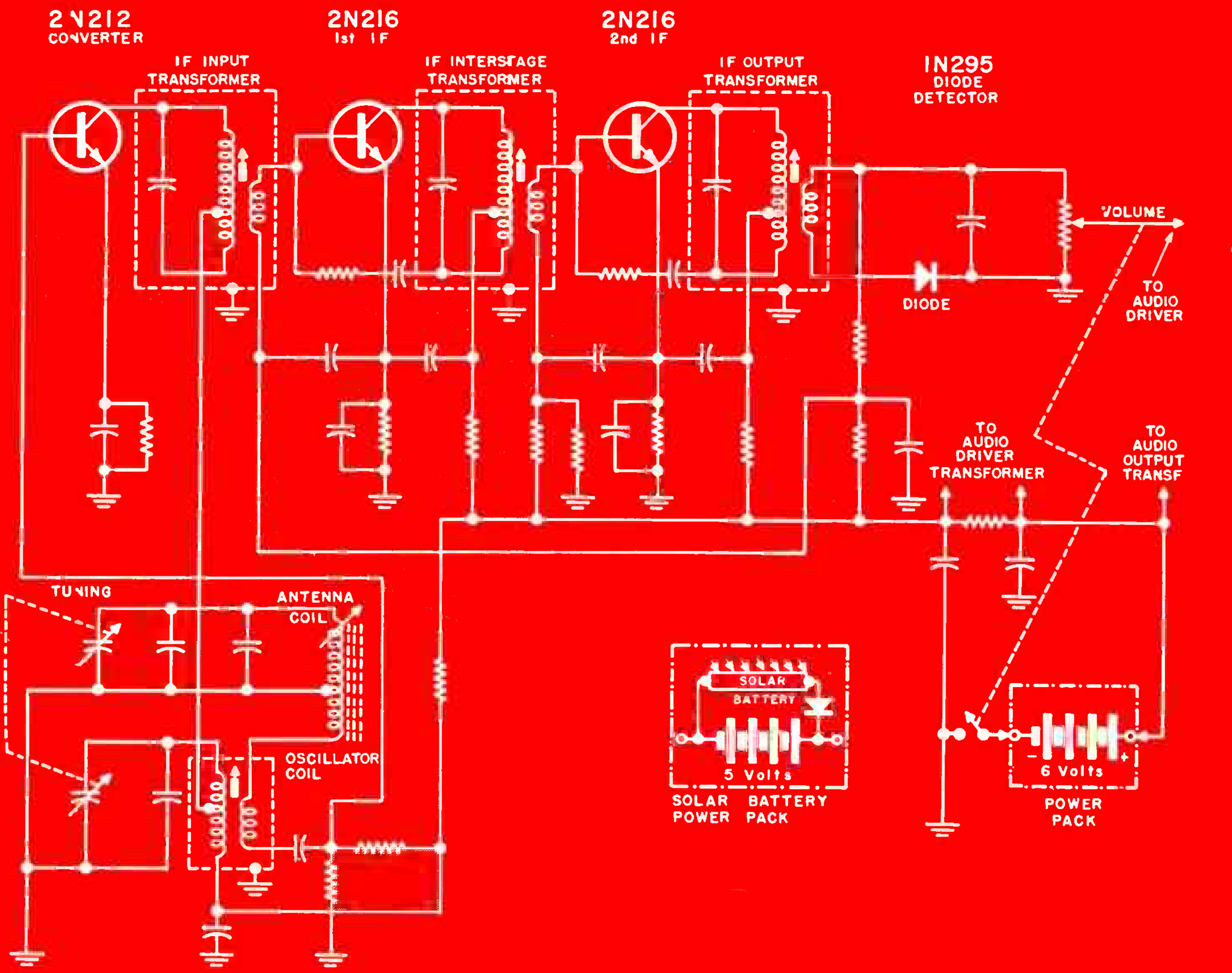
TELEVISION
ELECTRONIC

JUNE, 1957

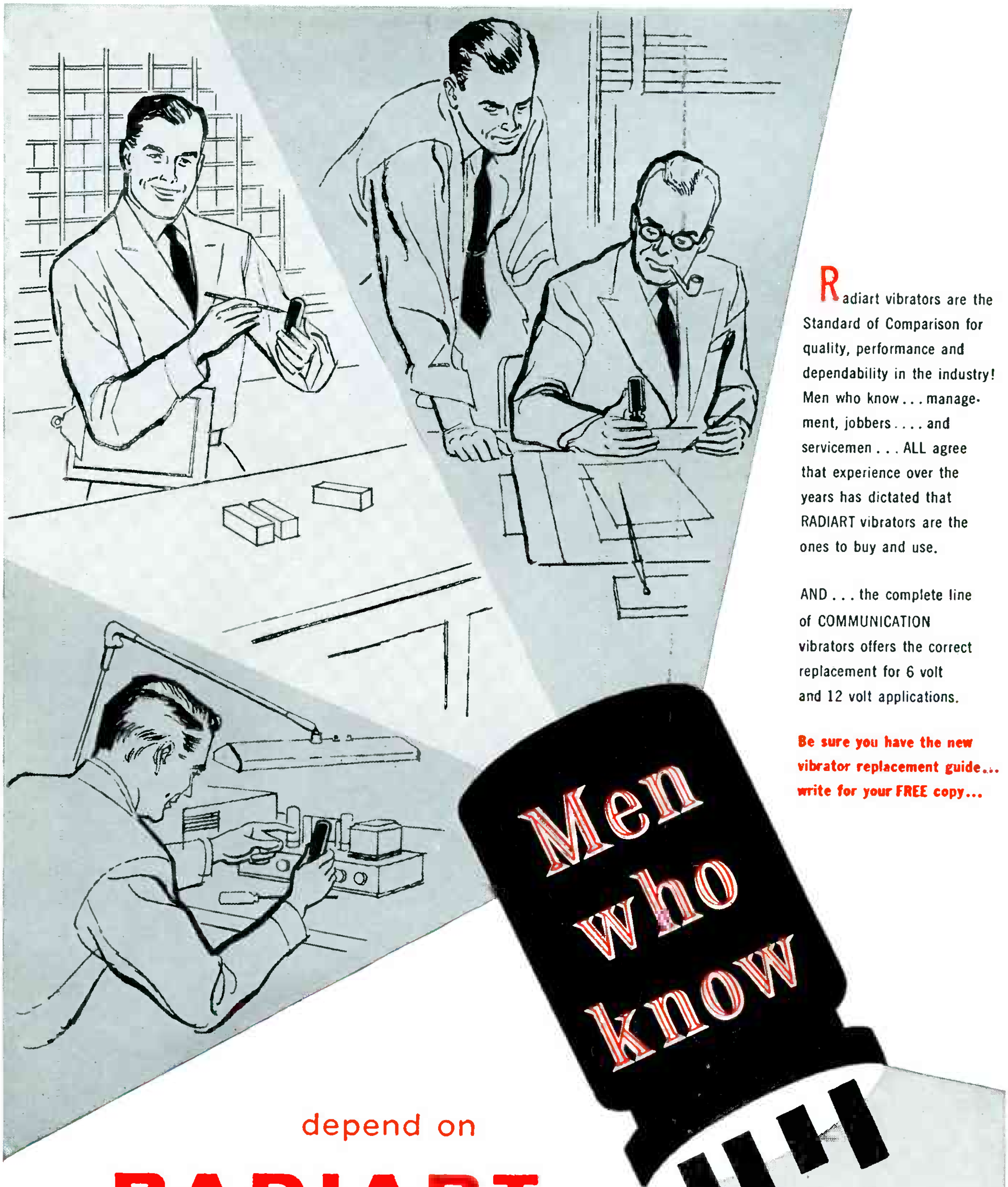
SERVICE

THE TECHNICAL JOURNAL OF THE TELEVISION-RADIO TRADE



Converter, if and detector stages in portable transistor radio designed for use with solar battery power pack.

See circuit analysis, this issue



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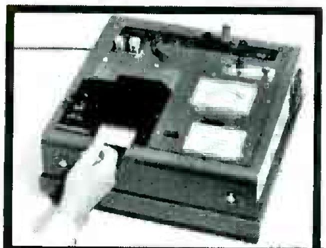
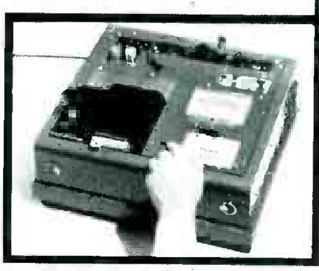


2 Quality Value



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THE TECHNICAL JOURNAL OF THE TELEVISION-RADIO TRADE

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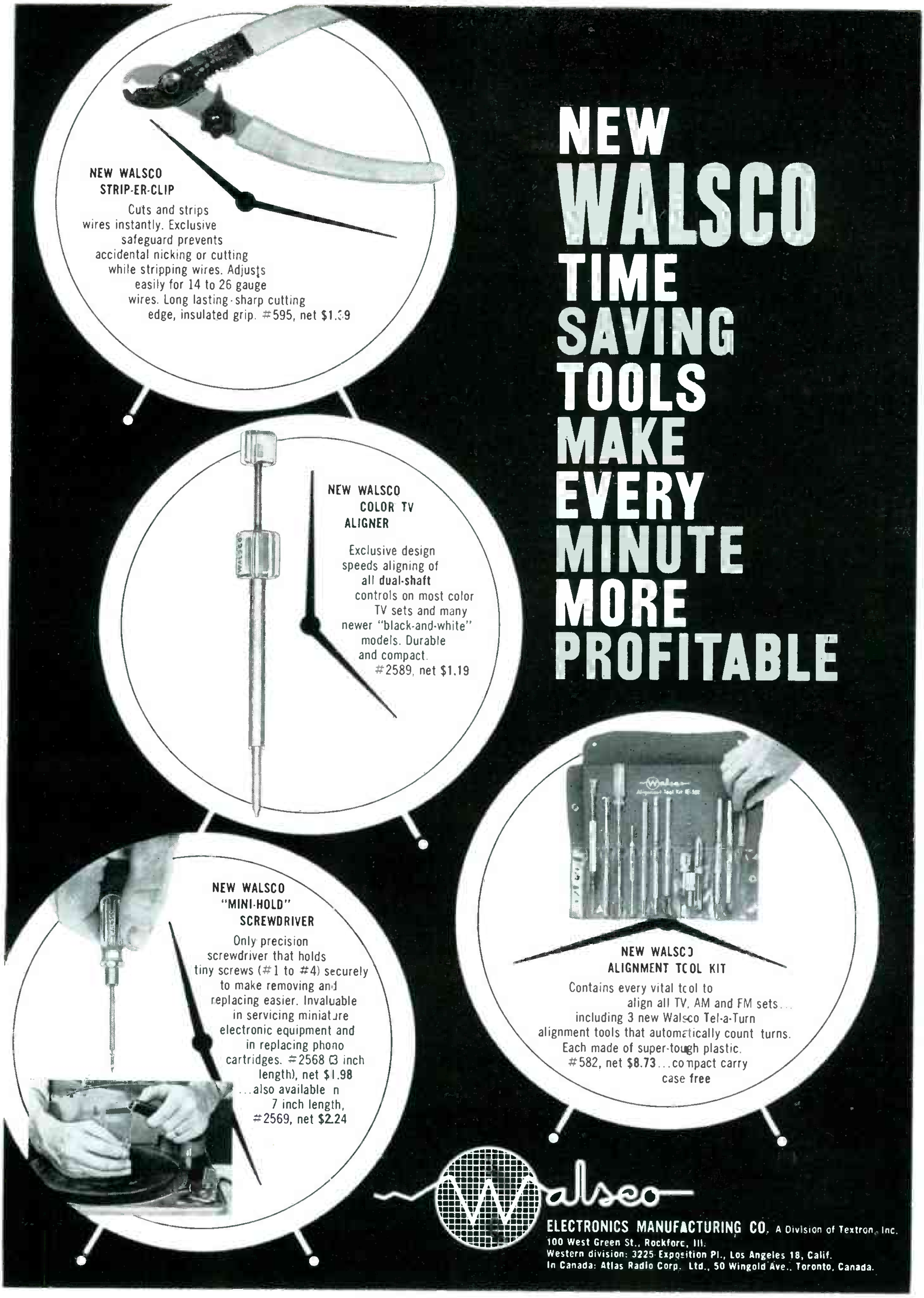
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THIS MONTH IN SERVICE

RAPID TRANSISTOR-GAIN CHECKER DEVELOPED BY BUREAU OF STANDARDS--A simplified tester, which can measure quickly current gain, or beta, of a variety of transistors, has been developed by the Bureau of Standards. . . .The device measures the common-emitter short-circuit current gain of pnp or npn transistors at low audio frequency. . . . In operation, a transistor is plugged into the test unit and a dial is adjusted to a point where a tone will be heard from a speaker. The gain can then be read directly from a dial calibrated over a range of 10 to 170. . . . The circuit design is similar in principle to one used for measuring the transconductance of a tube. In the tube circuit, part of the plate voltage is fed back into the grid through resistor and transformer coupling to develop oscillation. Similarly, with the circuit for measuring transistor gain, the output is fed back into the input through a variable resistor and a transformer; when the resistor is properly adjusted the circuit will begin to oscillate at an audio frequency. The substitution method can be used to calibrate the variable-resistor dial control. . . . To reduce the number of controls, circuit parameters can be chosen so that the transistor will adjust itself to a specified dc operating point. The resistors in the Bureau of Standards circuit were selected to fix this point at about 5-volts collector potential and 1 ma collector current. . . . The frequency at which oscillation begins will depend upon the characteristics of the transistor and the phase shift of the current gain. The current ratio of the usual audio transformer has a broad maximum centered at 1 or 2 kc and, if the phase shift of the transformer is sufficiently small, oscillation will begin at a frequency near this maximum. However, it has been found that the transistor gain required to produce oscillation for a given dial setting is not a particularly sensitive function of frequency. Accordingly, measurements accurate to within a few per cent of full scale can be expected with this device.

DRIVE-IN BANKS ADOPT CLOSED-CIRCUIT TV AS A BASIC SERVICE FEATURE--Banking by teller-vision, employing closed-circuit TV transmission of signatures and account information from centralized bookeeping departments to remote drive-in windows, has become a service feature of scores of drive-in banks. . . . The tie lines are providing speedier, streamlined banking services, resulting in considerable savings in banking costs. . . . One bank in Florida now uses five closed-circuit TV camera chains and 32 portable TV receivers to link its inside and drive-in teller windows with the bookeeping and savings departments. There are eight drive-in windows here, which serve up to 1,400 cars a day. . . . In another installation, the network consists of two cameras and 25 portable TV chassis. Approximately 10,000 cars are served monthly in this installation.

ANNUAL TEXAS CLINIC-FAIR TO BE HELD IN AUGUST--The Texas Electronics Association's fifth annual clinic and fair will be held in Fort Worth, Tex., at the Texas hotel, August 2nd, 3rd and 4th. . . . Lectures and demonstrations will highlight the program. Specialists will discuss multiple antenna systems, deflection and sweep circuits, servicing of transistorized equipment, tape recorder service, color alignment and convergence, troubleshooting color circuits and ceramic-capacitor applications.

TELEVISION WEEK SET FOR SEPTEMBER--National Television Week will be celebrated September 8th to 14th. Sponsors of the nationwide event are RETMA, NARTB and NARDA.

Miniaturized Signal-

Construction and Operation of Small-Size Tuners Now Being

by W. C. CALDWELL, Service Engineer, Delco Radio Div., General Motors Corp.

A NEW SIGNAL-SEEKING TUNER providing automatic-station selection in a smaller space than previous models has been designed for the '57 General Motors cars. The tuner affords the same automatic tuning advantages as earlier types, but it consumes less space on the radio chassis. The size change was prompted by the decreased area available behind the instrument panel of the modern automobile, and is consistent with the long-range trend in miniaturization.

The basic manual and push button mechanism for the new tuner is shown in Fig. 1. It is similar to the original *push-pull lock-up* tuner developed by Delco in '47. To tune, the button is pushed to one side, pulled outward, then pushed all the way in to lock it on the station being received. All of the parts in the new version are smaller, but they perform the same basic functions.

The tuning cores in the new miniaturized models travel only through a one-inch stroke to cover the broadcast band. They are attached to a common core bar which is moved whenever the *treadle* position is changed. The treadle is changed by preset cams on push button assemblies (Fig. 3), as a button is depressed. It can also be changed as the manual worm and gear is turned during straight manual tuning. To obtain automatic tuning, an ingenious method of moving the treadle and cores at a regulated *search* speed was developed. Very few additional parts are required for this operation (see Fig. 1), and they are mounted in the space available around the manual worm. This results in a much greater standardization of parts than was possible in the past, because push button and signal-seeking models are identical, except for the additional parts required for signal-seeking tuning.

The complete signal-seeking tuner, with all parts in their respective positions, is shown in Fig. 2. A power spring has been added to move the tuning cores for automatic tuning. The spring is mounted near the worm, and is staked at the front of the tuner; see Fig. 4 inset. This tends to pull the worm forward, moving the treadle and tuning cores toward their highest frequency position. Thus, during automatic tuning, the worm receives a straight-line movement from the power spring. The worm slips over a plined manual shaft, which gears the worm to the shaft only when the manual shaft is turned in a rotary direction. A method of governing the rate of power spring contraction is necessary, however, to prevent the tuning cores from being snapped rapidly forward during the search cycle. This is the function of the gear train governor, which is mounted at the rear of the worm unit. The governor meshes with special rack teeth at the rear of the rack-worm unit, thereby controlling its speed of lateral movement. This is accomplished by a friction disc within the governor, so that friction is increased as speed tends to increase.

A stopping disc in the governor, shown in the upper inset of Fig. 4, allows all movement of the governor gears and rack-worm unit to be completely halted by a relay arm. The relay mounts in front of the governor, and its action is controlled by an electrical trigged circuit[1] and the station signals. When the relay is energized by the electrical-starting circuit, the relay arm moves clear of the governor, allowing search tuning to begin. Then, the station signal causes the relay to deenergize and the relay arm drops back into the governor's stopping disc, stopping all tuner movement.

The solenoid, shown in Fig. 5, serves to recock the power spring and rack worm unit as the spring runs out of energy. The power switch, which mounts at the front of the tuner, is closed by lever arm 2 as the spring energy is depleted. This places 12 volts across the solenoid, which energizes and rapidly cocks the spring. The solenoid is then turned off as the power switch is opened by lever arm 2.

Another solenoid is shown in Fig. 6. This is called the *treadle-return solenoid*, since it serves to return the treadle and tuning cores to the low end of the band after the high limit has been reached. The treadle solenoid is energized by 12 volts as the *treadle-return switch* closes, and is deenergized as the switch is opened near the low-frequency band limit. The *treadle lever* accomplishes this tuning operation by its connection to the outer clutch disc. This is probably the most critical point of adjustment in this tuner. The position of the clutch disc and treadle lever ears 3 and 4 combine to set the band limits during search tuning.

The solenoids operate independently of each other. When the power solenoid energizes, it must recock the power spring and rack-worm unit without disturbing the treadle and tuning cores. Likewise, when the treadle and tuning cores approach the end of their travel (high-frequency

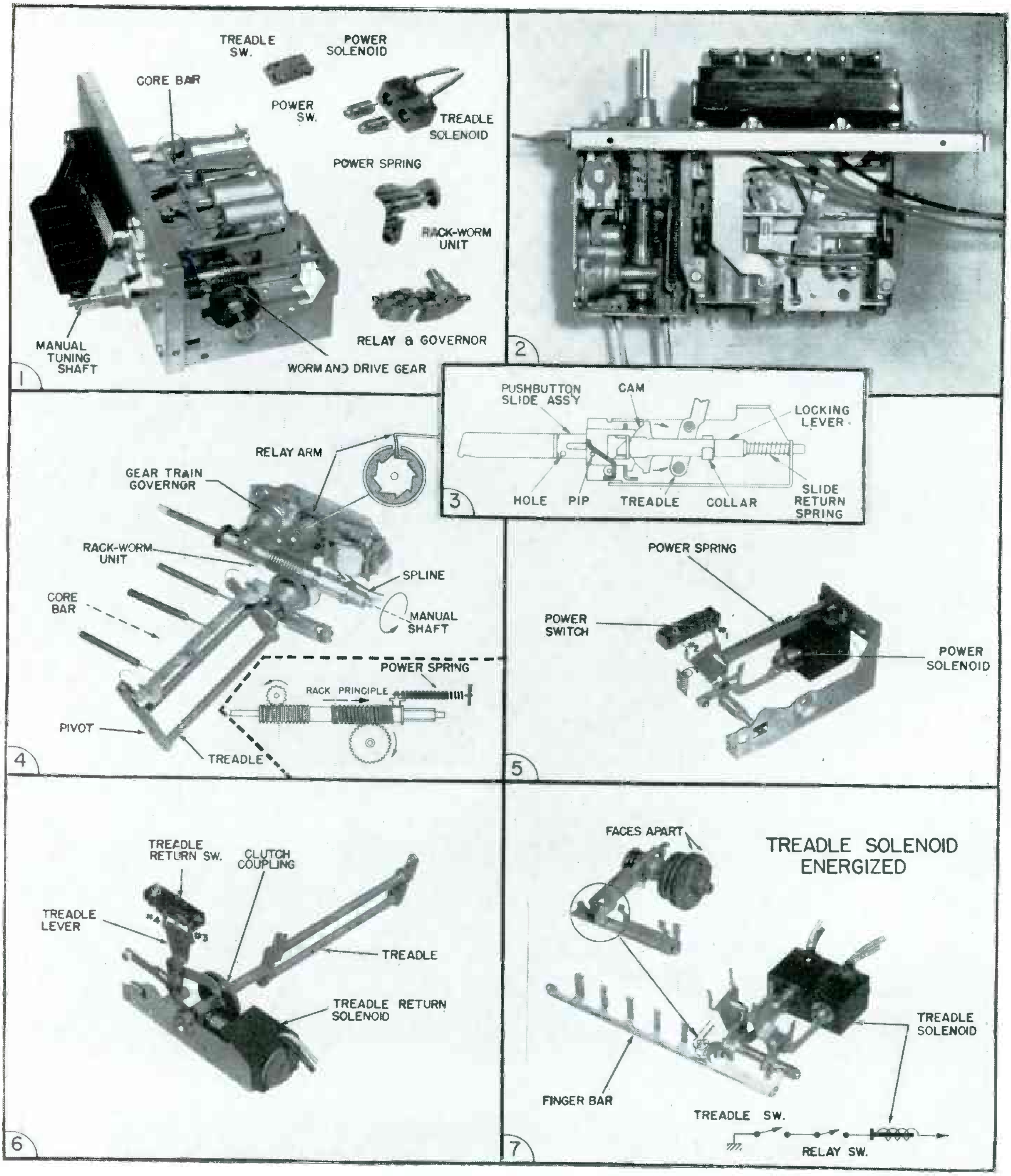
(*Continued on page* 51)

[1]This *trigger circuit* was completely described in a report on the *history of signal-seeking tuners* in the April, 1957, issue of SERVICE.

RIGHT—Figs. 1-7: Fig. 1 illustrates the basic miniaturized tuner incorporating manual and easy-to-set push-button tuning. Also shown are the major parts which were added to obtain signal-seeking tuning. A view of the completed tuner with signal-seeking action is shown in Fig. 2. Parts which drive and regulate the automatic tuning action are mounted around the worm unit. The method used to set the push buttons for standard push-button tuning is illustrated in Fig. 3. The button is shown in the unlocked position, ready to be set. Then, treadle position will be controlled by the cam when button is used. Detailed view of power spring added to pull the worm-rack unit during the search time appears in Fig. 4. A gear-train governor regulates tuning speed, and the relay controls starting and stopping. Action of the power spring when cocked by the rapid action of a solenoid is detailed in Fig. 5. Power switch turns solenoid on and off. When the tuner nears the high-frequency limit of band, the treadle solenoid returns tuning mechanism to low end; this operation is illustrated in Fig. 6. The Fig. 7 photo-diagram illustrates how declutching takes place when either selenoid energizes to prevent excessive drag, and to allow both solenoids to operate independently.

Seeking Tuners

Used in Tube and Transistor Auto Radios



The Chicago Electronic Parts Show

A Report on the Latest Developments Displayed at Annual Distributor Convention

MINIATURIZATION, in the form of lighter, smaller and yet extremely efficient replacement components, assemblies, tubes, transistors-semiconductors, test equipment, tools and accessories, headlined at the recent electronic parts show in Chicago.

Miniaturized Components

Among the ultra-small parts shown were capacitors, resistors and transformers, many of which were only fractions of an inch in overall size. One line of tiny capacitors displayed, available in .02 to 30-mfd values, ranged in size from .095″ by 11/64″ to 1/8″ by 11/64″. In an assortment of reduced-size audio transformers exhibited, there were types for transistor receivers and amplifiers which weighed but a half-ounce and were less than an inch overall.

Tiny, encapsulated replacement assemblies for standard and printed-wiring board chassis, featuring sealed-in capacitors, resistors and chokes, were also highlighted at the show.

Semiconductors

Since these miniature components, designed for compact chassis, could be affected by heat, every effort must be made to minimize the problem. Notable among the developments to resolve this situation are the new semiconductor rectifiers, a variety of which were on view in Chicago.

Featured were the silicon rectifiers which will be found in many TV chassis this fall. These new components have been so designed that they can operate with only a small voltage drop (approximately 2 volts at maximum current rating) across them. This voltage gain, which permits a boost in *dc* supply, has been found to improve receiver performance, while the lowered drop helps reduce breakdowns due to heat build-up. Many of the silicon rectifiers, which resemble cartridge type fuses, are being housed in ceramic bodies with polarized metal ferrules at each end and mounted in polarized fuse holders.

Automatic Test Instruments

Along instrument row, the trend toward automation was quite apparent. Several manufacturers exhibited tube testers employing punch-card techniques to expedite checks.[1]

Using pre-punched computer-type information cards, one model demonstrated performed tests for transconductance, interelectrode shorts and leakage, and gas content. Cards permitted the automatic selection of operating parameters, affording tests under load conditions.

Also shown was a coded-card instrument which provided tests for tubes and transistors, with transistors being checked for leakage current and forward gain.

Another unusual automatic test-equipment development revealed was a flying-spot scanner which produces TV pictures from 35-mm slides. The device, a picture and sound generator, can be used to transmit over community-antenna systems or tie lines in service shops, hotels and department stores.

With this instrument, audio can be modulated from a tape recorder, AM or FM tuner, or from a microphone input. The unit also has a built-in 400-cycle audio tone generator which can be used to check both audio and video circuits in a TV system.

Color-TV Equipment

A number of developments for color-TV were also on view for the first time in Chicago. One booth featured a bar-generator with a single master control rotating over a color-bar display pattern (with eight bars) etched in color on the panel. In the outputs of this instrument G-Y at 90°, and R-Y and B-Y, simultaneously, are available.

The generator also has a chroma level switch: 0 db for checking older style receivers and some current models; 6 db for video checks of newer receivers which use vestigial color side-band alignment; 15 db for checking color sync lock under weak signal conditions. Also available is a variable chroma control position for other chroma levels.

Another interesting item for color-TV, also disclosed for the first time at the show, was a color gun killer. This accessory operates guns individually to permit color-purity adjustments and avoids cutting or disconnecting leads for such checks.

Audio Accessories

The growing interest in audio was accented in the display of newly-designed lightweight-replacement cartridges and speakers.

One cartridge shown weighed but 1 gram and employed a magnet moving within a stationary coil. Both horizontal and vertical suspensions within this lightweight unit were said to have jeweled bearings.

New speakers on view revealed heavier Alnico magnets, improved seamless cones and space-saving pot covers.

Many manufacturers noted that they were going to supply resonant-point information with their replacement lines, to enable Service Men to match speakers properly, particularly in multiple-speaker assemblies now being used so widely.

[1]*Circuitry used in one type of coded-card tube tester appears on pages 20 and 21 of this issue.*

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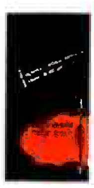

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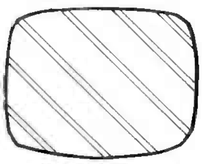
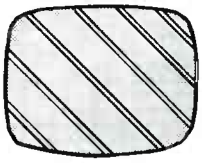
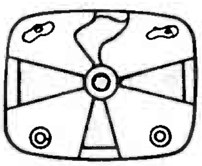
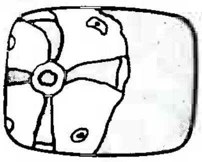
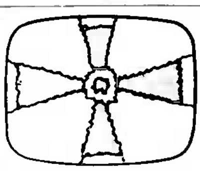
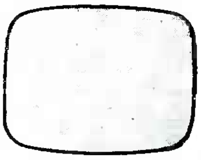
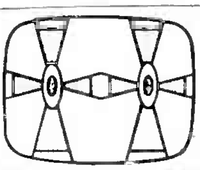
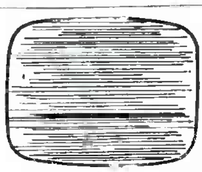
Horizontal AFC Troubleshooting Chart for

Picture Trouble	Visual Indication	Cause	Remedy
Loss of horizontal sync.	 (A)	150,000-ohm (R_{221}) resistor **(see circle 1—Fig. 1)** opens or increases in value. In *Fig.* 2, T_{106} is misaligned or has shorted turns; R_{181} (820,000 ohms), R_{182} (8200 ohms), R_{183} and R_{184} (150,000 ohms) open; C_{154A} (10-160 mmfd), C_{156} (.25 mfd), C_{172} (90 mmfd), C_{173} (5 mmfd) short; C_{157} (.02 mfd) shorts or opens: **see circles 2, 3 and 4 in Fig. 2.**	Realign T_{106}; replace defective component.
Loss of horizontal sync and low (or no) raster brightness.	 (B)	Problem is due to decreased p-p voltage of horizontal-output-tube grid waveform. Following components might be defective—C_{62C} (40-245 mmfd horizontal drive variable), C_{82} (2000 mmfd), C_{83} (.1 mfd), C_{84} (400 mmfd), R_{99} (120,000 ohms), R_{100} (10,000 ohms), R_{103} (47 ohms): **see circle 5 in Fig. 3.**	Replace defective component.
Hooking or bending at picture top; picture tends to lose horizontal sync.	 (C)	Following components change in value (usually increase)—C_{183} (.047 mfd), C_{184} (.022 mfd), C_{186} (.47 mfd), R_{223} (820,000 ohms), R_{224} (150,000 ohms), R_{225} (68,000 ohms), R_{228} (3900 ohms), R_{221} (150,000 ohms): **see circles 1 and 7 in Fig. 1.** R_{102} (560,000 ohms) may also increase in value: **see circle 8 in Fig. 3.**	Replace defective component.
Wavy picture displaced to left.	 (D)	The horizontal hold control syncs in picture; C_{137} (82 mmfd) shorted: **see circle 9 in Fig. 1.**	Replace defective capacitor.
Pie-crust or gear-tooth pattern.	 (E)	Either C_{79} (.02 mfd), C_{80} (.25 mfd) or R_{91} (8200 ohms) might be open or other fault obtains in the anti-hunt circuit: **see circle 10 in Fig. 3.**	Replace defective component.

Note: A less severe case of this trouble could be a wavy picture; intensity may be varied by adjusting horizontal hold control.

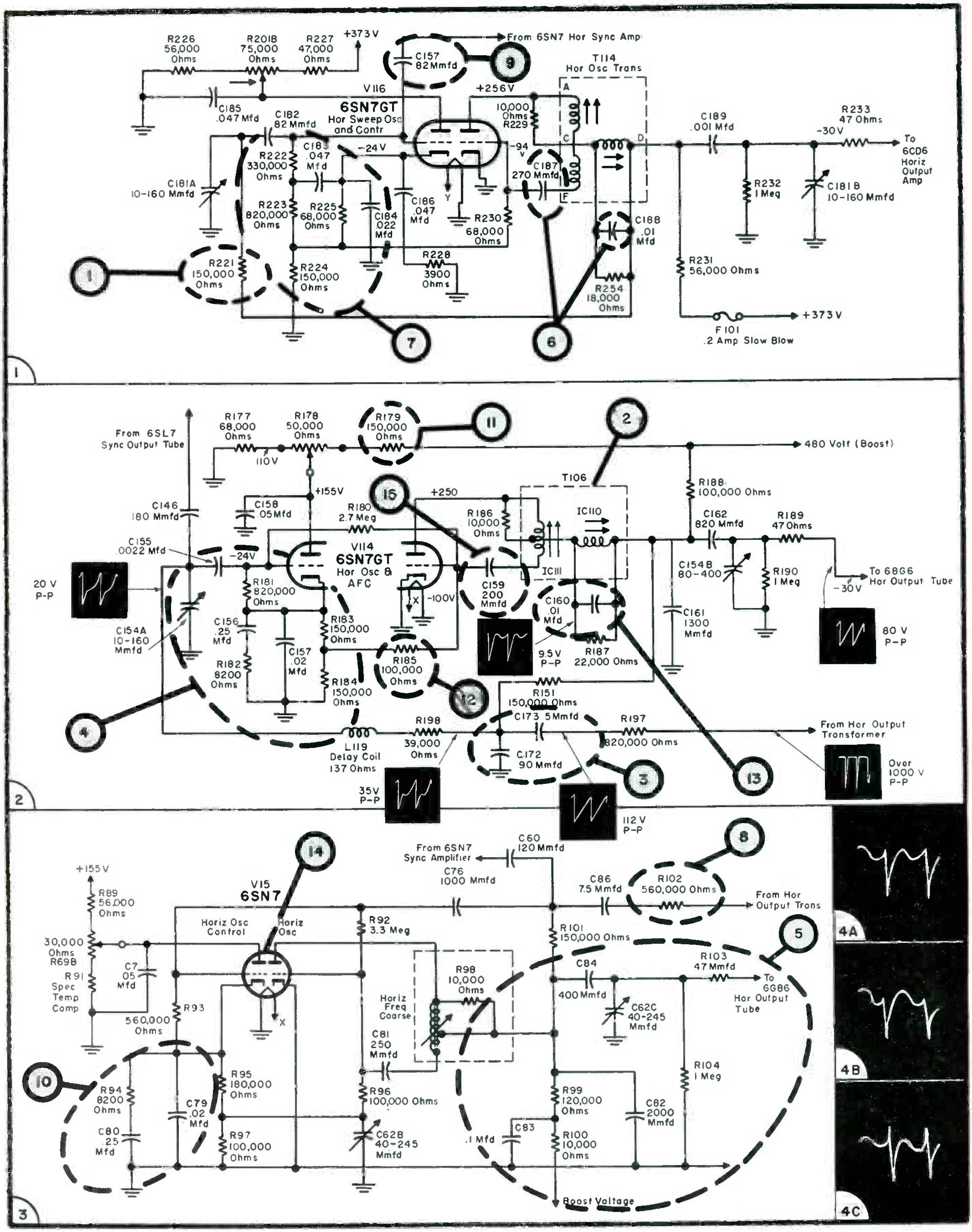
Picture Trouble	Visual Indication	Cause	Remedy
No raster.	 (F)	The horizontal oscillator is inoperative, C_{160} (.01 mfd) shorts, or R_{179} (150,000 ohms) or R_{185} (100,000 ohms) opens: **see circles 11, 12, 13 in Fig. 2. Also see comments in loss of horizontal sync.**	Replace defective component.
Horizontal double image.	 (G)	The 6SN7 might be defective; C_{79} (.02 mfd) or C_{80} (.25 mfd) may be open or the horizontal-frequency (coarse-control) transformer misaligned; **see circles 10 and 14 in Fig. 3.**	Replace defective component and realign the horizontal-frequency (coarse-control) transformer.
Christmas-tree effect.	 (H)	White horizontal flashes on screen caused by multiple triggering of horizontal oscillator; **see circles 2, 12 and 15 in Fig. 2.**	Replace C_{159} (200 mmfd) with a capacitor which has a 25% lower capacitance value and replace R_{185} (100,000 ohms) with a resistor which has a 50% greater resistance value; also realign T_{106}.

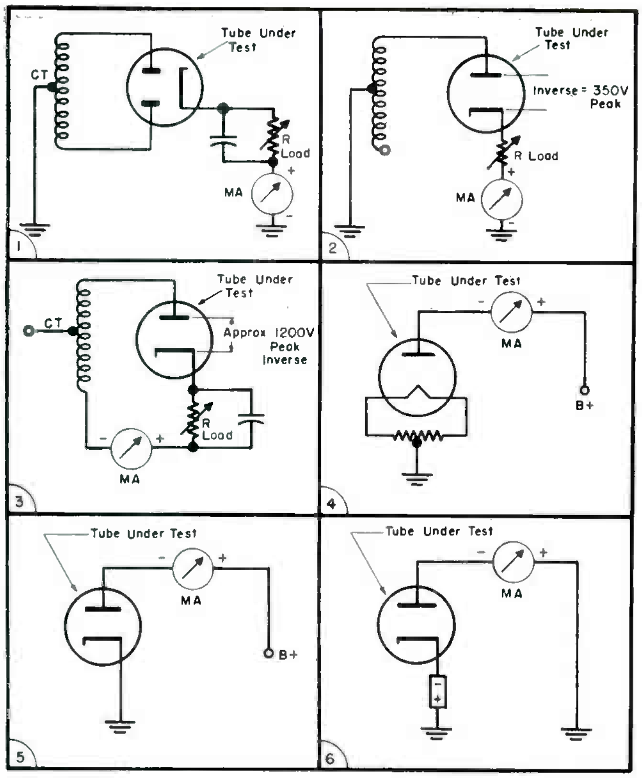
Note: Many troubles in the synchroguide circuit are due to a misaligned synchroguide transformer (T_{114} in Fig. 1). To check the transformer alignment, one should observe the waveform at the tap-point of the oscillator coil (point *C* on T_{114}). It should appear as shown in Fig. 4 (a). If it appears as in (b) or (c), the transformer will have to be realigned. Whenever a defective component is replaced, the transformer should be realigned in accordance with the set manufacturer's service notes.

RIGHT— FIG. 1, 2, 3 and 4: SYNCHROGUIDE, pulse-width circuits and waveforms. The synchroguide systems used in RCA 21-T-197 DE and Crosley 10-428 MX chassis are shown in Figs. 1 and 2. Diagram in Fig. 3 illustrates pulse-width circuit used in Motorola TS-9. Fig. 4 shows waveforms at tap point of oscillator coil. Correct frequency result is shown in (a); shape of waveform when the frequency is too low appears in (b); waveform in (c) represents condition when the frequency is too high.

Pulse-Width or Synchroguide Circuit

by JESSE DINES





Tube Testing With

Application of Punched-Card Equipment

by ROBERT D. WENGENROTH

(Left)

FIGS. 1-6: SIX TEST circuits for diodes. A full-wave setup for 5U4 and 6X4 tubes is shown in Fig. 1. The test circuit for half-wave tubes (35W4 and 35Z5) appears in Fig. 2. For damper diodes (6W4-6AX4) the Fig. 3 circuit is used. Fig. 4 shows circuit for 1B3-1X2 hv tubes. Test circuits for high (6AL5) and low (6AV6) perveance diodes appear in Figs. 5 and 6.

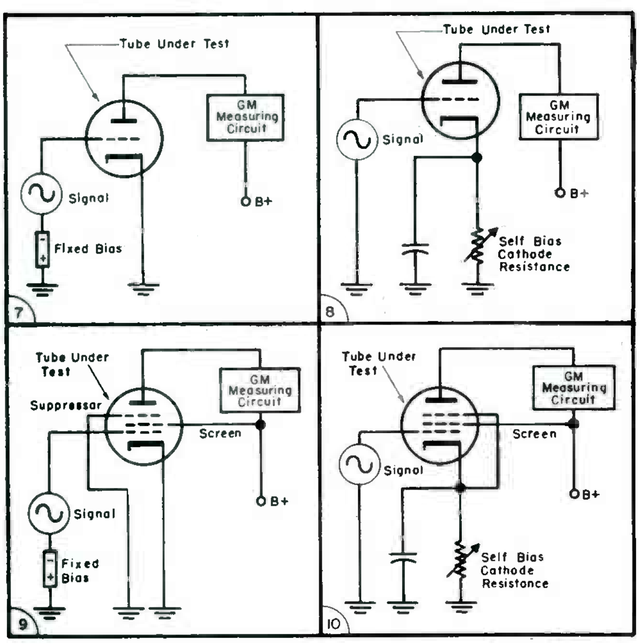
A RECENT DEVELOPMENT in professional tube testers is the card-coded instrument which automatically sets up conditions for the test and the point-to-point connections required. Then, with a knowledge of the circuit in which the tube is being used, the values obtained with the tester can be interpreted as to performance ability.

In one such tester* punched cards are used to make all settings of the instrument; some types of tubes require up to four cards for a complete test. Special card tests are available for such tubes as horizontal deflection amplifiers, which require a *knee* check to prove their quality.

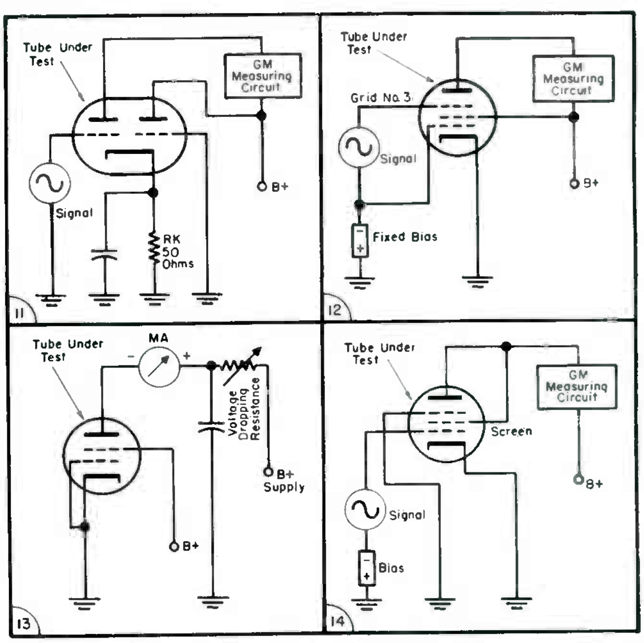
Six tube-check circuits have been designed for six different classes of diodes. One, a full-wave circuit (Fig. 1), can be used to test rectifiers such as the 5U4 and 6X4 in typical capacitor-input circuits. Here, the resistor is adjusted for each type tube to draw full-load current from a good tube. The milliammeter is shunted to provide a reading in the center of the good portion of the scale for the nominal current. If the tube is gassy, it will draw excessive current which will trip a protective relay; the tube will, in this condition, test *bad*.

Half-wave rectifiers can be checked in the circuit shown in Fig. 2. No capacitor is used here. The applied voltage is adjusted to the peak in-

FIGS. 7-10: TRIODE-PENTODE TEST circuits. A fixed-bias GM test circuit for 12AU7-6SN7 tubes is shown in Fig. 7. In Fig. 8 we have a self-bias GM circuit for the 6BZ7-12AT7 triodes. Figs. 9 and 10 illustrate fixed (6BQ6-6CL6) and self-bias (6AU6-6CB6) pentode test circuits.



FIGS. 11-14: KNEE-GM TEST circuits. Diagram in Fig. 11 covers a 6J6 GM test arrangement. In Fig. 12 we have a GM circuit for grid 3 of a 6DT6. A knee-test circuit for a 6BQ6 is shown in Fig. 13, and Fig. 14 is a GM test circuit for a 12AC6 auto-radio pentode.



Coded-Cards

To Check Assorted Tube Types

verse rating of the tube, the load is adjusted to draw rated current, and the meter is shunted to indicate if the operating condition is *good* for this current.

To test TV damper diodes the circuit shown in Fig. 3 has been developed for the tester. These tubes are similar to half-wave rectifiers, except that we have higher inverse-voltage ratings. The capacitor across the load resistor doubles the peak inverse voltage available, and peak *ac* applied is also twice that of the half-wave rectifier circuit. A total of 1200 volts is available. A defective tube will arc in this circuit, where the usual low-voltage test will not reveal its weakness. Current handling ability can be checked again at full rated current.

In making a test of TV high-voltage diodes the circuit used serves to check one point on the tube's characteristics against handbook data. A regulated *dc* voltage is applied to the tube, and the current is metered. The meter is shunted to read half-scale at the reject point.

There are two types of detector diodes, high and low perveance, and accordingly two test circuits are required. For both types 10 volts *dc* are applied, and the current is metered. Figs. 5 and 6 illustrate the high and low-perveance diode test circuitry.

The tester also provides for transconductance (also called mutual conductance or GM) checks on amplifier tubes. Here a small *ac* signal is applied upon the grid, and the *ac* component of the plate current is measured. The plate-circuit *ac* impedance is kept small to make the test a true GM test. A variety of voltages are available, so that the tubes can be tested in accordance with handbook specifications. Some tubes are normally operated with fixed bias; accordingly the tester applies a fixed bias to provide a realistic test. For those tubes normally operated with cathode bias a bypassed-cathode resistor circuit is used for test.

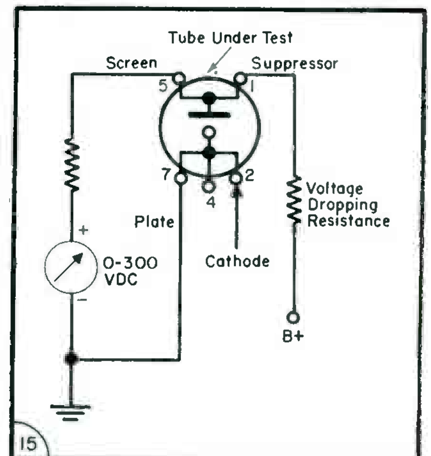
Special test circuits for tubes with extra control grids have also been included in this device. In one setup, provision is made for a 6J6 operated with a cathode bias, each half being tested separately. For 6DT6 tests, the tube operates with signals on both first and third grids and is tested for GM of each grid separately.

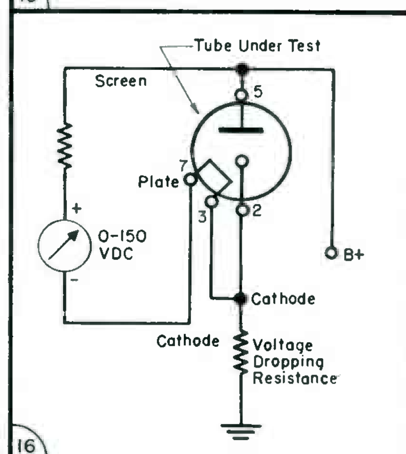
TV deflection amplifiers can show good GM with normal plate and screen supplies, but fail in service because plate current is inadequate at low plate voltages. The *knee* in the plate current-plate voltage curve must be at a low voltage in most deflection circuits. The *knee* test checks the current at low voltages required which is just above the *knee*. The circuit shown in Fig. 13 makes this test. The tube is operated with zero bias on the grid, and, for example, 150 *v* on the screen and 60 *v* on the plate. For a 6BQ6, the *knee* current under these conditions must be over 225 *ma*, if the tube is to give a full sweep in a TV set.

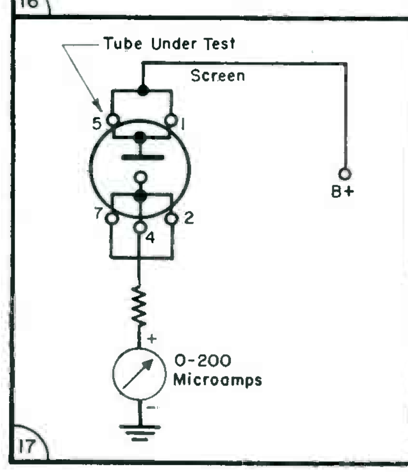
Auto receiver 12-*v* plate supply tubes, when used as triodes, can also be tested for GM as illustrated in Fig. 12. The *B+* supply is actually pulsating *dc*, but otherwise the test is the same as for other amplifiers.

Gaseous voltage regulators provide a special test problem. These tubes must be tested for regulation; the change in voltage drop at the nominal limits of the operating current range. In this card tester firing voltage is provided, and a meter indicates the voltage drop across the tube. The operator must decide if the tube is satisfactory from the change in voltage reading. Test circuits are shown in Figs. 15 and 16. A leakage current test circuit is also available (Fig. 17); in this instance, the applied voltage is below the firing voltage of the tube.

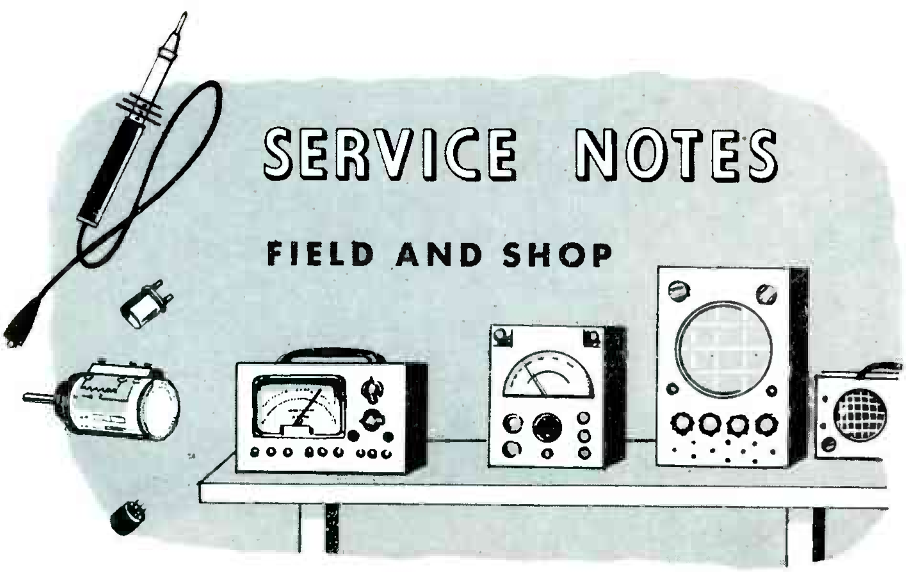
*Hickok model 123A.







FIGS. 15-17: SPECIAL TEST CIRCUITS. The Fig. 15 and 16 circuits are for OA2 and OA3 gaseous voltage-regulator checks. A leakage-test circuit for OA2-OB2 tubes is shown in Fig. 17.



Color-TV Troubleshooting* . . . Printed-Wiring-Board Checks . . . Horizontal-Pulling and Vertical-Rolling Remedies . . . Cures for Picture-Tube Arcing . . . How to Stop Ringing and Improve AGC

COLOR RECEIVERS are subject to color sync and shading problems.

Poor color synchronization, characterized by changing color-phase with fine tuning, can be caused by a break in the transformer winding to the burst amplifier. Though there is enough signal, capacitively coupled to produce some sync, the grid is left floating and sync is not satisfactory. A continuity check will show the open circuit.

Color shading, which appears as a variation in color as an object crosses the screen, is sometimes caused by an incorrect value of plate filter resistor, which permits a small sawtooth voltage to appear on the red or the blue picture-tube grid. This resistor is located between the plate of the killer tube and the transformer which couples to the demodulator grids.

Color shading during black-and-white reception on the same color receiver may result from an incorrect value of peaking capacitor in the output circuits of the color amplifiers. These capacitors have a tolerance of 10 per cent; they should be checked by replacing them with capacitors with known accurate values, or by disconnecting one end and measuring their value carefully with an accurate capacitor bridge. On a bridge with an accuracy of 5 per cent, the values should read within 5 per cent of nominal to ensure being within tolerance.

*Based on field notes prepared by RCA Service Co., for the RCA 21-CD-7895 series.

Printed-Wiring Board Checks

IN SOME NEW RECEIVERS, such as the G. E. *U* chassis, printed-wiring circuit boards are covered by a metal chassis to protect the circuit.

To repair these chassis, G. E. service engineers have developed a series of techniques. When, for instance, a chassis is believed to have some shorts, considerable time can be saved if a screwdriver is inserted through the chassis holes, bending any long leads away from the metal cover. Care must be taken so that the leads are not bent over too far to contact other components or connections.

Where soldering accessibility to the component board is limited, one should use a bent tip, lightweight soldering iron. Available for this purpose are ⅛″ tips that may be bent to 45° to reach all points of the p-w boards through the holes. The edges of the holes can be used as a rest for the side of the iron tip, allowing one to steady the tip of the iron while soldering. One must be careful not to scrape solder from the iron onto the side of the chassis holes, for such solder will later loosen and fall between the chassis and plated boards and develop shorts.

Leads of parts which require removal for checking should be heated alternately, while pressure is applied to the component until the leads become loosened from the solder boards. In most cases, loosening only one lead will be sufficient to permit a component or circuit test. The use of a soldering aid tool is recommended, particularly to clean component mounting holes after component removal.

One component that may be difficult to remove is the audio ratio-detector transformer and allied sockets. Here, removal is hindered by the number of connections that must be loosened. With careful heating, the part can be removed for checking; but, in some cases, it may be necessary to break away the transformer base or plastic socket and remove each connection separately.

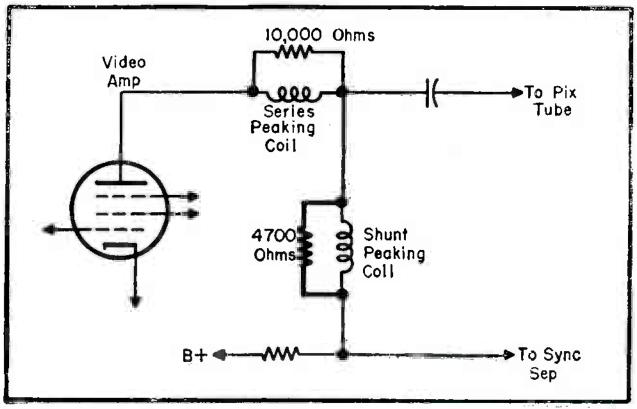
To gain additional access to the components on the component side of the board, the picture-tube strap and tube assembly can be detached from the main chassis by removing two nuts; one at the top and one at the bottom of the main chassis assembly. The tube may then be swung away from the chassis to permit direct access to the components. The neck of the tube should be supported to prevent breakage. An additional extension lead for the anode connector will provide extra freedom of movement to the chassis.

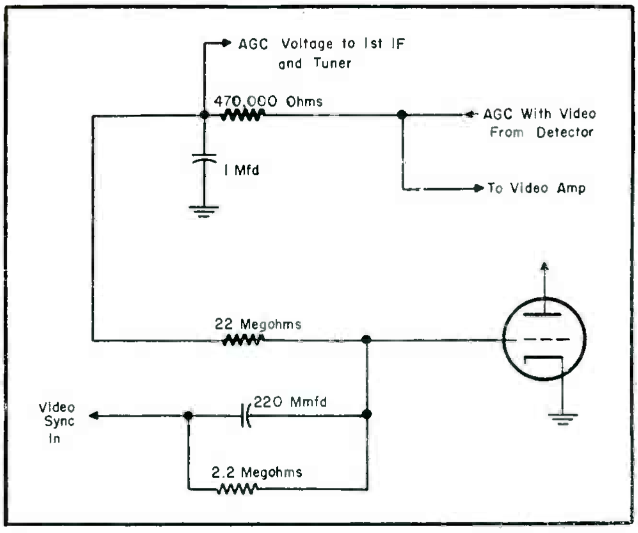
Whenever discriminator touch-up adjustment is necessary to improve sound reproduction and one wants to make such adjustments while the chassis is mounted in the cabinet, many an unpleasant burn can be avoided by simply removing the horizontal output tube. This will have no effect on the operation of the receiver sound system and both high voltage and heat hazards will be removed.

Emerson Production Changes

TWO PRODUCTION CHANGES have been made in recent models** to provide better operation under unusual conditions. Similar modification of other types of receivers may prove helpful under similar conditions.

Some TV stations peak the higher video frequencies to provide crisper pictures in average receivers. If the receiver also peaks in the same range, ringing (close spaced multiple images) may result. Fig. 1 shows the production change which eliminates the ringing condition. The 4700-ohm re-





FIGS. 1 (above) and 2 (right): Fig. 1 shows production change in Emerson 1258-59-68-69 chassis to eliminate ringing; a 4700-ohm resistor across the shunt-peaking coil serves to damp the circuit. Fig. 2 shows changes (indicated in heavy lines) made to provide better agc action and added freedom from jitter.

sistor across the shunt-peaking coil damps the resonant circuit which includes the coil and stray capacities at each end.

In very strong signal areas the *agc* circuit is sometimes unable to control the receiver gain and prevent sync jitter. Two changes (illustrated in Fig. 2) have been made to provide better *agc* action and additional freedom from jitter. A 470,000 *ohm* resistor has been substituted for the 1-*megohm* filter resistor in the *agc* lead from the detector to the first *if* amplifier and tuner. A 22-*megohm* resistor was inserted between the sync separator and the *agc* bus. These changes were found to increase the *agc* voltage and eliminate the feedback of sync pulses to the *agc* bus.

Intermittent Vertical Size Cures

Intermittent vertical size in the Motorola *TS-539* chassis has been found to be due to dressing of the shield of the picture-tube cathode too close to the terminal strip carrying part of the vertical-inverse-feedback network, causing a short of the vertical-inverse feedback voltage to ground.

This can be eliminated by redressing the shielded lead away from the junction of C_{606}, R_{607}, R_{609} and R_{610}. Although the end of the shield is taped, several tiny strands of wire protrude thorugh the tape and cause the intermittent short.

Horizontal Pulling and Vertical Rolling Remedies

Field reports have indicated presence of horizontal pulling and vertical rolling in some early production Trav-Ler models (*721-T-760, 721-K-765 and 721-K767*) containing the *836-17* chassis. This problem has been found to be due to 60-cycle hum pickup by the *agc* lead connected to the tuner. This can be eliminated by adding a .047 or .05-mfd bypass capacitor at the front end of the *agc* string. In very strong signal areas, it may be necessary to use a .1-mfd unit. This capacitor should be connected directly at the tuner socket pin that comes in contact with the tuner *agc* lead prong. All current production models with this chassis use a .047-mfd capacitor to avoid the pull-roll problem.

Picture Tube Arcing

Picture tube arcing will be found in some Motorola TS-538 chassis around the second anode button, due to leakage from the second anode button to the picture tube aquadag. To eliminate arcing, the red paint around the second anode should be removed.

In this same chassis intermittent operation of the *vhf* tuner has been reported. This trouble is due to incomplete electrical connection of some wafer male-pin connectors. The bottom shoulder of the pin should be soldered to the solder lug and the tube-socket pin connections going to the pin.

External Antenna Connection‡

The necessity for the use of an external antenna for the broadcast band is so infrequent that this provision is omitted on most radio receivers.

When an external antenna is required it may be coupled to the receiver using either of two methods.

In one method, one or two turns of wire, such as No. 18 insulated bell wire, should be wound around the loop antenna along the outer surface, near the outside turn; this will provide a suitable means for coupling from an outside antenna. One end of this two-turn loop should be connected to the outside antenna, while the opposite of the starting end should be connected to the radio receiver chassis or ground. Additional turns will generally not show too much improvement over the use of two turns, and in addition may require retuning the antenna circuit by adjustment of the trimmer capacitor. When using this method the loop antenna is still effective if the external antenna is disconnected, and when the external antenna is connected the loop still acts as a means for picking up a certain amount of signal and, of course, noise if noise is present in the immediate vicinity.

The most suitable arrangement, when using an external antenna, is believed to be a method whereby the loop antenna is removed entirely from the circuit and in its place a conventional antenna transformer, consisting of a primary and secondary, is used. The secondary winding should have the proper inductance to track with the gang capacitor across the band. A transformer having a variable inductance, such as those employing a magnetite core, is advantageous to provide proper tracking. When using a separate antenna coil instead of a loop, the connecting leads for the circuit should be kept short to avoid pickup on these leads. This method is very effective when local noise is present in the vicinity of the receiver.

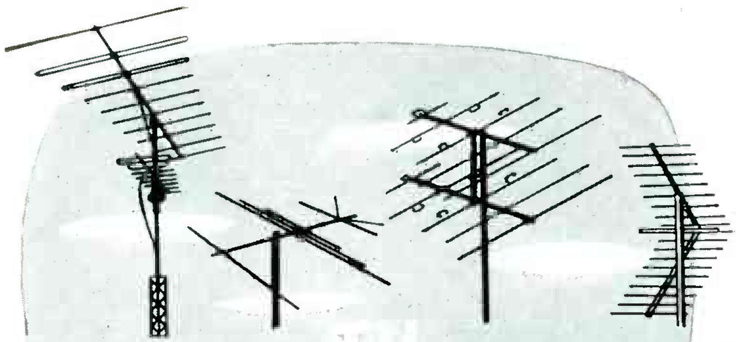
Intermittent Fine Tuning

In G.E. tuners, which use the front switch wafer for the tuning capacitor, there have been reports of intermittent operation in the fine tuning control. The trouble has been found to be caused by poor contact between the rivet and the silver plating on the textolite wafer. This may be remedied by applying a small amount of *silver print*†† so that it makes contact with the rivet and the silver plating.

***Emerson models 1258, 1268, 1259, 1269.*

‡*From field notes prepared by RCA Service Co.*

††*General Cement.*



UHF-VHF TV ANTENNA DIGEST

DESIGN • APPLICATION • INSTALLATION • SERVICE —— by JACK DARR

Community-TV Long Transmission Lines: Design . . . Installation . . . Maintenance . . . Test Procedures

The problems of the community-TV antenna system operator are many and varied, and often unusual, due to circumstances beyond control.

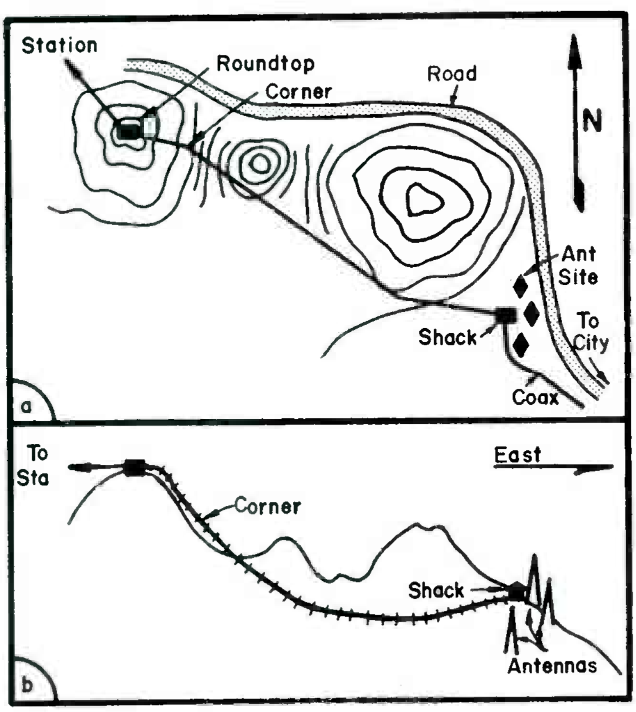
Illustrative of the odd situations that occur is the case, in our area, where an *increase* in power of a transmitter caused a *decrease* in the signal strength, at the system's antenna site. The decrease was found to be due to a change in the station's pattern. Instead of the previous almost circular pattern, the new one was ellipsoid, with the major lobes northwest and southeast to provide better coverage in these zones in which there were major markets.

The introduction of this pattern caused the signal to fall below usable levels at our community-antenna site. Elsewhere, we found that although another station provided good signals into the general area, reception on the mountain where our antennas were mounted was blocked. The site chosen originally for the installation had been on a mountain northwest of the city, not upon the peak itself, but halfway up the southeast side. This location was selected because of not only the proximity to the city served which shortened the run of cable, but because the pickup provided sufficient signal strength from the four stations in use; also the shoulder of the mountain provided effective shielding from unwanted co-channel signals coming from other stations in that direction. Then we found that this mountain shoulder had become a block to reception of the desired station.

Since it was economically impossible to move the antenna site to the peak of the mountain, and signals from the other stations were quite good at the original location, it was decided to attempt to pick up signals at the peak of the mountain, bring them down the mountainside to the antenna site, where they could be added to the *head-end* of the cable system.

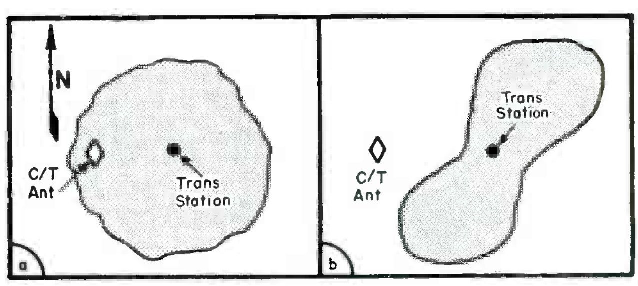
This setup was found to present several problems, not the least of

(*Continued on page* 28)



(Left: a)
ROUGH CONTOUR map of terrain showing antenna site, road to town, and shading of antenna site by both mountain peaks is illustrated in (a). The route of the transmission line is indicated; station is northwest from Roundtop. Note path from the 1200′ point, closest point to road of entire line. Other stations are all east and south.

(Left: b)
A VERY ROUGH PROFILE map showing shadowing of antenna site by both mountain peaks and also the approximate route of transmission line is shown in (b). Comparative height of two peaks are just about as shown, which illustrates why it wasn't possible to use the peak of the hill on which antennas were originally installed.



PATTERN OF SIGNALS obtained from station, before change (a) and afterward (b). It will be noted that when the community-TV antenna is almost entirely out of range a 95% signal-level decrease obtains.

ASSOCIATIONS

MINTSE, Minneapolis, Minn.

At its annual meeting at the University of Minnesota Continuation Center, Minnesota Television Service Engineers, Inc., voted to investigate the possibilities of state registration of engineers permissible under state law. Such registration, it was said, could be tantamount to state licensing without having to contact the legislature.

The association also set up plans to launch a safety inspection program. Since service shops are open to damage suits caused by chassis fires and other accidents, this safety program would serve to alert everyone to these potential problems.

Thirteen members were named to the MINTSE board of directors: *Harold Simonson, John Farmer, Frank Hylla, George A. Sherwood, Robert H. Johnston, Donald Folsom, H. B. Corbett, John W. Hemak, Robert Rohweder, Warren Schei, Howard Johnson, Erwin Larson* and *John Ringsred.*

Officers of MINTSE are: *John W. Hemak,* president; *Harold Simonson,* vice president; *Warren Schei,* secretary; *Robert Rohweder,* treasurer.

Active MINTSE committees include: registration and membership, qualifications, standards and legal, antenna standards, awards, apprenticeship tests, safety and health, institute and education, industry relations, public relations, local association relations, finance and budget.

MTTTA, Nashville, Tenn.

T. R. Nabors has been reelected president of the Middle Tennessee Television Technicians Association, Nashville, Tenn.

Other new officers of the group, which recently celebrated its fifth year, are: *Hubert Baker,* vice president and *Keith Jenkins,* secretary-treasurer. *N. T. Brinkley* was named membership chairman; *Jack Massey, Robert Mays and W. E. Stanley,* directors representing shop owners, and *Douglas LaMar, W. J. Thomas* and *T. E. Little,* directors representing Service Men.

NETSDA, Philadelphia, Pa.

Ray Cherrill has been reelected president of the Northeast Television Service Dealers Association, Philadelphia, Pa. *Charles Settle, Harvey Morris,* and *Ralph Newby* were reelected vice-president, secretary and treasurer, respectively.

Owen Costello, Charles Morelock and *Fred Kobert* were appointed to the membership committee. Others named were *Earl Fletcher* and *Danny Dee,* (entertainment); *Marvin Carfrey* and *Byron Frank,* (publicity); *John McCloy* Sr. and *Ed Shaeffer,* (judiciary); *John McCloy Sr.,* (corresponding secretary); *Ray Fink,* (NETSDA News editor); *Al Haas* (public and industrial relations).

RTG, Long Island, N. Y.

The Radio and Television Guild, Long Island, announced that the annual Electronics Fair of Long Island will be held on January 17, 18 and 19, '58 at the Hempstead Armory, Hempstead, N. Y.

IESA, Indianapolis, Ind.

George Roberts has been elected chairman of the Indiana Electronic Service Association, Indianapolis, Indiana.

Edward T. Carroll was reelected secretary-treasurer, and *Harold L. Crume* was elected vice chairman.

MINTSE OFFICERS, left to right: Robert Rohweder (treasurer), John W. Hemak (president), Harold Simonson (vice-president) and Warren Schei (secretary).

TRT, Kansas City, Mo.

Transistors were the subject of a recent lecture-demonstration program of the Television and Radio Technician Association in Kansas City, Mo.

Highlighted were blackboard diagrams comparing vacuum tubes with transistor plate-coupled multivibrators, cathode-coupled multivibrators, and blocking oscillators. In addition, a 'scope demonstration which featured the waveforms developed by these circuits was presented.

TSA, Detroit, Mich.

Karl Heinzman was recently reelected president of the Television Service Association of Michigan. Renamed as first vice president was *Charles D. Judd.*

New officers of the association include: *Clayton J. Hibbert,* second vice president; *Steven Raboczkay,* secretary; *Ed Ballantine,* corresponding secretary, and *Mike Dallen,* treasurer.

Now on the TSA board of directors are: *Russell Vogt, Pat Laforet, Phillip Fabian,* and *Hibbert* and *Ballantine.* Reelected to the board were: *Al Weiss, Jack Barton,* and *Harold Chase.*

RTA, Long Beach, Calif.

Clint Mathews has been named to head the Long Beach (California) chapter of the Radio-Television-Technician Association.

Horace Carr is secretary of the chapter which covers San Diego city and county.

TEN YEARS AGO IN SERVICE

Commercial sound was cited for its rapid rise in industry, offering new opportunities for Service Men, in an exclusive series of reports in Service. . . . Experts pointed out that enterprise and imagination could take the Service Man a long way in the sound business and industry was supplying a variety of practical equipment, components and accessories to help develop this flourishing activity. . . . The first report on new magnetic recording developments was published in Service. . . . Also presented for the first time was an analysis of speaker replacement techniques, highlighting the methods available to facilitate replacement of prewar PM and EM speakers with Alnico-V types. . . . The tremendous interest in sound prompted associations to set up clinic sessions featuring talks by industry experts. . . . Manufacturers reported that most of the receivers which would appear in the fall of '57 would be AM/FM type and that a number of models would be all-FM. The accent on FM was prompted by the increasing number of FM stations on the air. . . . Recognizing the increasing popularity of TV, a number of realty owners relaxed rooftop rulings and began allowing antenna installations that conformed to fire and building regulations.

TV Antennas

(*Continued from page 24*)

which was financial. The installation of a standard transmission line to the peak, using coax cable, would have required the construction of a separate power line to supply the necessary line amplifiers. Instead of that approach we tried another. A peak, locally called *Roundtop* was chosen as an antenna site because of its height and location. The peak of the mountain upon which the original antennas were set up was not only much lower, but was shadowed by *Roundtop*. From *Roundtop*, we found we had an almost direct line-of-sight path to the station. Another reason for the selection of this location was a forest service road which circled our antenna site. To install our system we cut a ten-foot path right-of-way from the antenna site directly to the peak in as straight a line as possible. Terrain configuration prevented an exact airline route. The terrain traversed by this line was completely uninhabited and extremely rugged. This routing was chosen because FCC regulations may, in the future, prohibit the use of lines in inhabited areas.

For this installation we chose an open-wire 600-ohm type of line using No. 12 copperweld wire. The basic factor which led to the selection of this line was its low loss at *rf*. Treated pine poles of the type used by light and power companies, averaging 15′ in length, were set 12′ above ground and 100′ apart. Line spacing was accomplished by using 6″ polystyrene rods.

At each pole, the line was fastened to standard No. 9 telephone-type glass insulators, using standard wrapping procedure. Precut lengths of wire, all equal in length, were used for wrapping. This technique was followed to balance the amount of metal used in each side of the line, thus making each side electrically equal as far as possible.

In our original installation we used *antenna boosters* with operating power being fed over the same lines that carried the *rf* signals. Because of the length of the line, we experienced a voltage drop, and this method was therefore discarded. Then we tried stepup transformers, using standard radio power transformers, with the high-voltage winding connected to the transmission line; about 300 volts were pumped into the line. At the top of the line a similar transformer was connected in reverse, to step the voltage back down to 110. The *rf* signals were fed into and taken off the line through matching networks using capacitors and *rf* chokes for isolation.

This approach proved somewhat better, but the signals were still not coming through the line satisfactorily. Limited power was available at the top end and the picture quality was very unsatisfactory. After several tests on this setup, it was decided that picture signals of the quality needed could not be transmitted over a combination line; therefore, we added another transmission line, using the same poles and the other side of the crossarms. This new line was transposed to minimize noise pickup from the power line and from random noises, making one full turn every four poles, by placement of the supporting insulators.

Some 1200′ down from the peak of *Roundtop*, chosen because it was the nearest point to the road and also because the right-of-way turned there, the top power supply was set up. The first amplifier was placed here; from previous experiences in other locations, it was deemed entirely feasible to get the signals down from the actual peak without excessive losses, and this later proved to be the case. By using this method, it wasn't necessary to place amplifiers on the peak itself, with attendant maintenance difficulties in the future.

To obtain distortion-free transmission of the TV signals over the mile and a half run of line we had to try a number of setups. First, we connected an amplifier into the line. The line from the peak, 600 ohms, was fed to the input through a matching section of tapered line and connected to the 300-ohm tap. The output, from the 300-ohm tap, was fed into the line through a similar matching section. At the antenna site, signals were fed into another amplifier, through a duplicate matching arrangement, and then into the amplifier shack. The results were unsatisfactory; signals were full of ghosts and smears.

To evaluate the reasons for these signal defects we installed a scanner[1] as a signal source (using a standard Indianhead test slide) on the 1200′ point of the installation.

The scanner-feed test disclosed that the system was suffering from feedback between input and output of the amplifier at the top of the line. This was verified by rechecking the connections; the high-signal levels in the output seemed to be feeding back into the input, causing smearing, due to the phase shift. The cause of this was evidently in the connections to the actual transmission lines. To eliminate this and to provide a better match into and out of the amplifiers, standard baluns were connected into the line. These were installed 20′ away from the amplifiers, at both top and bottom of the line; the connections between this point and the amplifiers themselves were made in coax cable (RG/59U) to avoid radiation.

The use of the baluns eliminated the ghosts almost entirely; only a very faint one was visible and it was not objectionable. The faint ghost was due to the very high signal levels used during the tests. The *rf* output of the scanner, at maximum was found to be as high as the signal levels obtainable from the average line amplifier. Results of the tests are shown below:

Input	*Output*
50,000 *uv*	10,000 *uv*
40,000 *uv*	8,000 *uv*
20,000 *uv*	2,400 *uv*
10,000 *uv*	1,150 *uv*

Levels were measured simultaneously at top and bottom of the line, using identical field-strength meters, which had been previously calibrated on a microvolter, so as to read alike on all ranges. (Incidentally, during the first part of this test, the output amplifier, at the bottom of the line, was taken out of the circuit entirely, and much better results obtained. It was apparently the cause of the small ghost observed in the initial tests).

Communication between top and bottom during the tests, an absolute necessity, was maintained by a pair of telephones. To send messages, these

(*Continued on page* 30)

[1]*B and K Dyna-Scan.*

TV Antennas

(*Continued from page* 29)

telephones were fastened to the *rf* transmission line by test clips. They were removed during *rf* measurements, of course, because of their shunting effect; the short caused by the balun across the line also prohibited their use. The baluns were also attached to the transmission line with test clips, so that one side could be disconnected to allow telephonic communications. Preset time-arrangements were made to insure contact; for instance, an *rf* signal of a given level was applied on the line for three minutes, then disconnected and the phones clipped on.

Initial measurements were made at channel-4's frequency. Although the line was originally intended to carry a channel-8 signal, we found an added loss due to the higher frequency. The computed loss of this line at channel-4 frequency was 19 db; the actual measured loss was near 18 db, entirely usable, with present-day amplifiers.

The problem was resolved in the following way: The signals picked up on the antenna array atop the peak, on channel 8, were traveled down the 600-ohm line to the 1200′ point. At this point, they were fed through a converter, emerging as channel-2 signals; a frequency not used in the system, and not adjacent to any of the other channels (4, 6 and 11) in use. The output of this converter was then fed into another amplifier, a standard-line amplifier, which had been specially realigned to give it a very decided *hump* on channel 2.

BENCH-FIELD TOOLS

MIDGET SOLDERING IRON

A MIDGET SOLDERING iron, *SL-10*, for work on miniature components and intricate or hard-to-get-at connections, has been introduced by Meadow Sales Corp., 2714 W. Montrose Ave., Chicago 18, Ill.

Unit requires no transformer or special attachments, weighs ½ ounce and measures 6″ long. Element is fully insulated and is said to heat in less than one minute. Rated at 10 *w*. Unit is furnished with 6′ line cord and molded plug.

° ° °

SCREWDRIVER WITH FLASHLIGHT

A SCREWDRIVER kit featuring a built-in flashlight assembly, *Toolite*, has been introduced by Suburban Products Co., Box 6531, Philadelphia 38, Pa.

Unit is made of polished steel chrome and includes a removable gripper chuck (so that flashlight can be used individually), four interchangeable screwdriver bits (¼″, ⅛″ and two Phillips heads) and a leatherette case.

° ° °

SOLDERING AIDS

Two SOLDERING aids, *Norseman 4* and *5*, have been announced by the Erikson Specialized Tool Co., P. O. Box 1424, Pico, Calif.

Units feature hex handles made of styrene, non-magnetic stainless steel ends separated from each other and stainless steel wire brushes for cleaning connections before soldering. Model *4* has a fine ⅛″ fork for work on transistors and other miniature components; *5* has a knife and scraper for printed circuits.

° ° °

MAGNETIC RETRIEVING TOOL

A FLEXIBLE MAGNETIC RETRIEVING tool, *MPT-1*, for picking up small parts from inaccessible chassis points, has been announced by Robins Industries Corp., Bayside 61, N. Y.

Tool consists of an Alnico magnet on the end of a long flexible shaft which may be shaped to any angle or curve and is said to stay in prescribed shape without springing back.

° ° °

CEMENT SAMPLER KIT

A CEMENT SAMPLER kit, *345*, containing 14 types of cement, has been announced by General Cement Manufacturing Co., Inc., 400 S. Wyman St., Rockford, Ill.

Included in kit are 14 two-ounce bottles, each with brush-in-top cap sealed for protection.

CATALOGS—BOOKS

Electronic Publishing Co., Inc., 180 N. Wacker Drive, Chicago 6, Ill., has released the spring-summer edition of Dave Rice's official pricing digest. Contains a guide to TV-radio service charges, showing national and regional average charges. Also features suggested list or resale prices on over 65,000 components and accessories.

° ° °

Erie Resistor Corp., Erie, Pa., has produced a plastic card (7⅜"x4⅛") reference chart with data on capacitors. Shows dielectric qualities and temperature coefficients of tubular and disc-ceramicons, as well as maximum available nominal capacities in mmfd, plus dimensions of ceramicons and *pacs*.

° ° °

Argos Products Co., 310 Main St., Genoa, Ill., has published a 4-page catalog describing Californian speaker enclosures (in completed cabinets and kits), corner speaker enclosures, corner and wall baffles, tube caddies and other cases.

° ° °

Blonder-Tongue Laboratories, Inc., 9-25 Alling St., Newark 2, N. J., has published a 4-page general catalog detailing its complete line of TV products. Among the new items described are crystal-controlled *vhf* and *uhf* converters and a series of all-channel indoor cable tapoffs.

° ° °

General Transistor Corp., 91-27 138 St., Jamaica 35, N. Y., is distributing a wall chart showing applications, maximum ratings and typical characteristics at 25° C of 56 types of germanium-junction-alloyed transistors. Also contains an interchangeability table, outlines of five different transistor cases, diagrams of various circuits and standard IRE symbols and definitions.

° ° °

Howard W. Sams and Co., Inc., 2207 East 46th St., Indianapolis 5, Ind., has released volume 6 of the *Auto Radio Service Data Manual*. Book covers 45 auto radio chassis (78 models) produced during late '55 and '56 with parts list, alignment information, schematics, and servicing information for each unit. Contains 240 pages; priced at $3.95.

° ° °

General Electric Co., communication equipment division, Syracuse, N. Y., has released an 8-page bulletin (ECR-458) describing *building block* design of two-way radio, explaining how components may be interchanged between station and mobile combinations to assure flexibility.

° ° °

Recoton Corporation, 52-35 Barnett Ave., Long Island City 4, N. Y., has published a 6-page cross-reference chart on replacement phono needles. Assorted types of needles are illustrated.

Ground Observer Corps Award

MAJOR JOHN W. BOGEN, U. S. Air Force, Chief of Organization and Facilities division of the eastern office of Civil Air Defense, Stewart Air Force Base, New York, accepting a replica of the Channel Master Ground Observer Corps Post Recognition Award from Harry Resnick, president of Channel Master Corp., expressing appreciation to GOC volunteers.

UHF Antenna Seminar

GROUP OF SERVICE MEN from New York's Southern Tier inspecting a 32-foot dish and a satellite tracking antenna, during a recent uhf seminar at the Sherburne plant of the Technical Appliance Corp.

TUBE • TRANSISTOR *News*

Design-Application Notes on Wide-Angle Picture-Tube Replacements, 12-V Auto-Radio Tubes and Semiconductor Power Rectifiers . . . Highlights of Latest Semiconductor-Tube Handbooks

REPLACEMENTS for 600-ma 110° deflection picture tubes (14AJP4, 17BRP4 and 21CZP4) have been announced by G.E.

All are aluminized, electrostatic-focus and magnetic deflection types. They feature relatively short overall length and small neck diameter. An external conductive coating serves as a filter capacitor when grounded.

14-Inch 90° Tube

A RECTANGULAR 14-INCH 450-MA picture tube (14ATP4) with a 8.4-*v* heater has been developed by RCA.

The tube, with an overall length of 13 3/16″, uses a straight-type electron gun which permits a shortened neck (5½″ long) and eliminates the need for an ion-trap magnet.

The 14ATP4, of the low-voltage electrostatic-focus and magnetic-deflection type, has a spherical filter-glass faceplate and an aluminized screen, 12 1/16″ by 9½″, with slightly curved sides and rounded corners.

ROBERT G. SCOTT, sales manager; Alfred Y. Bentley, division manager, and John Wolke, assistant manager, renewal sales of the TV tube division of Allen B. Du Mont Laboratories, Inc., with some of the 435 receiving tube types Du Mont has announced for the replacement market.

Auto-Radio Tubes

TWO ADDITIONS to the Sylvania 12-*v* hybrid auto radio tube line have been announced.

One tube, 12EL6, is a T5½ combined double-diode detector and high mu triode. Designed primarily as a detector-audio amplifier, it features a transconductance of 1,200 *u*mhos, a plate resistance centered at 45,000 ohms and an amplification factor of 55.

The second auto tube, type 12CX6, is a sharp cutoff pentode 7-pin miniature, designed as an *rf* and *if* amplifier in hybrid auto applications. Features a transconductance of 3,100 *u*mhos maximum and plate resistance centered at 40,000 ohms.

These tubes have been designed to operate at a 12-*v* plate supply directly from the automobile storage battery.

Transistor-Semiconductor Diode Booklet

A 24-PAGE BOOKLET on transistors and semiconductor diodes has been published by the RCA semiconductor division.

The booklet contains a general explanation of transistor theory and operation. Complete characteristic data on 18 types of transistors and four semiconductor diodes are supplemented by equivalent circuits and dimensional outlines.

Another feature of the booklet is an interchangeability directory, prepared to guide the Service Man in selecting the proper transistor type as a replacement, and to help identify and describe many of the transistor types introduced by different manufacturers. The listings contain more than 500 type designations including junction and point-contact types.

The booklet also contains eight pages of circuit diagrams which illustrate 20 of the more interesting transistor and diode applications.

Copies of the booklet may be obtained from RCA distributors or by sending 25 cents for each copy to RCA commercial engineering, 415 S. Fifth St., Harrison, N. J.

Tube Handbook

DATA ON 1,593 TUBE types are contained in a revised and plastic-ring binder edition of General Electric's tube handbook, *Essential Characteristics.*

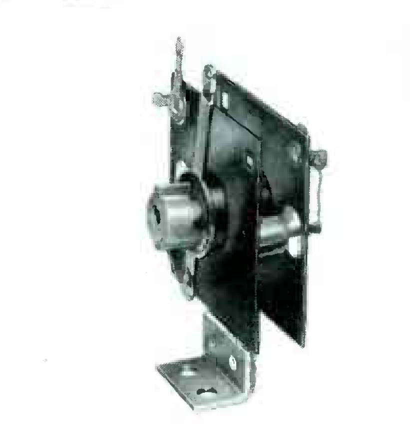
The new book, a 228-page volume, contains a column listing plate dissipation ratings, and also features a page of basic data on construction of loudspeaker enclosures.

There are 1019 basing diagrams in the handbook, and information on interpreting of technical data plus tube classification charts, tube envelope outline drawings and dimensions, characteristic curves, and typical circuits.

Available from authorized distributors.

Semiconductor Power Rectifiers

SEMICONDUCTOR rectifiers are now being made by G.E. for not only TV receivers, but higher-power industrial electronic applications. Typical of the latter types are the 1N151 and 152 rectifier units. These units can supply 15 *v dc* at .50 ampere with an applied 35 *v ac* resistive load. Combinations, in series or parallel, can provide a total of 161 different circuit arrangements.



SEMICONDUCTOR power rectifiers now available for TV chassis and industrial-electronic applications. Types include 1N151, 1N152, 1N153 and 1N158 (General Electric).

Ask your distributor's salesman to make up your display with the tool selection of your choice, he has all the details and can show you samples.

Wake Up Your Tool Sales With Kraeuter's Exciting New Color Line!

This new K-1 stocking merchandiser will add color and profits to your tool department. Kraeuter now offers you the 18 most popular tools in its line with comfort built into each and every one. Sparkling cushion grip handles in the colors shown allow easy identification and are provided at no extra cost.

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#1830-8	Electrician's side cutting pliers.
#1802-8½	Linemen's oval N.E. head side cutting pliers.
#1820-7½	Gripping and cutting pliers.
#1661-6	Long chain needle nose pliers.
#1641-5	Short chain needle nose pliers.
#1781-7	Extra long chain nose pliers.
#1663-6	Radio and ignition nose-cutting pliers.
#1751-6	Long flat nose pliers.
#1650-6	Transverse cutting pliers.
#71-8	Short jaw nose cutting pliers.
#1841-8	Button's pattern pliers.
#4501-5	Diagonal "oblique" cutting pliers.
#4501-6	Diagonal "oblique" cutting pliers.
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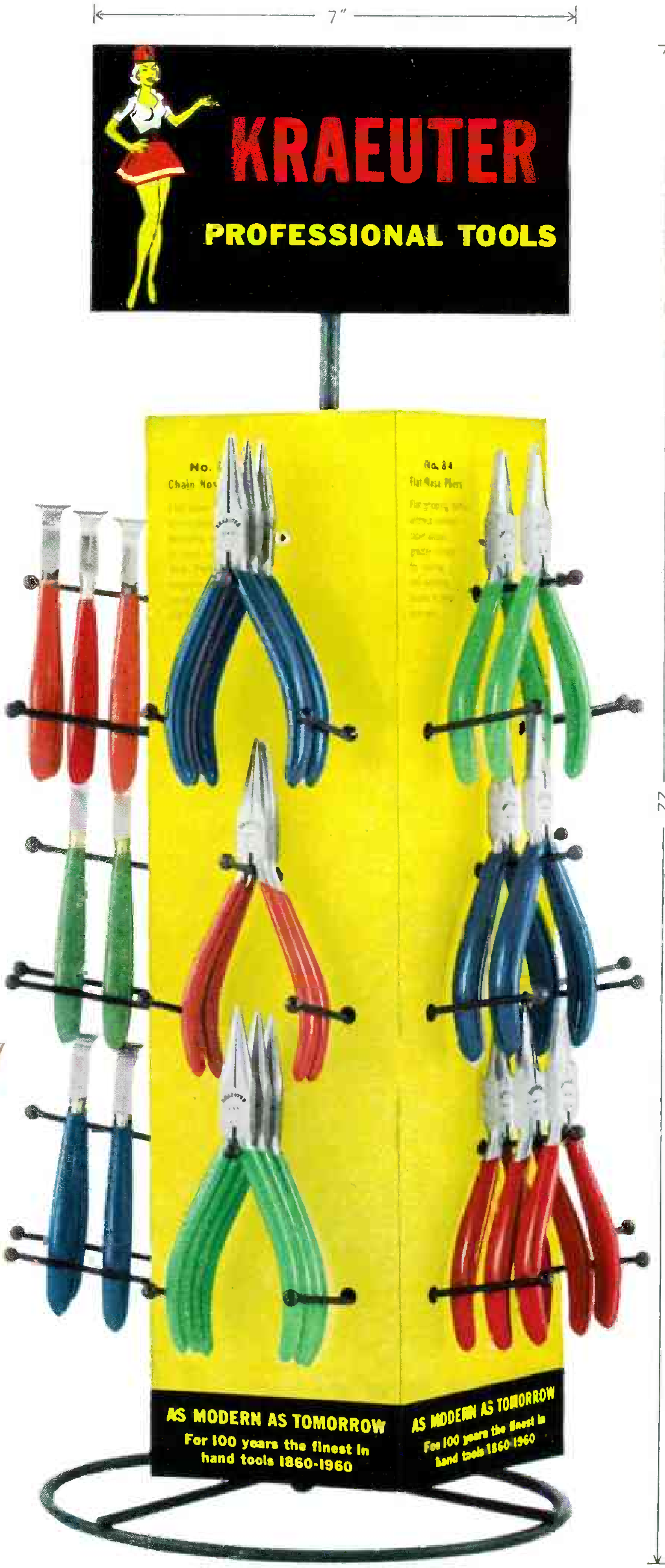

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VOM Design and Operation

Use of Instrument Rectifiers... Multiplier Resistances... AC/DC Measurements

INSTRUMENT RECTIFIERS in *vom*'s are extremely efficient, but often we are inclined to believe that their efficiency is perfect. We assume that these devices pass current in one direction perfectly without any voltage drop, and completely oppose the flow of current in the opposite direction. This is not true. Actually these rectifiers are variable resistance devices. Each element passes current with a certain volt drop in the forward direction, and passes a very much smaller current in the opposite direction, even when a much higher opposite voltage is applied.

The multiplier resistances for *ac* voltage ranges are always put ahead of the rectifier. This means that the current is controlled by the multiplier resistance, especially on the higher ranges, before the rectifier can have any effect on the accuracy of the relationship between voltage and current. On high ranges then, we can regard the instrument rectifier together with the microammeter, as basically a current-measuring device, in much the same way as we regarded the microammeter as a current-measuring device in using *dc* voltage multipliers.

But even under this condition, the measurement situation is not quite so simple as it was in the *dc* case. With larger rectified currents up to the full scale rating of the instrument, the ratio of reverse resistance to forward resistance in the rectifier is greater than it is for smaller currents. This means that at readings approaching full scale, practically all of the rectified current goes through the meter; whereas at readings lower down on the scale, the reverse current drawn by part of the rectifier will slightly reduce the reading on the scale, as compared with a hypothetical perfect rectifier. This is why different scales are provided, even on the higher ranges, for *dc* and *ac* readings, although usually the scales are aligned at the full scale end.

On low ranges of *ac* voltage, there is another cause of inaccuracy. This is the change in effective resistance, in the forward direction, at different currents. When the series multiplier is many times the effective *ac* resistance of the instrument with its rectifier, the multiplier swamps the fact that the rectifier-input resistance does not behave according to Ohm's law. On the lower ranges, the voltage drop across the rectifier is an appreciable fraction of the total voltage applied to the instrument, and hence this swamping action disappears.

This accounts for the considerably non-linear scale used for the lower ranges of *ac*. As an example, the scales for 1.2 and 3-volt *ac* readings are often considerably modified from the *ac* scale for higher ranges.

On the higher ranges, an accuracy, including the action of the rectifier within ±5% or better, is quite usual on *ac* ranges. On the lower ranges, it is difficult to guarantee that the accuracy is as good as this, because of the possible variation that occurs with the aging of the rectifier, since this contributes considerably to the calibration. To minimize this effect, as well as the swamp resistance in series with the microammeter, a shunt is provided across the overall arrangement; thus the rectifier operates at a higher full scale current than the 50 microamps used for full scale reading on *dc*.

Measuring AC/DC Combinations

The foregoing method of connection, by appropriate choice of values, provides a range such as to minimize possible variations between individual samples of rectifier, and also with the age of the same rectifier.

Now we come to an interesting problem in the use of a *vom*, that occurs fairly frequently. Across a certain point there is some kind of voltage; is it *ac*, or is it *dc*, or is it a combination of both? Whatever voltage there is, how can we use the *vom* to find out exactly what is there? With practically all modern *vom*'s there is a *common terminal*, *a +* *terminal*, used for *dc* or *ac* measurements, according to the range setting, and a terminal marked *output*. Usually, there is just a capacitor connected internally between this terminal and the other + terminal, so that connecting the test prod into the *output* socket will eliminate any *dc* component from the voltage being measured, and only measure the *ac* component of voltage, when the instrument is switched to the *ac* range.

Similarly, by setting the range switch to the *dc*-voltage measurement position, unless an *ac* voltage larger than the *dc* component is present, which will cause the instrument pointer to vibrate, we'll have a *dc* reading. Any *ac* superimposed on the *dc* will not materially affect the reading, because the pointer will indicate the average current flowing through the coil. The *dc* position on the range selector eliminates the rectifier, so this can have no effect upon the reading due to the *ac* components that may be preseent.

Thus, if we have *ac* only, switching the instrument to the *dc* position will give zero reading. If we have *dc* only, switching the instrument to the *ac* position, and putting the test prod in the *output* socket, will cause the instrument to give zero reading.

But suppose we get a reading in both of these positions, how are we to determine what kind of combination of *ac* and *dc* we are trying to measure? To interpret readings in this case, we must delve into the circuit used in the *vom*.

There are two methods used to connect instrument rectifiers in the *vom*'s The behavior of the *vom* will differ according to the type used. The type employed can easily be determined by using some check on the *ac* and *dc* voltages, and seeing the relationship between readings obtained in different manners.

One form of instrument rectifier uses two elements, only one of which actually serves to pass current through the instrument. The other one shunts away the alternate half wave that is not being used. One may wonder why the second element is required; it is particularly neces-

(*Continued on page 55*)

A NEW CONCEPT IN TV ANTENNAS
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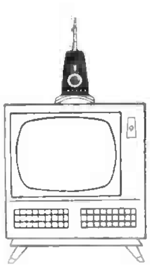

BLACK
WHITE
COLOR
-FM-
VHF/UHF

*Though transmitted horizontally, indoors the TV signal arrives with high amplitude vertical component.

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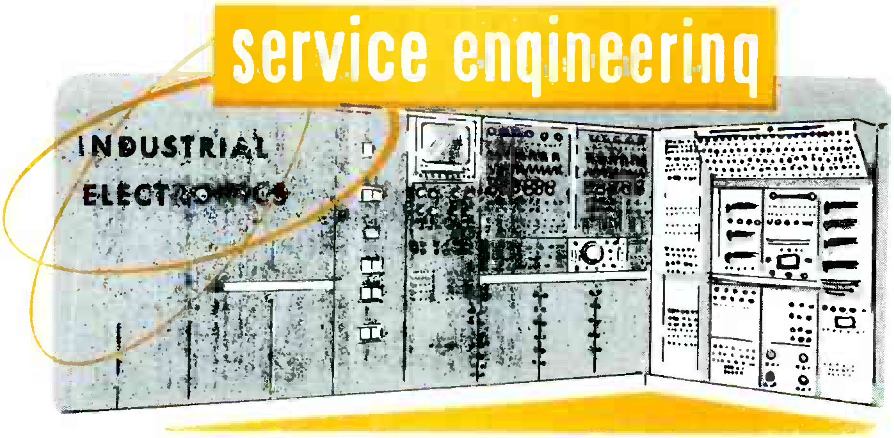


Latest 2-Way Developments: Selective-Calling Systems . . . Shortened Antennas . . . Compacted A-B Power Supplies . . . Transistor Circuit Chassis . . . Narrow Band Models Using AM

by LEO SANDS

Two-way radio, now an $85,000,000 per-year business, is growing at an ever-increasing rate. It is estimated that almost a million mobile radio units are now in use, each of which requires service, plus replacement tubes and parts. With yearly service-component charges per mobile unit running from a minimum of $10 to over $200 for the more elaborate gear, the market for 2-way repair-replacement is a substantial one.

The use of two-way radio is expanding rapidly because of easier availability of licenses, lower-priced and better-performing equipment, and particularly because existing users are waving the flag for two-way telling others how radio saves them time and money.

Operationally, two-way radio units of the latest vintage do not differ from the earlier post-war equipment. The equipment is used in the same manner now as a decade ago.

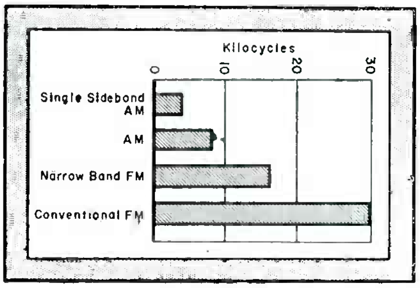
But, skip interference on the 25-50 mc band is no longer a problem. Heretofore, signals from stations on the same frequency, hundreds or even thousands of miles away, often roared in with as much strength as local signals which arrived by ground wave.

Now, in some systems the squelch does not open unless the signal is preceded by an audio tone which, when riding on the *rf* signal, unlocks the squelch to permit reception. Signals strong enough to open ordinarily the squelch, but which are not modulated by a tone of suitable frequency, will not be heard. It is possible, however, that once the squelch has been opened by a tone-bearing signal, an unwanted signal of greater intensity (3 db or more) might take over and wipe out the desired signal.

There are two basic types of tone-operated squelch systems. One employs a tone burst to unlock the squelch which is then held open by the *rf* signal. In other systems, a continuous tone is transmitted which is necessarily filtered out so as not to cause annoyance. The tone unlocks the squelch which remains open only when the tone and signal are both present.

The tone-operated squelch is not new. It was introduced a decade ago as an *instant call*.[1] A tone was sent out at the start of each transmission from the base station. This unlocked the squelch which was held open by the *rf* signal. In other systems, a con-dropped out when the *rf* signal was interrupted.

The tone-squelch system can work both ways; outbound from base sta-

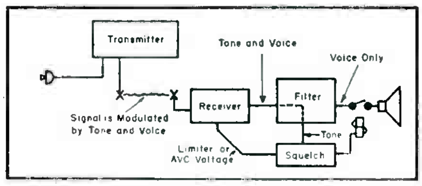


BANDSPACE REQUIREMENTS of various types of mobile radio systems.

tions and inbound from mobile units to base stations.

In recent types of equipment[2], the tone-operated squelch system is a built-in feature. Others[1], on the other hand, provide it as an optional external accessory.

Several manufacturers are known to be developing tone-operated



TONE SQUELCH SYSTEM basic circuitry. Both tone and voice modulation may be applied to the transmitter simultaneously, or tone first and then voice, depending upon the system. The filter allows the tone to get through to the squelch circuit, but prevents it from getting into the loudspeaker. The relay is shown to illustrate the gating effect of the squelch circuit. In practice, most squelch circuits are entirely electronic.

squelch adapters which can be built into a mobile unit or as an external attachment. One of these setups employs a reversible transistorized circuit which serves as a tone generator when transmitting and as an electronic gate when receiving.

While the tone-operated squelch offers many advantages, especially to avoid skip interference when operating in the 25-50 mc band and when sharing frequencies with other stations in the 152-174 mc band, its use is not always justified. Thus, it is an optional feature which can be valuable when needed and superfluous when not required.

Selective Calling

The ability to signal or talk privately to the driver of one vehicle of a fleet without disturbing other mobile units is termed *selective calling*. In the tone-operated squelch systems a tone causes the squelch circuits of all mobile units in a specific fleet to open simultaneously, permitting all to hear transmissions intended for that fleet, but rejecting transmissions originating from a base station or mobile unit of another system, which may not be equipped for tone-gating or may be using a tone of some other frequency.

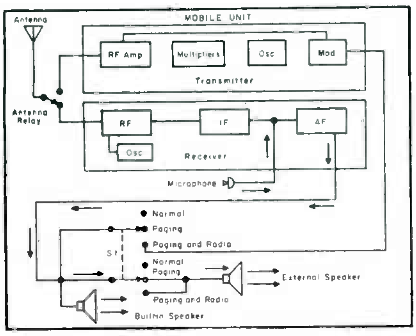
This can be expanded so that the base station transmits one tone to call some of the associated mobile units

(*Continued on page* 38)

[1]*Bendix.* [2]*Motorola.*

Service Engineering

(*Continued from page 37*)

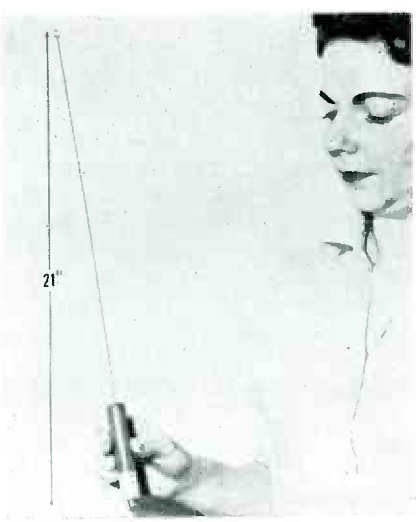


(Above)

MOBILE UNIT as a paging system. The switch (S_1) permits: (1)—normal operation with built-in speaker live, and external speaker off; (2)—paging with transmitter disabled, where the microphone is fed through the receiver's audio system and both speakers are live; (3)—paging and radio transmission that takes place simultaneously; incoming radio calls are heard through the built-in speaker only when set to normal, and through both speakers in the paging and radio position.

(Above)

TONE-OPERATED SQUELCH unit (at left) which plugs into the mobile two-way unit shown in the center. (Bendix Radio)



THE 6' TO 8' WHIP on the bumper or cowl used with 25-50 mc band communications equipment can now be replaced with a less-than-two-foot loaded whip. (Tele-Beam)

and a different tone to call another group, etc. To call all vehicles, a special tone or all of the various tones are transmitted simultaneously or sequentially.

By employing more tones, each of several mobile units may be signaled individually. When the number of mobile units is large, the tone system becomes complex. When single tones are used, there are only so many different tones within the voice band (up to 3000 cps) that can be used. The bandwidth of the filters used to select individual tones, rejecting all others, is the limiting factor. Filters become more expensive and increasingly critical as bandwidth requirements become narrower.

To permit individual selection of a great number of mobile units, it becomes necessary to transmit more than one tone, either sequentially or simultaneously, in various combinations so that each mobile unit will have an individual tone combination to which it will respond.

Pulsed-Tone Calling System

Tones and tone combinations are generally selected by operation of push-buttons or selector switches. The main advantage of the tone-type selective-calling system is its speed of response. Its disadvantage is the relatively high cost of adequate filters or frequency-selective relays which will not permit false operation.

The other basic selective-calling technique utilizes pulsed tones which may be coded by a push-button actuated code sender or an ordinary telephone dial.

One of the recent developments in this field is a selective calling system[3] which makes use of a dial-pulse code sender at the base station and decoders at mobile units. Individual mobile units are signaled by dialing a certain number such as 3-5-6, for example. The decoders in all of the mobile units in a specific fleet are actuated, but only the one set to respond to 3-5-6 will sound an alarm or turn on the loudspeaker of the *called* mobile unit.

At the base station the dial interrupts a single tone which is generated by an oscillator. At the mobile units this tone is accepted by a filter and is converted to *dc* which actuates a selector[4].

This selector can be set to respond to any of 10,000 possible code combinations. The code to which an individual selector will respond can be easily changed.

The selectors are set so that by dialing the number assigned to an individual mobile unit, only that specific vehicle will be alerted. All others receive but ignore the coded tone pulses. The selectors in all vehicles of a fleet can also be set so that in addition to responding to individual code combinations, they will all respond simultaneously to a common code, such as the single digit 2. Thus, mobile units may be called individually, in groups and all-at-once as desired.

This telephone-type dialing technique has been further expanded so that mobile units can be equipped with dial-code senders. Thus, mobile units can call other mobile units individually and when more than one base station is used in a system, only

(*Continued on page 41*)

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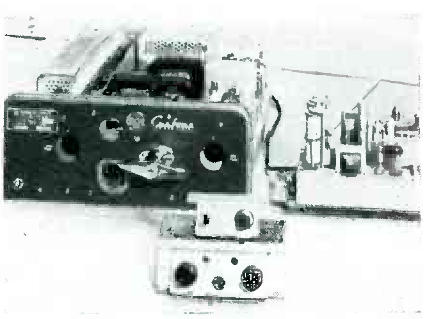
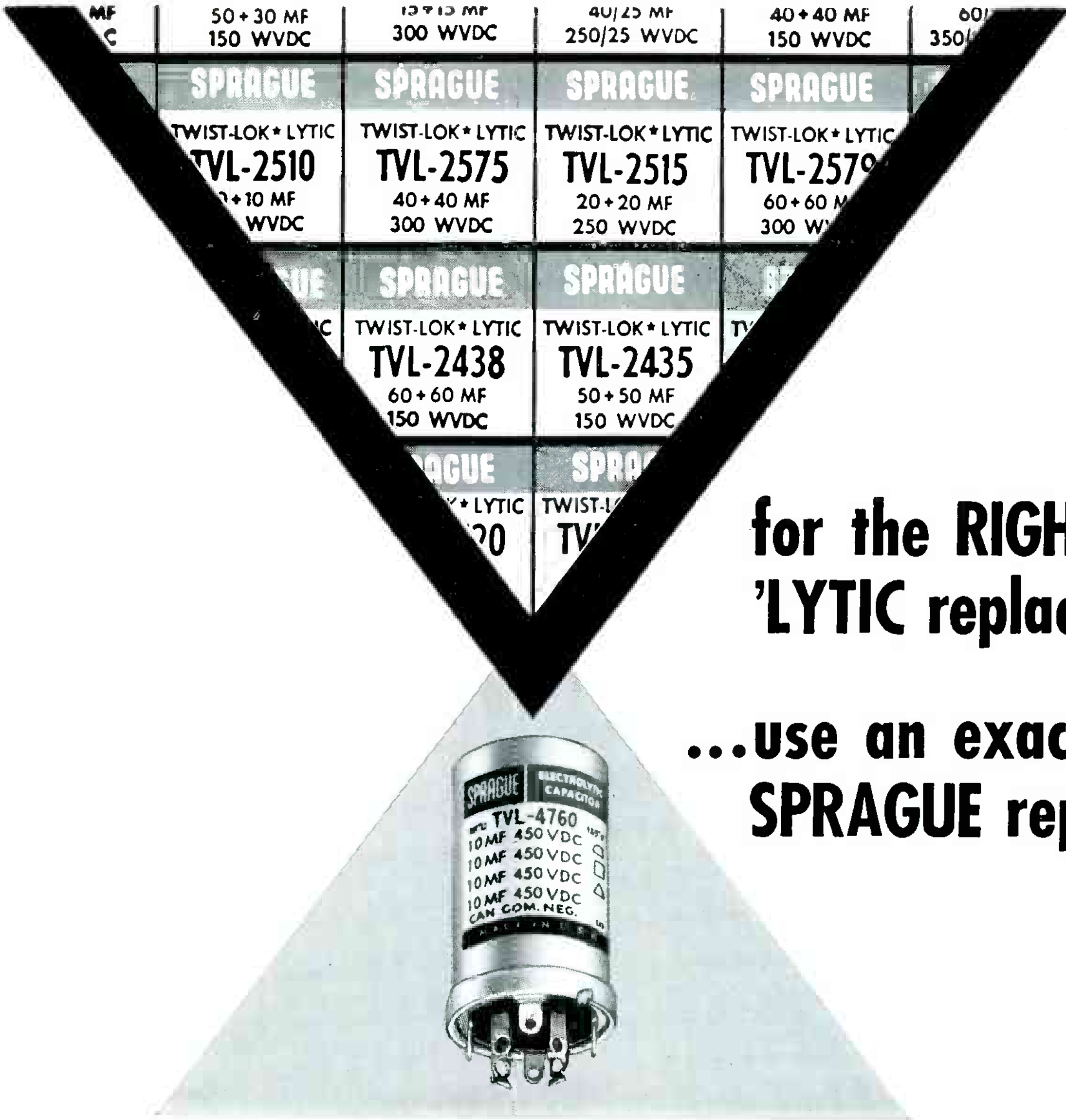
[3]*Secode.* [4]*Secode 49H selector.*



A 450-MC MOBILE UNIT with a Secode selective-calling attachment. The add-on selective-calling unit shown here is of the dial type. It uses a selector which can be set to respond to any of a million dialing combinations. (RCA)

MOBILE UNIT only a foot long which can operate from a 6 or 12-v battery or ac line. Chassis uses AM instead of FM and therefore requires only one-fifth as much bandspace. (Kaar)



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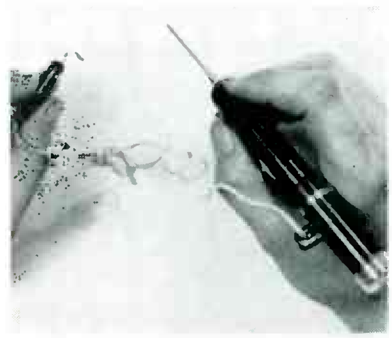
TEST INSTRUMENTS

PENCIL-TYPE VOM

A POCKET-SIZE, pencil-type *vom*, *Mini-Meter*, has been introduced by the Electrovox Co., Inc., 60 Franklin St., East Orange, N. J.

Mini-Meter is said to make accurate *ac/dc* voltage and resistance checks without *pulling* chassis. Direct-reading, magnified dial located at head of major probe provides readings from any angle. Unit operates on penlight cell.

Available as a premium with Walco *Tote-Pak*.



° ° °

IN-CIRCUIT CAPACITOR TESTER KIT

A CAPACITOR TESTER, *CT-1* (kit), said to make in-circuit checks for *opens* or *shorts*, has been announced by Heath Co., Benton Harbor 11, Mich.

Unit is claimed to detect *open* capacitors from about 50 *mmfd* up, when not shunted by excessively low resistance values, and to detect shorted capacitors, when not shunted by less than 10 ohms. Employs 60-*cps* and 14-*mc* test frequencies. Unit functions from *ac* power line; uses electron beam *eye* tube for indication.

° ° °

PORTABLE OSCILLATOR

A PORTABLE OSCILLATOR, *Utilator*, for the 4.5 to 220-*mc range*, has been developed by Kay Electric Co., 14 Maple Ave., Pine Brook, N. J.

Unit incorporates self-contained attenuators, power supply and output meter. High level *rf* output, *agc'd* for flatness over the entire range, plus a direct reading frequency dial, said to be accurate to ±1%, are provided. *Rf* output is .7 *v rms* into nominal 75 ohms. Attenuators are in switched steps of 20 db, 20 db, 10 db and 6 db, plus continuously variable 6 db.

Service Engineering

(*Continued from page* 38)

the desired base station need be alerted.

In some large communications systems, drivers may dial into the base station and then into a land-based telephone system which utilizes automatic dialing. Thus, drivers may call personnel at land-based telephones without the aid of an operator. At the present time, this is applicable only to private telephone systems such as used by railroads, pipe lines and electric utilities which are integrated with mobile radio systems. Technically, it is feasible to dial into common carrier telephone systems in the same manner.

Apparatus for selective-calling systems of this type is now being packaged as outboard attachments for both mobile units and base stations of any make. It is anticipated that in the future, dial-type decoders will be built into some mobile units. Their use provides individual as well as group calling, plus the benefits of tone-operated squelch systems.

Shorter Antennas

Heretofore, antennas used with 25-50 mc band mobile units almost invariably were ¼-wave whips; because of the whips' lengths it has been necessary to mount them on the cowl or bumper. In some instances, where overhead clearances do not prohibit it, whips have been mounted on the roof of the vehicle. Here, however, the length of the whip and its weight has presented mechanical problems.

Now, the ¼-wave 25-50 mc band whip can be replaced with a whip antenna[5] that is only about two feet

(*Continued on page* 42)

[5] *Tele-Beam.*

CHECKING TUBES on 2-way equipment for grid emission to prevent service failures.

Service Engineering

(*Continued from page* 41)

long. This antenna can be mounted on the roof of a vehicle and looks no more obtrusive than the whip antennas used in 152-174 mc band systems. The shorter antenna is made possible by using an enclosed loading coil, about 3" long, at the base of a 21" flexible wire whip. The exact length of the whip is determined by the operating frequency.

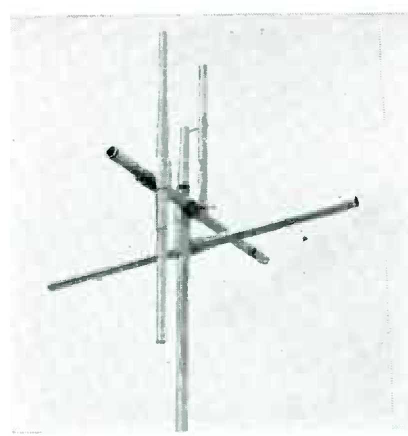
Base-Station Antennas

The most widely used base-station antennas include coaxial, ground-plane and triple-skirt types. One recently-developed antenna is a combination coaxial-ground plane type. Its radiation pattern can be modified by attaching another element, which converts it from an omnidirectional antenna to one with a cardiod pattern.

Two of the coaxial-ground plane antennas can be ganged to provide a figure-8 radiation pattern. Using the basic elements of the coaxial-ground plane antenna, an array which is a vertically-polarized yagi has been developed.[5] Since the elements may be individually oriented vertically and horizontally, the radiation pattern can be modified so that signals can be squirted into areas which would otherwise be dead spots.

Power Supplies

Nearly all modern mobile units are designed to operate directly from either a 6 or 12-v battery. The method of conversion from 6 to 12-v oper-



COAXIAL GROUND-PLANE antenna for 150-mc band with extra element added to provide cardiod pattern. Another element can be added on the otherside of the radiating portion of the antenna to form a vertically-polarized yagi. The large diameter elements have been found to contribute to the effectiveness of the antenna. (Tele-Beam.)

ation and vice versa varies among manufacturers. Some employ a switch or a plug which transfers the circuitry.

One recently-announced mobile unit[6] has been designed to operate from either a 6 or 12-*v* battery or 115 volts *ac*, without modification. The transfer from one *dc* voltage to the other is accomplished by reversing the power cable plug where it attaches to the mobile unit. For *ac* operation, a different power cable is used.

Vibrators are now used much more commonly in power supply circuits than dynamotors because of weight, size and cost.

When mobile units are installed on materials-handling vehicles which have 24 or 32-*v*, or other relatively high-voltage batteries as the propelling power source, power for operation of the radio equipment is derived in various manners.

Some mobile units are available with special power-supply assemblies designed for operation directly from the available battery source. In other cases, an *ac*-operated mobile unit is used in conjunction with a *dc*-to-*ac* rotary inverter or a vibrator-type converter. Some 12-*v* sets, however, may be powered directly from a 32-*v* (or other unusual value) battery merely by using a series-ballast resistor arrangement.

Circuit Innovations

Power transistors are used in some mobile units in the audio output stage to reduce tube and power requirements. Recently, one manufacturer[7] announced the development of a transistorized-receiver assembly which is only a fraction of the physical size of existing tube-type mobile receivers.

Two-way units can now also serve as mobile paging systems. One type[6], for example, when equipped with an auxiliary loud speaker, can be used as a mobile sound system. The microphone, the auxiliary speaker and the audio end of the two-way unit form a mobile *pa* system. A switch permits use of the apparatus as a paging system, with or without simultaneous radio transmission. The auxiliary speaker permits hearing of radio transmission outside as well as on board the vehicle.

Channel Expansion Moves

The FCC has announced that more radio channels would be made available by splitting some of the existing channels, so that two mobile radio systems can be operated in the same bandspace as heretofore was allocated to a single system. More recently, the FCC advocated splitting of even more channels.

This means that two-way equipment will have to be more selective and must be more stable in regard to staying on frequency. The amount of bandspace a transmitter can occupy must be reduced. The existing standard two-way FM units have a frequency swing of ± 15 kc or a deviation ratio of 5:1 for the voice transmission. By reducing swing to ±8 kc, deviation ratio is cut and the benefits of FM over AM become less significant.

As a result AM is again being used in some mobile units. By employing noise clippers, performance has been found to be equal to that of comparable FM systems. The AM sets require only ±4 kc bandwidth or only one-fourth that of standard FM systems. Single-sideband AM systems require even less bandspace and are expected eventually to supersede FM.

Since the bands now allocated to two-way are almost fully taken, industry is looking to new frontiers. Investigations in the 800-mc region are now under way. Ten years ago, Sperry and the Rock Island railroad demonstrated the feasibility of mobile radio at 2600 mc.

While waiting for the development of equipment which will work satisfactorily at these frequencies, more advantageous use of the 450-470 mc, 152-174 mc and 25-50 mc bands is proposed. The FCC has advocated reallocation of some of the frequencies in these bands, plus splitting of some channels, to alleviate congestion.

More highways of communication are being opened up for those clamoring to use two-way radio. This means more business for the service industry.

[6]*Kaar Imp.* [7]*RCA.*

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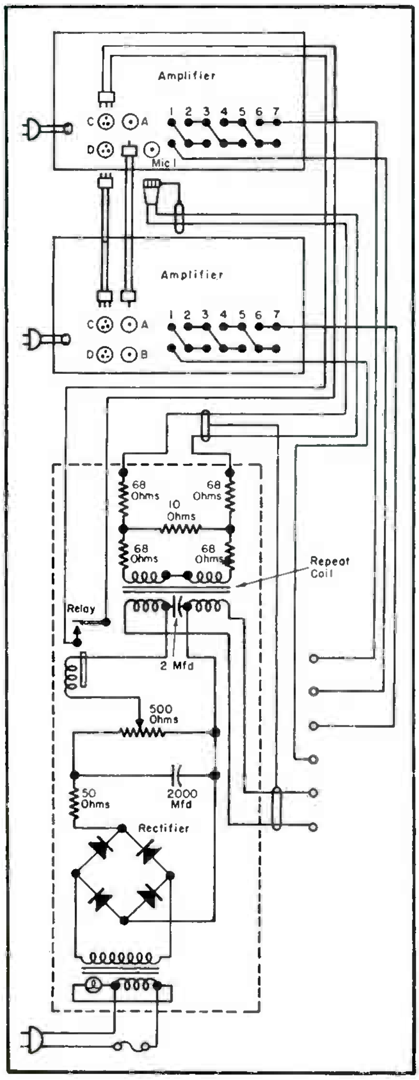
Outdoor-Indoor Train-Intercom System

A Report On A High-Power Installation Designed For Rail-Grinding Cars‡

Special service trains, such as those used to grind rails, are large users of sound systems to maintain car-to-car and car-to-field contact.

In one rail-grinding train installation, an intercom network has been devised to provide one-way loudspeaking communication from a selected location on either side of the cars comprising the train, plus loudspeaking contact from within the control cabs of the train. The equipment has been placed so that voice instructions from the pickup points can be heard the full length of the train (inside control cabs as well as outside) and for a distance of at least two car lengths in front of and behind the trains. Two microphone locations have been set up to enable crew members to carry on conversation by speaking alternately into their respective microphones and listening alternately to the adjacent loudspeaker.



(Left)
AMPLIFIER-POWER SUPPLY circuitry for intercom used aboard rail-grinding train.

Microphones have been equipped with plugs to permit connection to the loudspeaking system by way of a weatherproof type jack on the side of the car (or a non-weatherproof type jack inside the control cab); this arrangement serves to provide automatic contact to the entire system.

Equipment used for this installation was of the heavy-duty type mounted with due regard for weather, track dirt and iron particles. Shock mounting was used to curb vibration.

Amplifier Features

The amplifier was a heavy-duty 50-watt industrial type installed in a rail-mounted 16-gage steel cabinet, shock mounted for installation on each control cab equipped car. Input and relay control components were included in this cabinet.

A weatherproof input receptacle was installed on each side of each control car. In addition, receptacles were mounted on a condulet within the control cab.

Speakers-Mikes Used

The control-cab loudspeakers were wall - mounted direct - radiation type with a power - handling capacity of about 8 watts.

The exterior loudspeakers feature weatherproof diaphragm mechanisms mounted on reentrant horns; each speaker had to be capable of handling around 25 watts.

Microphones provided, using four-foot cords, were palm-held differential carbon types, with press-to-talk switches.

After the installation was completed, the system's wiring was carefully checked for continuity and freedom from shorts, crosses, and grounds.

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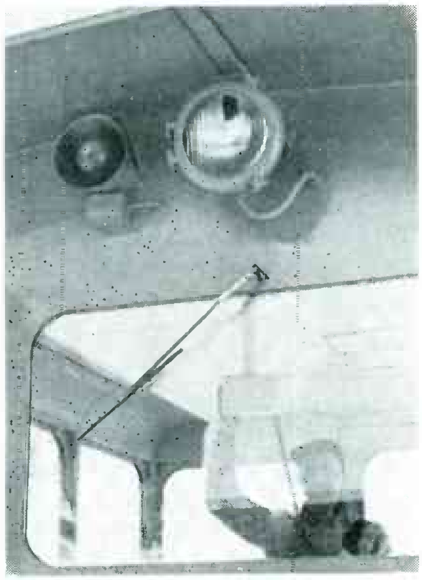
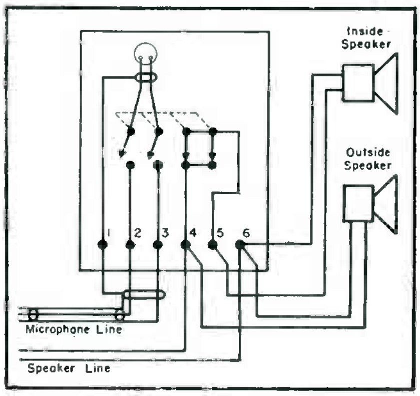
‡*From field notes supplied by the* ***Centralized Audio Corp.****, Newark, N. J., who designed and installed the complete sound system.*



(Above)
SPEAKER installation aboard control car of rail-grinder.

(Above)
AT INTERCOM mike inside cab of rail-grinding train.

(Below)
WIRING of amplifier rack with feeds to microphones and dual internal - external speakers.



AUDIO

INSTALLATION AND SERVICE

Phono • Tape • PA

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Replacement Output-Transformer Installation Tips . . . Cures for Low-Frequency Instability . . . Square-Wave Tests . . . How to Prevent Improper Needle Tracking

In the installation of replacement output transformers in amplifiers, instability at low frequencies is often encountered; a slow up-and-down movement of the 'scope trace obtains. The remedy here is to change the values of various coupling capacitors. Best results are usually obtained by changing the capacitor coupling the plate of the first stage to the grid of the second stage; value here may be either larger or smaller.

Values twice and half that of the original capacitor should be tried; see whether either change improves the oscillatory condition. The change should either stop the oscillation or make it less violent. Either modification will change the frequency of oscillation, if the oscillation persists. Having found the right way to go, the value change can be taken further, larger or smaller, until sufficient margin of stability is achieved.

The foregoing can be checked by short-circuiting the oscillator to see whether there is sufficient margin to prevent the *bounce* effect. If you run into serious difficulty at the low frequency end, the best remedy may be to increase the feedback resistor slightly, to provide less feedback than in the original circuit.

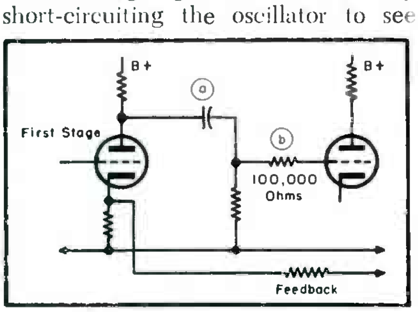

FIG. 1: IF THE value of the coupling capacitor (a) must be increased to achieve low-frequency stability, a resistor may be needed (b) to avoid blocking.

LF-HF Instability Cures

If you find yourself troubled with instability at both ends of the frequency response at once, with the output an odd-shaped wave with high-frequency bursts on it, it may be necessary to kill the high-frequency oscillation by installing a capacitor (about .01 mfd) from plate to ground in the first stage, so you can concentrate on eliminating the low frequency oscillation. Then, having eliminated the low-frequency oscillation, you can work on the high-frequency oscillation problem.

If, to eliminate low-frequency oscillation, it proves necessary to use a larger capacitor from the plate of the first stage to grid of the second, you may run into blocking troubles on program material. This effect will not show up on audio-oscillator tests, but can be very annoying when the amplifier is in actual operation.

A needle plop or some other noise, which might not be particularly noticable in the loudspeaker, may be of sufficient high amplitude at the second stage to cause a small amount of grid current momentarily. The large value of capacitance will bias the stage back to cutoff for sufficient time to lose some of the audio program. This will not happen with the smaller capacitor because the time constant is much shorter.

To remedy this a series resistor should be inserted between the grid-leak resistor and the grid itself, as shown in Fig. 1. This circuit alteration will also provide an alternate way of investigating the high-frequency rolloff or stability margin. Instead of installing the capacitor from plate to ground, a much smaller capacitor can be connected from the grid of the second stage to ground; Fig. 2.

The adjustment should be made until the ideal rolloff characteristic is achieved when the oscillator is swept on up to about 200 kc. A resistor of about 100,000 ohms will serve as this anti-blocking resistor.

A popular test for modern amplifiers is to see how well they reproduce a square wave. If your audio oscillator happens to have a square-wave output, your customer may want to have the square-wave response demonstrated. But you may find, after you've made all these adjustments, that the square-wave output is not as good as that published for this particular amplifier with its original transformer. On the surface, this looks like a reason for dissatisfaction.

However a number of modern amplifiers have their square-wave response *faked*. This means the various phase compensation capacitors have been juggled so that the amplifier produces a wonderful looking square wave. But, unfortunately, the amplifier's transient response may not be nearly as good as the square wave would lead you to believe. Although the method just outlined may result in a square wave that is somewhat more rounded than the original, or perhaps the amplifier has a slight tendency to ring at some points, practical comparison tests have shown that the ability of an amplifier to handle actual program transients is better when adjusted according to the procedure outlined,

(*Continued on page* 49)

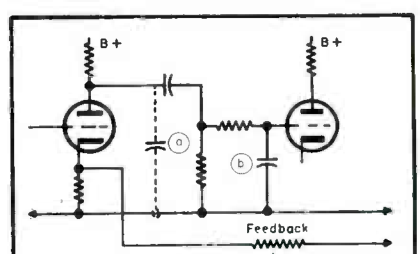

FIG. 2: WHEN A blocking-stopping resistor is used, the value of the capacitor controlling high-frequency stability can be reduced and transferred to improve performance as shown at (a) and (b).

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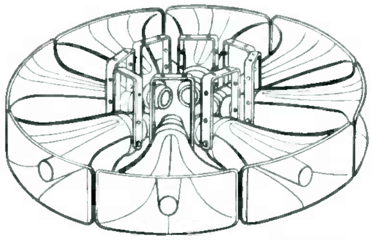
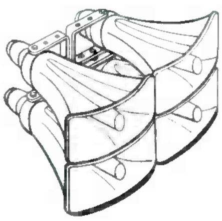
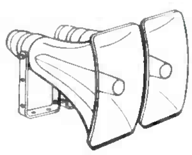


PATENTS PENDING





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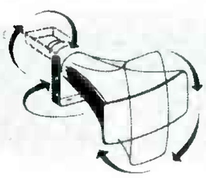
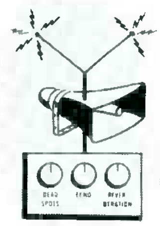


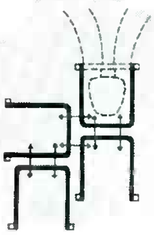
Horn *bell* rotates full 360° on its axis, while the 'U' mtg. bracket provides better than 180° vertical and 360° horizontal adjustment of *projector* positioning. Thus, sound can be distributed in *any* direction regardless of projector location.

"TUNE OUT" ECHO & REVERBERATION



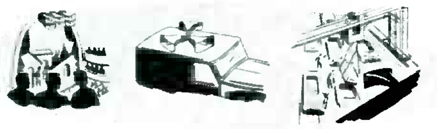
The unique *pin-point adjustment* possible with the CLH at last provides the long-awaited answer to coverage of "dead spots" and control over troublesome echo and reverberation—regardless of structural or physical placement limitations!

USE SINGLY OR STACKED



The 'U' mounting bracket of the Model CLH is specially designed to link two or more projectors into *any* configuration, achieving *exactly* the sound distribution pattern required. Even diagonal or alternating projections are just as easy to achieve as "standard" patterns.

VERSATILITY & ADAPTABILITY UNLIMITED



Meets every soundcasting requirement. Use the CLH wide-angle projector with *any* University driver to get exactly the frequency response, efficiency and power handling capacity you need. Here is dependable performance and *real* economy—for actual dollar savings you can count on year after year.

LISTEN *University sounds better*® COMMERCIAL · INDUSTRIAL

UNIVERSITY LOUDSPEAKERS, INC., 80 SOUTH KENSICO AVENUE, WHITE PLAINS, N. Y.

THE MOST COMPLETE SELECTION OF DRIVERS IN THE INDUSTRY NOW AVAILABLE FOR USE WITH THE CLH

Model PA-50. Features extended high and low frequency range, highest continuous duty power capacity, greatest conversion efficiency, husky *built-in* multi-match transformer with terminals conveniently located at base of unit. The answer to the toughest sound problem. Nothing finer!

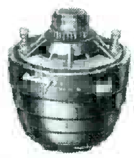
Response: 70 to 10,000 cps. Power Capacity: Full Range 50 watts; Adjusted Range 100 watts; List Price: $57.50.*

Model PA-HF. For applications requiring the greatest power handling capacity, maximum sensitivity, widest range frequency response, *plus* rugged lifetime construction. *Completely die-cast* aluminum housing. Increased sound output cuts amplifier requirements in half!

Response: 70 to 10,000 cps. Power Capacity: Full Range 50 watts; Adjusted Range 100 watts; List Price: $47.50.*

Model SA-30. "Battleship" construction for maximum durability against abuse or in hazardous environments. *Completely die-cast* aluminum housing and *built-in* matching transformer for connection to high impedance lines or "constant voltage" systems.

Response: 80 to 10,000 cps; Power Capacity: Full Range 30 watts; Adjusted Range 60 watts; List Price: $47.50.*



Model SA-HF. Will deliver that extra punch needed to cut through heavy noise. Use for speech or high quality music.

Response: 80 to 10,000 cps.; Power Capacity: Full Range 30 watts; Adjusted Range 60 watts; List Price: $36.00.*

Model MA-25. Low in cost, high in quality, featuring high efficiency magnet, tropicalized 2" voice coil, "rim-centered" breakdown-proof bakelite diaphragm.

Response: 85 to 6500 cps.; Power Capacity: Full Range 25 watts; Adjusted Range 50 watts; List Price: $27.50.*

**Program response adjusted to horn cut-off.*

ACCESSORIES

2YC CONNECTOR PMA ADAPTER

2YC Connector enables two driver units to be used with one CLH trumpet for up to 200 watts output. Now you can get the Super-Power you want . . . when you want it, using standard stock drivers.

PMA Adapter fits standard ½" dia. threaded pipe to the CLH 'U' mounting bracket. Takes the headache out of mounting on pipe!

ACCESSORIES

BATTERY ELIMINATOR ADAPTER

A BATTERY ELIMINATOR adapter, *BEA*, designed to adapt older battery eliminators for transistor radio tests, has been announced by Electronic Measurements Corp., 625 Broadway, New York, N. Y.

Two leads from adapter are connected to output terminals of battery eliminator. Binding posts of adapter are then used as output terminals for testing.

° ° °

CONELRAD MONITOR

A CONELRAD MONITOR, *CD-1*, for converting a receiver with *avc* into a Conelrad alarm system has been introduced by American Electronics Co., 1203-05 Bryant Ave., New York 59, N. Y.

Unit is said to develop a loud tone in receiver when broadcast station goes off the air. A twin triode, 12AU7, and two transformers are used in the circuit.

° ° °

MOBILE-FIXED POWER SUPPLY

A MOBILE-FIXED power supply, *C-1470*, designed to power both transmitter and receiver, has been introduced by James Vibrapowr Co., 4050 N. Rockwell St., Chicago 18, Ill.

Supply, it is said, can be used mobile from a 12-*v* battery and also connected to a 117 *v ac* power source while in vehicle. For transmitter, unit provides low power of 150 *v* or 225 *v* at 70 *ma* simultaneously with high power of 400 *v* or 500 *v* at 175 *ma*; 95 *w* output available. Filament power for receiver and transmitter, when operated from 117 *v ac* supply, is 12 *v* at 5 *amps*, from separate filament transformer. Control relay is included for muting receiver during transmitting.

° ° °

TUBE BRIGHTENERS

PICTURE TUBE BRIGHTENERS, *BT-1*, *BT-2* and *BT-3*, have been announced by Raypar, Inc., 7800 W. Madison St., Chicago 34, Ill.

BT-1 is an autoformer model for parallel-filament sets; *BT-2* for parallel and series circuits. *BT-3* is a universal unit said not only to brighten picture tubes, but also to relieve cathode-filament shorts at normal or boosted voltage in parallel or series TV circuits. A printed-circuit selector sets up *BT-3* functions. Further information in bulletin *BT956-10*.

Audio

(*Continued from page 46*)

than when adjusted to produce the most perfect-looking square wave.

The foregoing amplifier-stabilization procedure to provide a satisfactory stability margin may sound rather involved. In practice, once you have adjusted one or two amplifiers in this manner, the procedure will be found to be at least as simple as radio-receiver alignment.

Improper Needle Tracking

Before operating a changer one should make sure that it is *absolutely level*. A torpedo or similar type level should be used on the record changer base plate. Adequate shims should be used to level the record changer pan or combination cabinet to achieve perfect level.

Failure of a needle to track across the record properly under the foregoing conditions could be caused by an accumulation of lint or dirt around the needle. Dirt around the needle should be removed with a soft brush, similar to the type used for camera lens cleaning. The needle should also be checked to see if the tip is bent or broken, in which case replacement will be necessary.

If the trip finger cam does not disengage from the pickup arm return locator when the cycle is completed it must be checked. There should be a 1/32" gap between this cam and

(*Continued on page 50*)

A 12-INCH woofer speaker with a specially - treated, deep - convolution cone edge, and a linearized air gap and suspension system. Also includes a built-in electromechanical crossover system to help provide a positive roll-off at 1500 cps crossover point. Has an 8-ohm impedance; 14.5-ounce Alnico V magnet; power rating of 25 watts for program material and 50 watts for instantaneous peak. (A1-403; General Electric Co., Specialty Electronic Components Dept., Auburn, N. Y.

Audio

(Continued from page 49)

the return locator when the machine is not in cycle.

Binding in the pickup-arm post bearing, return locator, or trip finger cam could cause faulty or erratic tracking of the needle.

If the pickup leads are too tight, they can also cause the needle to drag. These leads should have enough slack to allow the tone arm to move freely across a record.

Anti-Skate Lever Checks

Anti-skate levers found in a number of phonos should be checked to make sure they are connected properly. Binding in this lever can cause improper tracking. It should be free of burrs and turn easily.

ELLIPTICAL CONE TWEETER for single or multiple use in separate two, three or four-way hi-fi systems. Elliptical shape is claimed to give broad spatial coverage at high frequencies. (T-64; Sonotone Corp., Elmsford, N. Y.)

TWIST CARTRIDGE said to operate without a preamp. Output is .4 volt measured on Columbia test record RD103. (TX-88 Superfluid; Ronette Acoustical Corp., Lynbrook, N. Y.)

Signal-Seeking Tuners

(*Continued from page* 12)

end of band), they must be returned to the low end without interference from the power spring. The treadle solenoid lever recocks the outer clutch disc, which is screwed on the treadle shaft. During the seeking time, the energy of the spring normally drives the treadle through the clutch coupling. However, if the clutch faces are opened by the solenoids, the two will operate independently. This is the function of the declutching mechanism shown in Fig. 7 (p. 13). As either solenoid energizes, the *finger bar* at the front of the tuner is pulled inward by a bushing on the solenoid plunger arm. This causes the clutch to open: There are five extra fingers on the finger bar; these are pushed inward by one of the five push buttons when button tuning is used. During automatic tuning, the power spring stroke is shorter than the treadle stroke, which means that it must be cocked more often than the treadle. This simply results in a slight pause in dial movement each time the spring is cocked by the power solenoid. The treadle and dial tuning is not disturbed otherwise, because they are isolated by an open clutch during this instant.

To prevent the treadle solenoid from energizing when the radio is manually tuned to the high end of the band, a special set of contacts has been added in series with the treadle solenoid switch. These are mounted on the relay, and allow current to pass through the solenoid only when the relay is closed and the tuner seeking; Fig. 7.

Summary of Operation

Automatic signal-seeking operation has been obtained by adding a few parts to the basic miniaturized push-button tuner. The major parts and their functions are:

Power spring—to power the tuner for search travel.

Rack teeth (on worm unit)—to provide governing a surface as worm is moved forward.

Governor gear train—to govern speed of tuning by meshing with rack teeth.

Relay—to stop the tuner by engaging the governor.

Treadle solenoid—to return dial and tuning mechanism when they approach high-frequency limit.

Power solenoid—to cock the rack-worm unit and power spring.

Treadle-solenoid switch—to energize the treadle solenoid.

Power solenoid switch—to energize the power solenoid.

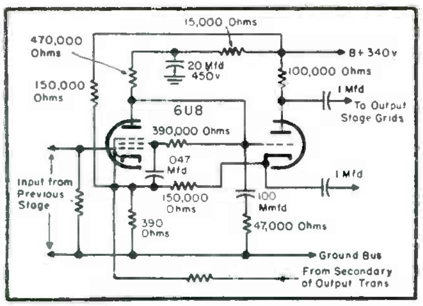
Channel-Orientation Session

TELECASTERS AND ENGINEERING-SALES members of JFD and Mountain Electronics (JFD distributor) at a recent meeting in Charleston, W. Va., set up to review antenna orientation and installation required in view of relocation of channel 13, 8 and 3 stations in the Charleston area. Left to right: Herb Yassky, JFD regional sales manager; Charles A. Meyer, Mountain Electronics Co., Inc.; Simon Holzman, JFD chief antenna engineer; Robert Tincher, general manager of WHTN-TV and vice president of Cowles Broadcasting Corp.; Charles Prohasick, operating engineer of Cowles Broadcasting Corp., and Charles Quentin, chief engineer of Cowles Broadcasting Corp.

Amplifiers For Outdoor Commercial-Sound Systems

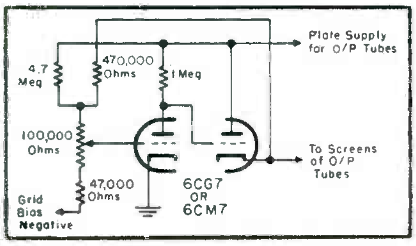
by NORMAN CROWHURST

Circuitry Features, Operation and Repair of Recently-Developed Low-Distortion Amplifiers Designed to Eliminate Acoustic Feedback and Afford Matching Flexibility



(Above)
FIG. 1: SCHEMATIC of infinite gain stage. Values shown are typical. (Bogen)

(Below)
FIG. 2: INSTANTANEOUS screen voltage regulator. (Bogen))



In the design of amplifiers for commercial outdoor use, the trend has been toward lower distortion and bigger power output, as well as the elimination of acoustic feedback. In addition, provision for flexible matching has also received prime attention.

To achieve real low distortion in modern amplifiers, it is necessary to apply a large amount of feedback and at the same time maintain stability with different kinds of output loading. For feedback up to about 20 db there is no problem, but to get much lower distortion than is possible with only 20-db feedback, amplifiers have utilized multiple loops, stepping up the total feedback to as much as 80 db. This creates severe stability problems.

In one recently-developed line of amplifiers, positive feedback is used with negative feedback; the basic circuit for this technique is illustrated in Fig. 1. For economy a TV type tube is used; a combined pentode and triode, the 6U8. This provides phase splitting and positive feedback service. The fact that both tubes use a common cathode return, 390 ohms, provides just 100% positive feedback.

The additional resistor from the output transformer secondary gives what in the absence of the positive feedback would be 20-db negative feedback. With the positive feedback, the negative feedback is virtually infinite. Without the negative feedback connected, the positive feedback would make the 6U8 oscillate, which is something out for nothing in or infinite gain. The negative feedback *holds it down* and the gain is only about .5 db more than without the positive feedback.

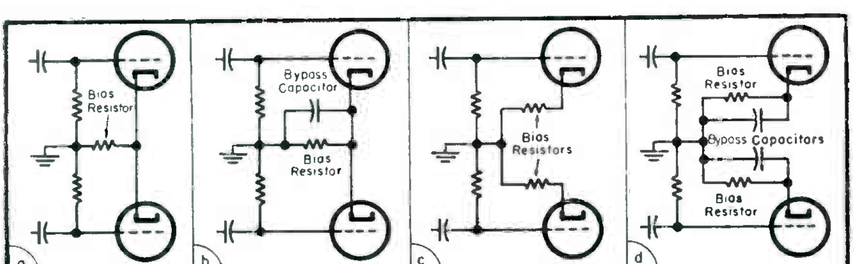
Bias for the 6U8 pentode section is obtained by means of a 150,000-ohm resistor which serves as a high-voltage bleeder from the 340-*v* plus point, to the 390-ohm feedback resistor. Also contributing to the bias is the current through the triode section, which feeds through the 100,000-ohm resistor to the plate and then through the 150,000-ohm unit from the cathode to the top end of 390 ohms.

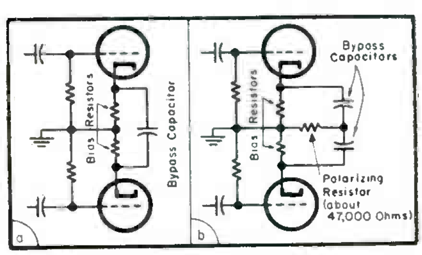
The cathode of the triode section also provides a control for the screen voltage of the pentode section, maintaining it at a relatively low screen potential, about 31 *v*. The pentode plate is directly coupled to the triode grid. The fact, combined with the feed for the pentode screen from the triode cathode, helps to render the circuit quite stable.

If instability at extreme high frequency occurs, one should suspect either the 47,000-ohm resistor or the 100-mmfd capacitor connected between the triode grid and ground.

If the drive for the output stages proves to be off balance, resulting in reduced output, one should check the values of the 100,000-ohm plate resistor of the triode, and of the *effective* cathode coupling, which consists of the 150,000-ohm resistor between the cathodes of the two halves in parallel with 390,000 ohms between

(*Continued on page* 54)





FIGS. 3-4: FOUR TYPES of automatic bias circuitry are shown in Fig. 3 (above). Fig. 4 (right) shows two more circuit types, using separate resistors for each tube, overcoming deficiency of the circuit shown in (d) of Fig. 3.

Outdoor Amplifiers

(*Continued from page* 52)

the cathode of the triode and the screen of the pentode. A break in the .047-mfd capacitor from screen to cathode would throw the balance out, reduce the positive feedback, and cause the pentode to introduce some distortion; mostly second harmonic. Error in any of the resistor values would result in unbalance in the drive to the output tubes.

To achieve maximum output in these amplifiers, horizontal deflection amplifier tubes (6AV5) are used in the output. These can be driven considerably harder than tubes of earlier design with corresponding dissipation. They can also be operated with a class-*AB* arrangement using a considerably higher plate voltage than usual, 540 *v* in this case.

But fixed-bias operation has always brought trouble in small amplifiers, in getting a satisfactory overload characteristic. This has been overcome by using a special screen voltage regulation supply; an *instantaneously*-regulated supply to produce the right voltage to maintain the correct operating conditions for the tube at every instant.

Where earlier fixed-bias circuits would have overbiased themselves as soon as overload begins, this circuit takes the somewhat larger negative bias developed from the grid when overload occurs, and inverts it in the 6CG7 or 6CM7 tube, so as to provide a slightly more positive voltage on the screen. This method of operation serves to *reset* the operating condition so that crossover distortion does not occur.

The method of supplying the screen is much better than a stabilized screen supply using a voltage regulator tube. When this kind of circuit runs into heavy power, the high voltage supply loads down. This normally results in a change of operating conditions reducing the available power from the tube. But in this circuit, the decrease in high voltage supply to the plates also gets fed into the inversion tube, the 6CG7 or 6CM7, providing momentarily a higher screen voltage to keep up the operating power from the tube.

The net result is that the tubes can operate with a really low quiescent current, when no signal is passing, and they automatically adjust themselves to the signal level at any moment.

Modern tube design has also come to the aid of the circuit designer. For two-tube output, providing 30 watts, 6CG7s are used in inverter stages for the voltage regulator. For the 60-watt output, which uses four 6AV5s in push-pull-parallel, the 6CM7 has been found practical. This tube has one triode almost identical with one triode of the 6CG7, while the other one has a transconductance of almost exactly double. This design factor conveniently provides the same operational characteristics for supplying four tubes, without the need to parallel an additional triode with the second half of the 6CG7.

The use of this effective stabilizing circuit does not alter the fact that fixed-bias amplifiers are usually more costly than automatic bias types.

Automatic bias can be used with either common or separate resistors for the push-pull stage. The resistors may or may not be bypassed with capacitor (s). This is shown in Fig. 3 (p. 52). Sometimes the use of a bypass will reduce distortion, dependent on the rest of the circuit; screen returns, in the case of pentode operation. Using separate resistors means each tube is independently biased, so as to accommodate slight differences between individual tubes in a pair, and avoid overdriving one at the expense of the other.

VOM Design—Operation

(*Continued from page* 35)

sary when higher voltages are being read. If the second element were not there, the extremely high resistance developed in the reverse direction would give rise to a high voltage across this rectifier element which would break it down. The presence of the second rectifier element shunts away this current, so as to avoid this harmful rise in voltage.

In a simple sinusoidal waveform and that portion which passes through the microammeter using this rectifier circuit, the average reading is .318 times the peak current. The nominal *rms* value of this current is .707 times the peak value. This means that this rectifier circuit must use a correction factor of .707 divided by .318, or 2.22, somewhere, to give a correct reading. The instrument shunt combined with the series multipliers are arranged to take this correction factor into account.

This means that if the same range is used to measure *dc* in the direction of the half wave used on *ac*, the instrument will give a reading of about twice the reading obtained on the same *rms ac* voltage. On the other hand, *dc* connected in the opposite direction will give no reading at all, because the current will be shunted away through the second rectifier element.

The other kind of instrument rectifier used is the full-wave bridge. Here both half waves of current are used through the instrument and the waveform is converted. In this case the average current measured by the microammeter is .637 times the peak value, while its nominal *rms* value, on which the calibration is based, is .707 times the peak value. So a correction factor of 1.11 has to be used in the instrument.

Thus if *dc* is applied to the *ac* range, either way round on this kind of instrument, the reading will be about 1.11 times the reading given for the same *rms* value of *ac* voltage. In other words, if *dc* is applied to the instrument and the *ac/dc* switch is flipped, there will be a change of the reading in about a 1.11 to 1 ratio.

Therefore, the best method to use to check the kind of voltage we are measuring will depend somewhat on the type of instrument used. In turn, we can check which kind of instrument we have simply by comparing readings obtained on *ac* and *dc* voltages applied to the *ac* range and connected differently.

There is one more set of ranges on which the question of accuracy may arise; these are the ohmmeter ranges of the *vom*. It will be noticed that a *vom* uses a non-linear ohms scale. This is much more widely spaced at one end than the other. Assuming that the resistors used to build out the ohms scale are capable of giving an accuracy of the order of 1% and the microammeter has an accuracy of 2%, then the reading at any point on the scale will be within ±3% *of the current reading* at that point, *not the ohms reading.*

Color-TV Pict-O-Guide Author

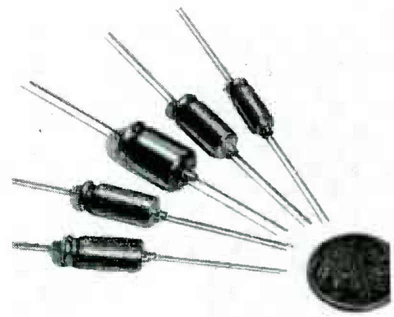
JOHN R. MEAGHER using his color-TV Pict-O-Guide in his laboratory to locate trouble in a color-TV chassis. Guide contains illustrated installation, adjustment, and servicing step-by-step instructions, with full-color photographs taken from an operating TV receiver, supplemented with monochrome illustrations and circuit diagrams. Also included are waveform photos which illustrate signal-tracing methods for localizing troubles in the color circuits (RCA).

COMPONENTS

SUBMINIATURE ELECTROLYTICS

Subminiature aluminum-cased electrolytic capacitors, *TT*, for replacement service in miniature electronic equipment, transistor and battery-powered units, have been developed by P. R. Mallory & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.

Units are available in more than 30 capacity ratings from 1 to 110 *mfd*; from 1 to 50 *wvdc*. Smallest capacitor measures 3/16" diameter by ½" long. Operating temperature range is from −20° to +65° C.



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MINIATURE CAPACITORS

Miniature electrolytics, *ML*, for transistor radios, hearing aids and portable TV receivers, have been introduced by Pyramid Electric Co., 1445 Hudson Blvd., North Bergen, N. J.

Units are hermetically sealed in aluminum cans; also available in ceramic cases.

° ° °

FLYBACK REPLACEMENTS

Three exact replacement flybacks, *HO-269*, *HO-270* and *HO-271*, for Zenith TV sets, have been announced by Chicago Standard Transformer Corp., 3501 W. Addison St., Chicago 18, Ill.

Units replace Zenith part numbers S-22720, S-18125 and S-23438 in 15 chassis and 93 models. Detailed information in bulletin 533.

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APPLIANCE REPAIR AIDS

COFFEE STAIN REMOVER

A COFFEE STAIN REMOVER, *CSR*, for removing stains from coffee makers, has been developed by Maid Easy Cleansing Products Corp., Mt. Vernon, N. Y.

Preparation is said to soak out bitter-tasting residual oils not removed by ordinary cleansing methods and to leave no odor or aftertaste.

° ° °

STEAM IRON CLEANER

A LIQUID CLEANER, *SSS-T*, for removing scale from clogged steam irons, is now available in unbreakable plastic bottles, from Fast Chemical Products Corp., 65 Page Ave., Yonkers 4, N. Y. Said to be good for four cleanings.

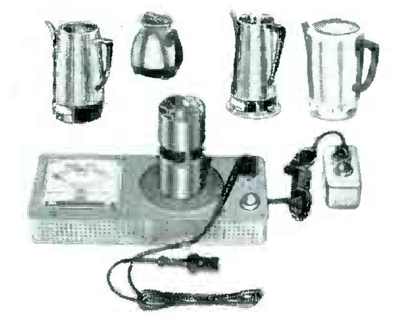
° ° °

FRYER-COFFEE MAKER TESTERS

TWO TESTERS, *Fri-O-Matic* and *Dri-O-Matic*, for checking frying appliances and coffee makers, respectively, with no mechanical contact required to appliances, have been introduced by Elematic Equipment Corp., 6731 S. Chicago Ave., Chicago 37, Ill.

Fri-O-Matic is a self-contained one-unit dry tester with an automatic compensating pyrometer. Instrument dial is graduated in degrees *F* to correspond to thermostat knob setting of frying appliances.

Dri-O-Matic tests coffee makers with bottom side up, to facilitate setting of thermostat on appliance. Setting points corresponding to water temperatures are marked on instrument dial. Unit is self-contained; requires no voltage reducing transformer or resistor.



PERSONNEL

RAYMOND E. WARD has been appointed sales manager for distributor accounts of Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.


Ward


Berger

JEROME BERGER has been named director of sales for the Brach Manufacturing Corp., Division of General Bronze Corp., 200 Central Ave., Newark 3, N. J.

° ° °

HERMAN C. BLOOM has been appointed distributor sales manager of International Rectifier Corp., 1521 E. Grand Ave., El Segundo, Calif.

° ° °

STANLEY J. KOCH has been elected vice president, tube operations, of Allen B. Du Mont Laboratories, Inc., 750 Bloomfield Ave., Clifton, N. J.

° ° °

JAMES L. LEWIS has been named president of Insuline Corp. of America, subsidiary of Van Norman Industries, Inc., 186 Granite St., Manchester, N. H.

° ° °

DONALD G. BROWN has been elected president of the Mid-Lantic chapter of The Representatives of Electronic Products Manufacturers, Inc. . . . JOHN T. STINSON is the new vice president. . . . L. PARKER NAUDAIN has been named secretary, and JAMES P. FARIES is treasurer.

° ° °

HARRY A. FRIEDMAN has been appointed assistant sales manager of General Transistor Distributing Corp., Jamaica, N. Y.

° ° °

LAWRENCE J. EPSTEIN, University Loudspeakers, Inc., has been named chairman of the public-relations committee of the Institute of High Fidelity Manufacturers, Inc., 204 Front St., Mineola, N. Y. . . . Other members of the committee are TOM DEMPSEY, Reeves Soundcraft Corp.; ARTHUR GASMAN, British Industries Corp.; HAROLD REISS, Friend-Reiss Advertising, and ADRIAN PRICE, Wexton Co.

° ° °

HIRAM PRINCE has been promoted to sales manager of Permo, Inc., 6415 N. Ravenswood Ave., Chicago 26, Ill. . . . CHARLES WEIGAND is now chief engineer.

° ° °

HERBERT G. KRUMICH has been appointed sales rep in the metropolitan New York area for the electronic tube division of Westinghouse Electric Corp., working out of the Bloomfield, N. J., sales office.

° ° °

W. E. BOSS has been promoted to director, color television coordination, for RCA.

FULL COLOR TV

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TELEVISION ANTENNA ROTATOR

MODEL U-98—first and finest fully automatic rotator. Eye-appealing decorator colors—Ivory, Forest Green and Standard Mahogany Grain. Retail **$44.25**

MODEL T-12—with exclusive Tenna-Teller Pointer—highly accurate. Striking, modern design. Forest Green and Ivory or Standard Mahogany. Retail . . . **$34.25**
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DON'T ASK VIEWERS TO PUT UP WITH A 'STAY-PUT' ANTENNA!

- TV authorities admit the higher sensitivity of color.*
- Viewers won't tolerate weak, washed out color!
- Maximum directivity with ALLIANCE TENNA-ROTOR is the best insurance for top antenna performance—for FULL COLOR!

Wherever you find Color TV, it will pay you to recommend Alliance!

Every color TV buyer is a potential Tenna-Rotor sale . . . even in metropolitan areas. Because the ***"fringe"*** area for color is closer to the transmitter! Viewers who might tolerate black and white TV that's "so-so", will ***not*** put up with irritating, "ghosty" color. And independent interviews ***at point of sale*** show that color TV customers find it ***easy*** to say Yes to Alliance Tenna-Rotor!

******Practically all TV authorities agree "color is critical"—more sensitive than black and white. "Chromatic gradation" with color that's ghosty, is harder on the eyes than black and white. Many recommend properly installed outdoor antennas with rotators, to improve directivity of the antenna, to help overcome interference and reduce annoying effects caused by the higher sensitivity of color, and the normal characteristic of **color** to "drop out" quicker.*

Ride the Trend to Color . . .
and soak up those extra profits with Alliance! Tie in with the longest and strongest TV campaign in TV accessory history! Remember . . . Poor color is worse than no color . . . and Alliance Tenna-Rotor is the sensible answer!

THE ALLIANCE MANUFACTURING COMPANY, INC.
(Division of Consolidated Electronics Industries Corp.)
ALLIANCE, OHIO
In Canada—ALLIANCE MOTORS, Schell Avenue, Toronto 10

For

"ROLL-OVER"

...prescribe

RCA TUBES

- Proved by acceptance
- Proved by performance

When the picture's bright,
But won't stand still,
Rolls like a barrel,
Going down hill...

here's good advice: *check the vertical oscillator and amplifier tubes!* It may be time to prescribe fresh tubes —RCA High-Quality types.

Why RCA? Because these tubes have controlled cutoff characteristics and high output efficiency—essential qualities required for stable sync performance. RCA Tubes are manufactured to high standards of electrical uniformity. No tube juggling to fit the circuit. You can replace right "out of stock." Reward yourself with fewer callbacks. Always carry RCA Tubes in your tube caddy—and on your shelves.

HERE'S A TIP

Make your store window-display interesting. Remember, the public judges your shop by what they see—make sure your neighbors see you at your best. Ask your RCA Tube Distributor for dramatic sales-stimulating RCA window display materials.

RECEIVING TUBES

Radio Corporation of America
® Tube Division Harrison, N. J.