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MAY 1968

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55804

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EFFECTIVE 8/1/67

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# ELECTRONIC TECHNICIAN / DEALER

WORLDS LARGEST ELECTRONIC TRADE CIRCULATION

MAY 1968 • VOL. 87 No. 5

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**DEAN GREENER**

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## COVER

The smiling miss on this month's cover demonstrates the increasingly popular use of CB radio for outdoor sports

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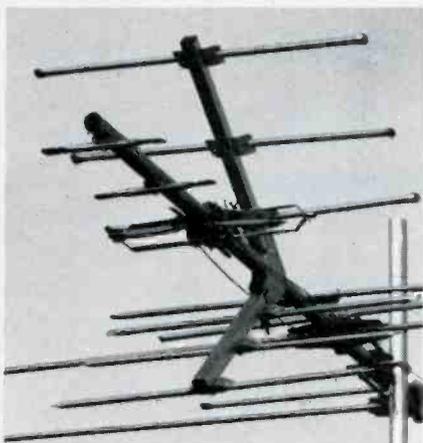
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# New RCA advances will change your thinking about antennas and rotators.

The era of compromise is over! Formerly, a UHF corner reflector (long known as the finest antenna for UHF reception) could not be combined with a VHF antenna without sacrificing gain on the VHF band. Now, RCA engineers who have had the experience of working on antenna space projects, have developed a corner reflector that doubles as a VHF director and actually *increases* gain.



High-gain UHF corner reflector with built-in VHF-UHF crossover network, also acts as VHF director.

The new RCA COLOR POWER combination antennas are the first broadband integral antenna design to deliver high gain and sharp directivity on both UHF and VHF bands—resulting in clear, crisp reception on Color and Black & White TV. The secret is in the combining network and balanced phasing lines. Note the parallel connecting bars in photo. They stay parallel, because they're thick aluminum strips, rather than wires that easily bend. Installation is fast because of



Balanced phasing lines, of rugged aluminum, stay in shape.

snap-lock elements. Ghost rejection is great, because of designed-in, deep electrical nulls resulting from straight, parallel dipoles and completely balanced design. All strong, tubular aluminum construction.

Until now, a rotator drive unit could have problems coping with wind, icing and large antenna loads. Now, RCA introduces a new dimension in antenna rotators with exclusive pre-turning momentum, that develops the torque necessary to handle such situations. Heavy-duty, rugged clamps also prevent mast slippage that can develop under these conditions.

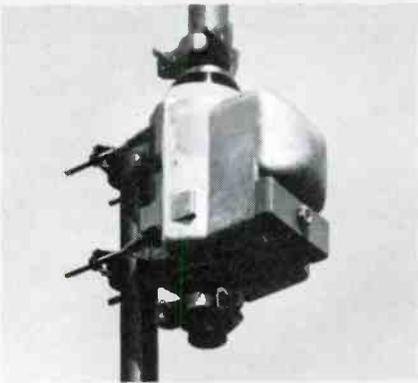
These new RCA rotators have the non-slip ruggedness of a main drive gear that's part of the shaft, meshed to a rugged worm drive.

RCA's exclusive over-running gear clutch permits motor momentum to develop before turning the mast—assuring the torque that is necessary to move heavy loads. You'll like its easy installation. The terminal board cover has an attached captive thumb nut. Weather resistance is assured by a plastic shield. High strength, light-weight aluminum housing results in less load on the supporting mast.



Rotator control is solid-state designed, to prevent mechanical wear and synchronize with drive unit.

RCA's rotator control unit was designed to please the decor-conscious housewife, as well as the family's TV fans. The RCA 707 is completely electronic too, for longer life.



Pre-turning momentum, for ice-breaking torque, is attained in RCA rotator drive unit.

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## LETTERS TO THE EDITOR

### Old Tubes

We have a large stock of old and odd tubes. If any ET/D reader is having trouble locating a certain type of tube we would be glad to be of assistance.

J.W. ADAMS  
Enterprise TV  
420 No. College

Fayetteville, Ark.

### Schematics, Manuals and Miscellany

Need a schematic for a Model 660 Senior tape recorder, serial No. 9116, manufactured by Freeman Electronics Corp., Los Angeles, Calif.

CLIFFORD CHRISTIANSON  
Clif's Electric

Zahl, N.D.

... Can an ET/D reader supply me with a schematic and parts list for a Model 650A signal generator, manufactured by the Superior Instrument Co. I have had no success in trying to contact this company and any help would be appreciated.

RAYMOND E. OMLOR  
2311 Holyoke Ave.  
Bradenton, Fla. 33505

... I need a schematic and alignment information for a B.F. Goodrich (Mantola) radio, Model 11-701. Can an ET/D reader help me?

ALFRED G. JOHNSON  
1939 Arbor Dr.  
Burlington, N.C. 27215

... Can any ET/D reader tell me how I can obtain a schematic, operating and service manual for an Omega Electronics stereo transistor amplifier, Model 1600?

HOWARD W. BENZ  
3390 Lownesdale Rd.  
Cleveland, Ohio 44112

### Welcomes Printed Circuits

Your December 1967, Letters to the Editor carried comments by Heinz Neuman bemoaning the lack of service-oriented thought in the design of electronic equipment. I must agree with the basic thought behind the letter, but I do not agree with his opinion of printed circuits.

Standardization of parts is something all technicians would welcome with open arms, and serviceability of equipment in most cases leaves a lot to be desired. The way to scotch such

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## LETTERS TO THE EDITOR

inept design would be to require each design engineer to spend six months in the field servicing his own equipment. But that day will never come. As far as hand wiring vs printed circuits is concerned, I would personally work on a PC set five times before I would even look at a hand-wired job. I have found poorly soldered and unsoldered joints, hidden parts and slipshod lead dress in hand wired equipment. Tracing a PC circuit is definitely easier because all the wiring is in plain view. Nothing is more nerve wracking than trying to trace a wire in a cable half the size of your wrist only to find three or four wires of the same color emerging from the opposite end.

As for "standards going out the window when printed circuits came in," I respectfully call Mr. Neuman's attention to the 500-odd tube types in the commercial category alone. Many of which would be interchangeable except for basing. The manufacturer he lauds so highly is one of the greatest offenders in this category, adding 10 to 15 tubes to the technicians already bulging caddy every year.

Printed circuits offer another, the bonus of highly stable circuit response from one set to the next. Because most of the wiring is fixed to the board, voltage loops, changes in distributed capacity and arc-overs because of sloppy lead dress are almost nonexistent.

I don't think a parallel can be drawn between starting salaries of college professors and apprentices of any service-oriented profession. Most college professions are based on the knowledge of material which can be collected in books and taught in the classroom. A service technician, no matter how well taught, does not really reach his full value until he has a few years of actual experience under his belt. No amount of book-reading or teaching can give you that "its the coupling capacitor" feeling as soon as you look at the screen of your best customer's color set. How far you go after you have gained that experience is really up to you and your own initiative.

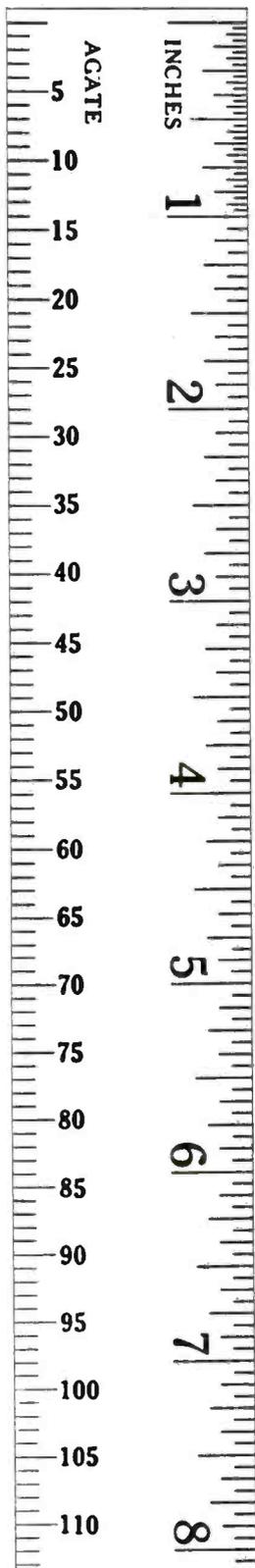
Mr. Neuman's "old ideas are the best ideas" attitude may have its applications, but I would like to have seen him carrying his all-wave, around-the-world radio to the beach 40 years ago.

JAMES C. SINK

Birdsboro, Pa.

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## EDITOR'S MEMO

### Short-Timer to Technician

We have all heard reports about the shortage of technicians. Almost every journal in the trade says something about it. It's a true enough situation, but not a hopeless one. Nor is it one which is going along as unnoticed as a dull play.

As much as three years ago many service-dealers in the country took it upon themselves to do their own technician recruiting and training. They joined with high schools in work programs. The student interested in electronics could spend his mornings in the classroom, then work as an apprentice technician in a shop which graded him on his efforts, skills and ability to learn. Additionally, the apprentice gains scholastic credit as in any regular school course, and at the same time earns his own spending money.

Service-dealers who participate in these training programs say that the results are excellent. Many of the young men learn quickly and become valuable full-time technicians after graduation. Many continue on to engineering degrees because of their exposure to electronics and spend their summer vacations gaining valuable practical experience in shops.

The government's Dept. of Defense (DOD) also has a plan to stimulate young men into learning specialized trade skills. Servicemen in line for discharge are being given the chance to learn a civilian skill in a program sponsored through the cooperation of the Service Technician Development Program (STDP) of the EIA Consumer Products Div.

This newly planned venture calls for a specialized short-term course designed to prepare exiting armed services personnel for jobs in civilian life. Army and Navy short-timers in the Chicago area are the first of the trainees who will soon take their place as consumer electronics technicians.

It is a long-term, manufacturer-sponsored program to increase the ranks of electronic technicians, and will eventually be projected into military bases in other states as soon as the pilot project in Chicago gets under way. Industry lends the equipment for the project. The DOD provides the facilities, and with the cooperation of the STDP they select and place the candidates.

It all seems to bear out the simple fact that problems of education can be ironed out through a common effort on behalf of all the affected parties.

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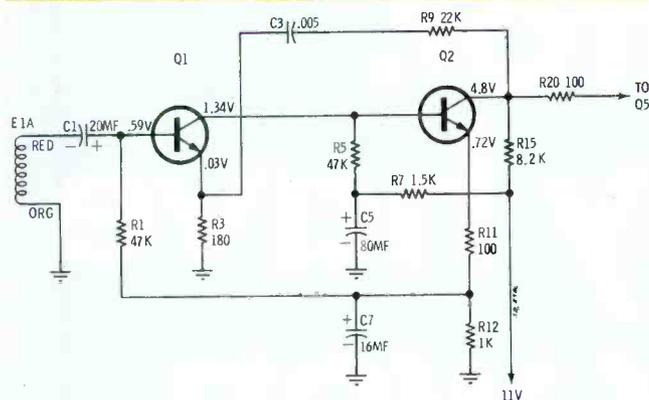
# TECHNICAL DIGEST

## MOTOROLA

### Tape Player Model TM706 — Circuit Descriptions

#### Preamp Circuit

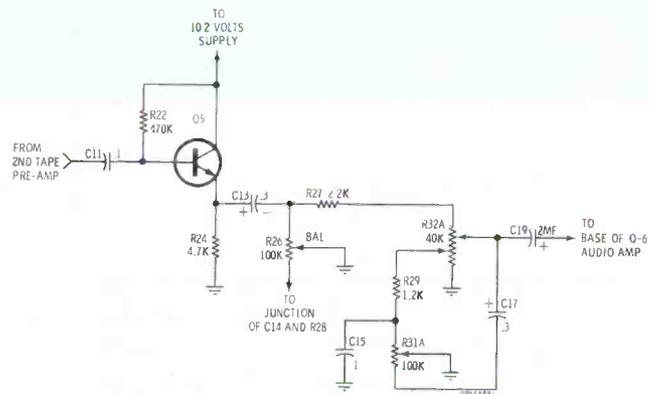
The tape preamp circuitry shown is for the left channel, since the right channel is a duplicate of the left. E1A is the left channel portion of the tape head. The 1st preamp tran-



sistor, Q1, is a NPN silicon type, specially selected for low noise applications. Direct coupling between the collector of Q1 and the base of Q2 is used for better frequency response. The feedback network, consisting of C3 and R9, is used for tone shaping because of characteristics in the tape and playback head.

#### Emitter Follower Circuits

The emitter follower, Q5, is used to match the relative high impedance of the collector circuit of the 2nd tape pre-amp Q2, to the low impedance volume control and base



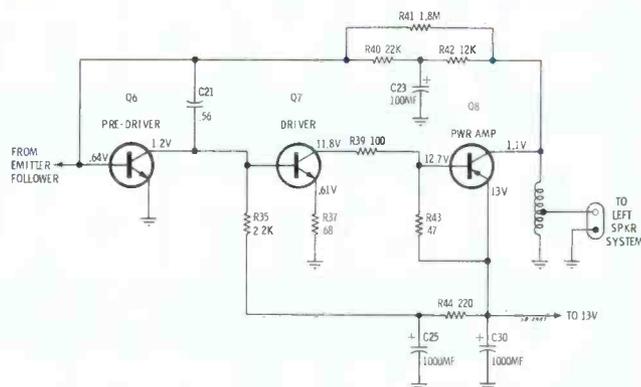
circuit of the audio predriver, Q6. The forward bias for the emitter follower is furnished by Q5. The output of Q5 is developed across load resistor R24. Audio to the volume control is coupled by C13.

#### Audio Output Section

Shown in diagram is the left channel output circuit. Transistors, Q6 and Q7 are NPN silicon types. The popular PNP germanium type, Q8, SP1556-2 is also used. The predriver, Q6, is a high gain, low level, stage with its collector connected directly to the base of Q7, the driver transistor, and becomes a part of Q7's bias network.

#### Thermal Stability

Temperature stability is built into the bias network in-



stead of depending on a thermistor for temperature compensation.

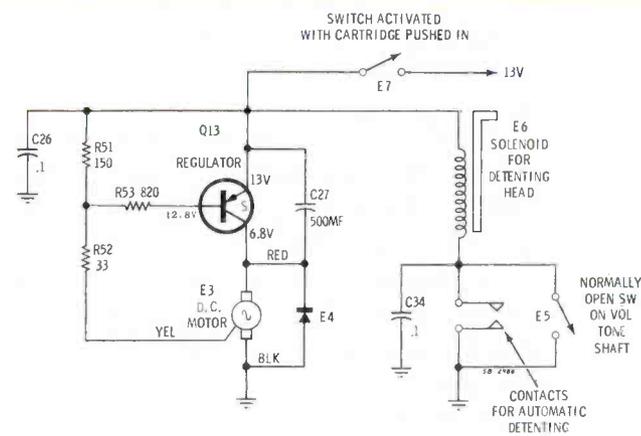
As the collector current through the output transistor, Q8, increases (because of an increase in temperature), its collector voltage will increase. This voltage is coupled by R42 and R40 back to the base of the predriver, Q6, causing it to conduct harder and in turn causes the driver, Q7, to conduct less. This decreases the forward bias on Q8, preventing thermal runaway.

Note that forward bias for Q6 is obtained from the collector of Q8. Therefore, if Q8 does not conduct, Q6 will have no forward bias. Also, if Q6 becomes open or is cut off, Q7 will have maximum forward bias, causing both Q7 and Q8 to conduct hard, with possible damage to the output circuit.

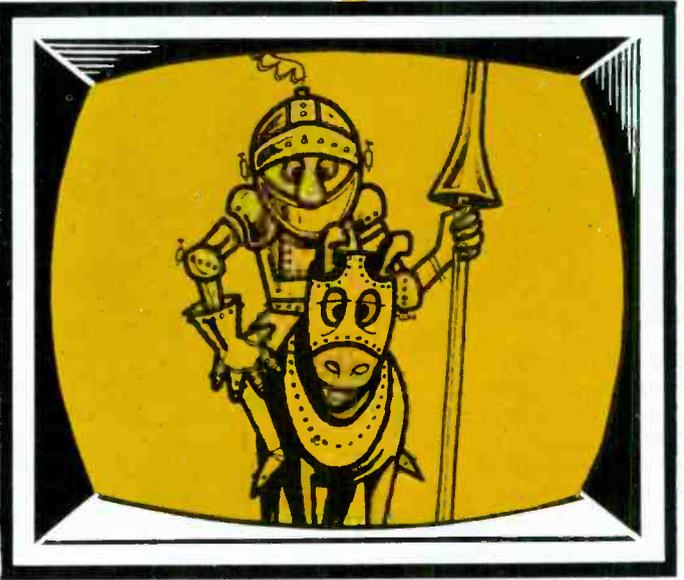
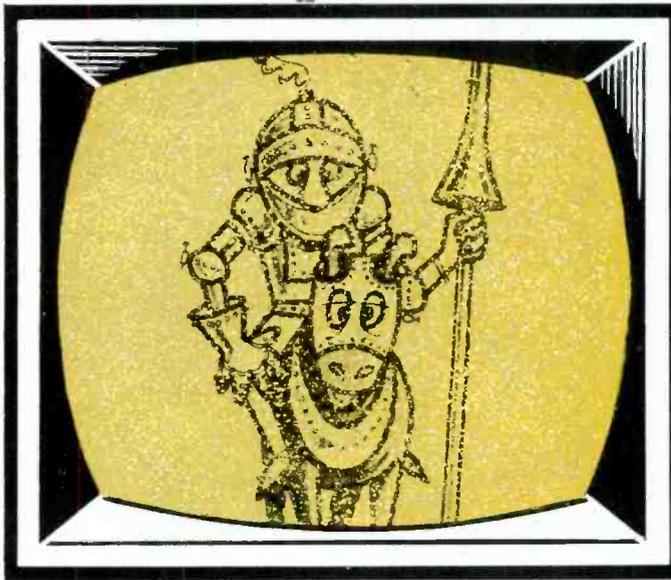
Proper output load (8  $\Omega$ ) is important in this circuit. Shorting the output to ground, for example, may increase the collector current of Q8 by as much as 1 amp.

#### Motor Regulator Circuit

Shown in diagram is the transistor regulator circuit. When the tape cartridge is inserted, microswitch E7 is closed and 13v is applied to the emitter of Q13, the regulator transistor. A network consisting of R51 and R52 and the closed motor governor contacts forward bias Q13 into conduction, thereby applying voltage to the motor. When the motor exceeds 3000rpm, the resultant centrifugal force opens the governor contacts, hence, no current can flow through R51 and R52 and no difference potential exists between base and emitter of Q13.



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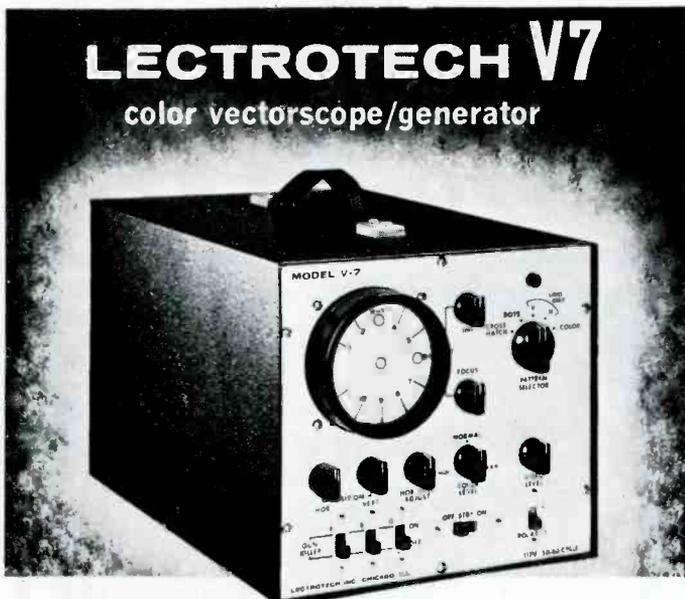
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## TECHNICAL DIGEST

With the base and emitter both at 13v, Q13 is zero biased (cutoff) and the voltage across the motor is switched off. This switching on and off of the motor voltage occurs at a rate of 100-200 times a second. The 500  $\mu$ f capacitor (C27) is used to establish a constant dc bias level. The 0.1  $\mu$ f capacitor (C26) eliminates any decaying type noise that could exist when the tape cartridge is pulled out and the motor slows down.

Voltage regulation for the motor is provided by Q13 which can be considered a variable series impedance which varies with changes in its bias, resulting in a constant 7-8v at its collector which is applied to the motor.

Diode, E4, is placed across the motor to prevent transient spikes from damaging the transistor.

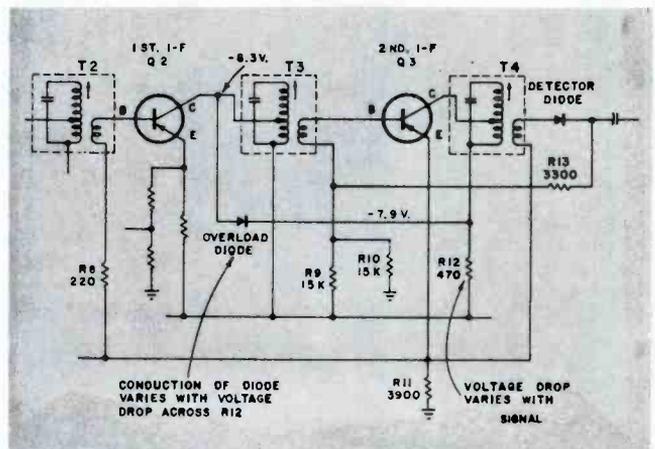
C27 filters noise generated by the motor from appearing in the B+ circuit.

## RCA VICTOR

### TV Chassis KCS153 — Transistorized AGC Circuits

Since the strength of radio and TV signals vary greatly from station to station and from one locality to another, it is important that some provisions be made in the receiver circuits to "level off" these variations.

Automatic gain control (AGC) circuits are employed to accomplish this. In tube-type circuitry, the "remote cut-off" type tubes permit using a bias voltage (derived from the incoming signal) to vary the over-all gain of the receiver.



In solid-state circuitry, this becomes more difficult since the transistor is basically a "sharp cut-off" device. Many radio receivers use the overload diode to accomplish a measure of "AGC."

In this circuit, an increased incoming signal causes an increase in voltage drop on R12 (see illustration), which causes the overload diode to conduct. This produces a "shunting" effect on the primary of T3 which reduces the gain.

The transistorized TV chassis employs a special AGC circuit which controls the gain of the RF amplifier and 1st IF amplifier to achieve AGC action.

The system consists of a closed loop made up of the AGC gate, the RF amplifier, IF amplifier, 1st video amplifier and back to the AGC gate. The circuit maintains a constant voltage at the emitter of the 1st video amplifier over a wide range of signal inputs.

It is a "gated" or keyed AGC system in which an AGC

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# RCA

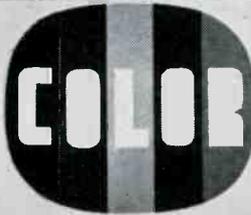
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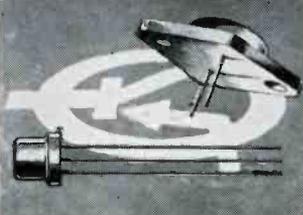
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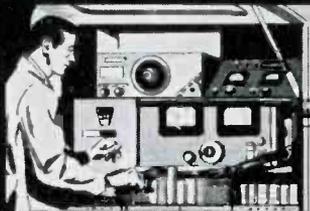
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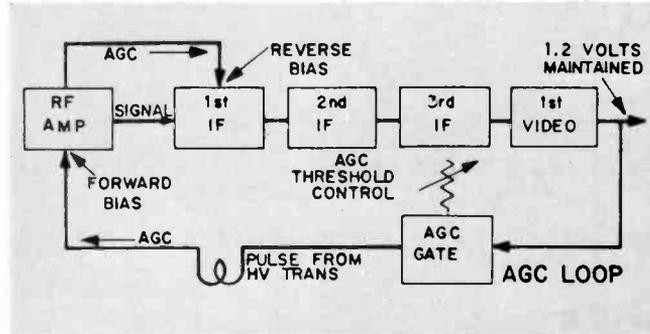
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## TECHNICAL DIGEST

voltage is developed at horizontal sync time and sustains for the duration of horizontal scan time. Sync tips only are employed to produce the control voltage; the system is noise immune and not affected by scene variations.

Operations of the AGC circuits are as follows: As signal increases at the antenna, the output of the 1st video amplifier tends to increase. The increased video level is applied

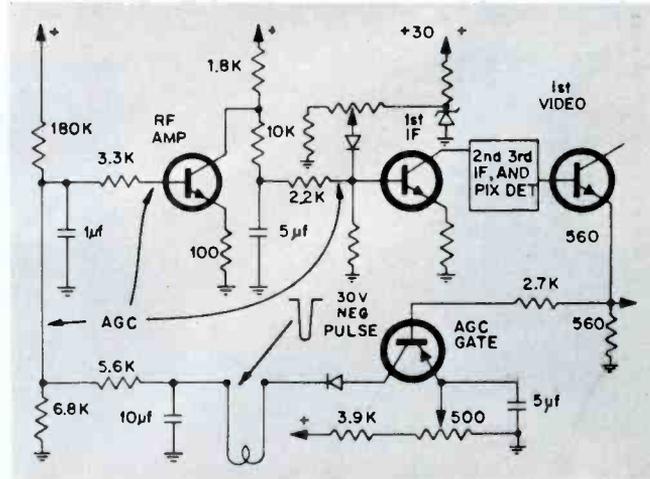


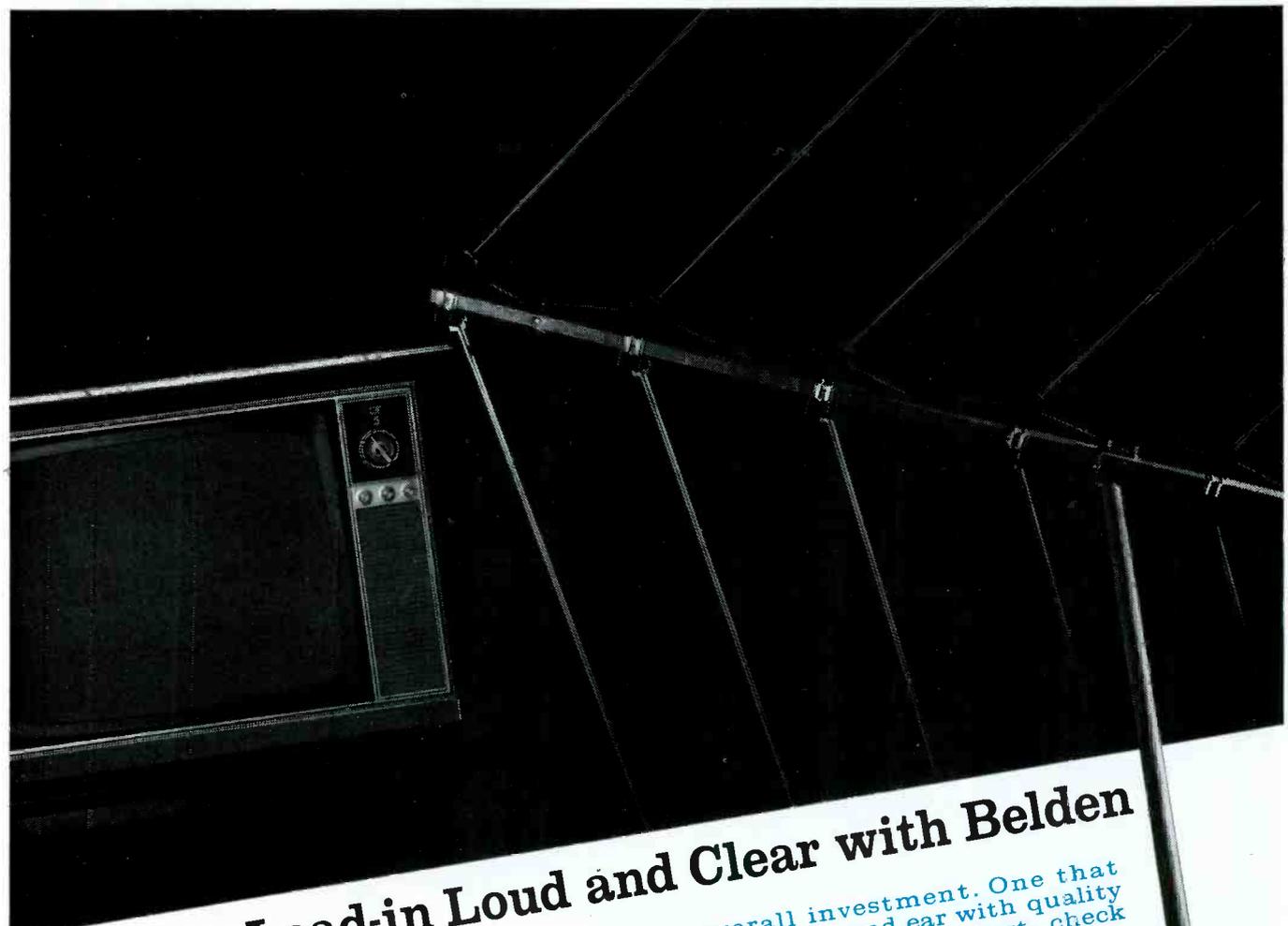
as an input signal to the "AGC gate." The AGC gate is rendered operative at horizontal sync time by a 30v negative pulse from the HV transformer which is applied to the collector of the AGC gate. At that time, the AGC gate amplifies the sync signal which is simultaneously occurring at the base. A positive AGC voltage is then developed, this is retained during scan time by the long-time constant of the AGC bus. To prevent the collector-to-base junction of the AGC transistor from becoming forward biased by this developed AGC voltage, a diode is inserted between the AGC gate collector and the AGC bus. The positive AGC voltage so formed is then applied as forward bias on the RF amplifier transistor. This reduces the gain of the RF stage.

The RF amplifier then serves a "dual" role. In addition to its function as an RF amplifier, it amplifies and inverts the AGC voltage variation, delivering it to the base of the 1st IF amplifier as reverse bias. This reduces the gain of the 1st IF amplifier.

It should be noted that either reverse bias or forward bias will cause a reduction of gain in a transistor amplifier. In one case, the cutoff characteristic of the transistor is employed and in the other the saturation characteristic is used.

In this manner both the RF amplifier and the 1st IF amplifier act to reduce the gain of the system.





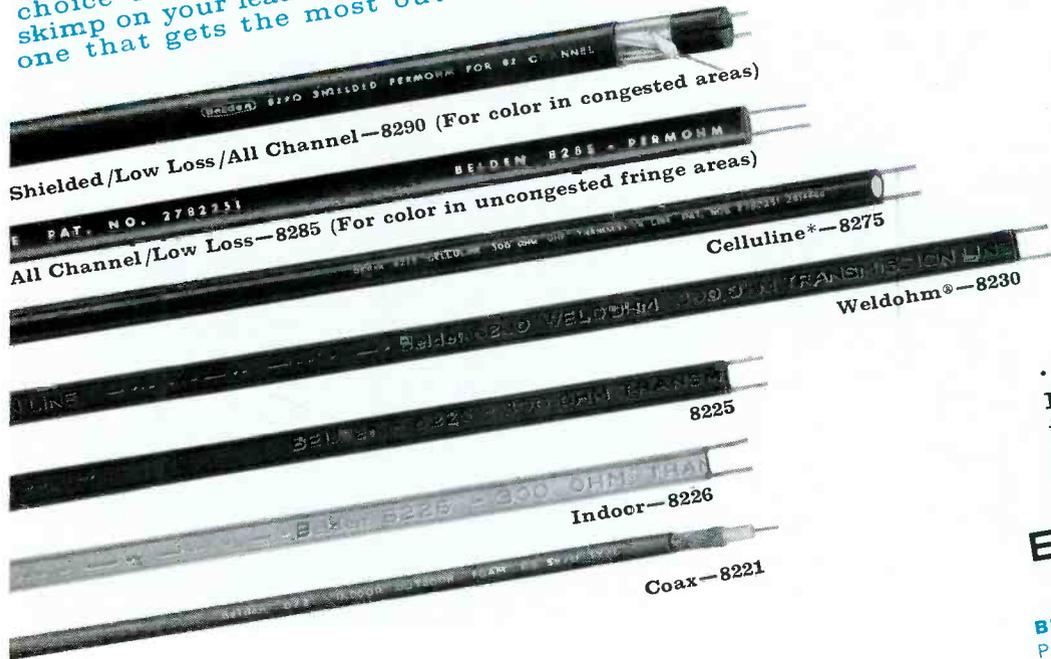
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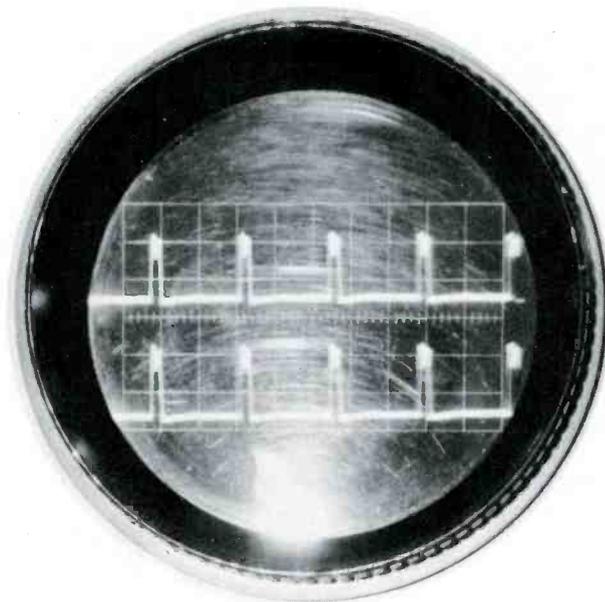
Delco Radio, Division of General Motors, Warren, Indiana.



Part one of a two-part series

# Move Up to a Triggered-Sweep Dual-Trace Scope

Learn what advanced servicing techniques can do for your business



■ You can perform troubleshooting jobs in rapid-fire order by using a lab-type scope. It can do more than any other instrument to firm up your service stance. Much of your future work will require a scope of this caliber and even now a lot of troubleshooting jobs can be simplified if you have one and learn how to use it effectively.

Not many TV radio service shops now have a lab-quality, triggered-sweep, dual-trace scope. But more shops will have them when the competition gets keener. Until you use one, you can't imagine what an asset it can be for fast, accurate and efficient troubleshooting.

Many advanced servicing procedures can be carried out with the aid of a triggered-sweep scope and squarewave generator. Checking RC multicomponent networks, molecularized units and micromodules are only a few jobs it will do. The dual-trace scope can troubleshoot ICs and isolate defective sections fast.

Certainly, you can use an external electronic switch (flip-flop) instead of a dual-trace scope. But one problem may arise: instability of the dual-trace and some interaction of alternate traces. Also, in

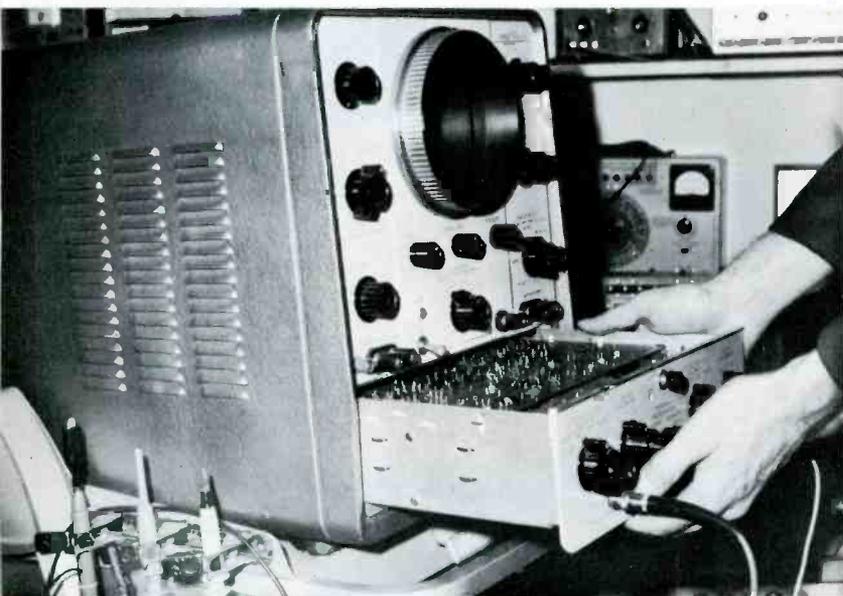


Fig. 1 — Plug-in dual-trace amplifier partially removed from scope.

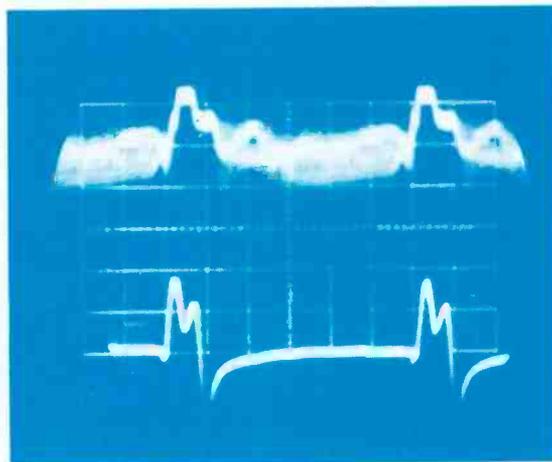


Fig. 2 — Two different phenomena being displayed on dual-trace amplifier scope.

certain work, a rather high-speed switch is necessary — which runs into considerable money. And when it comes to isolating slight distortion in a stereo amplifier or other minute defects which present-day discriminating customers are sensitive about, you cannot beat the fast rise-time and sweep stability of a lab scope. If you can't afford to shell out a "grand or two" for this type scope, some used ones are available at a reasonable price. You can start with a used one and upgrade later.

#### Why Use a Lab-Type Scope?

First, a lab-type scope has excellent power supply voltage regulation. This gives a rock-steady trace on the scope screen and waveforms that won't jump up and down, quiver and waver.

It has been conservatively estimated that only about 50 percent of the technicians in electronic home-entertainment equipment servicing use a scope for troubleshooting. And we suspect one reason is because most waveforms they observe hop around on the screen, drift out of sync and are generally unstable.

Lab-type scopes are P-P voltage and sweep calibrated, which means the vertical and horizontal amplifiers are calibrated for volts per cm

P-P for pulse amplitude measurements. The horizontal beam's sweep speed across the scope screen is also calibrated for sweep time per cm/seconds, milliseconds or microseconds. Pulse duration and pulse rise-time can be measured — great for measuring transistor pulses' on-and-off time.

What is all this business about triggered sweep? This means simply that the pulse you're checking will trigger the horizontal time-base saw-tooth oscillator into action. And this makes for stone-steady waveform display.

Some have delay lines in the vertical amplifier so the triggering pulse may be viewed. Of course, the sweep may be set for free-running time, also.

On a free-running sweep the rise and fall time of a squarewave cannot be measured because the edges would be compressed. Also the leading and trailing edge of the squarewave cannot be expanded. Random pulses or waveforms can also be effectively displayed with triggered sweep.

Most lab scopes can be set for a one-shot sweep. That is, a triggered sweep is obtained by using a one-shot (overbiased) sweep oscillator. Whenever a positive-going leading edge is applied by the incoming sig-

nal, the sweep oscillator responds with one output sweep cycle. These scopes are normally provided with sync phase inverters so the sweep oscillator can be triggered by either a positive or a negative-going pulse signal.

For more exacting troubleshooting, a synchroscope deflection is required. By this method, the triggered scope can place small sections of a waveform (like the 3.58MHz color burst) under high horizontal magnification. Some scopes also have high vertical magnification. A small section of a waveform can be expanded both horizontally and vertically for a better look.

#### Like Looking through a Microscope

A dual-trace amplifier plug-in unit pulled out for inspection is shown in Fig. 1. Other amplifier types may be plugged into this scope. This dual-trace scope will simultaneously display and permit observation of two phenomena (see Fig. 2). The scope has two identical input channels, each having a frequency response only 3db down from dc to 10MHz. These two channels identified as "A" and "B" inputs, can be operated individually or simultaneously. In the simultaneous mode, the scope provides a

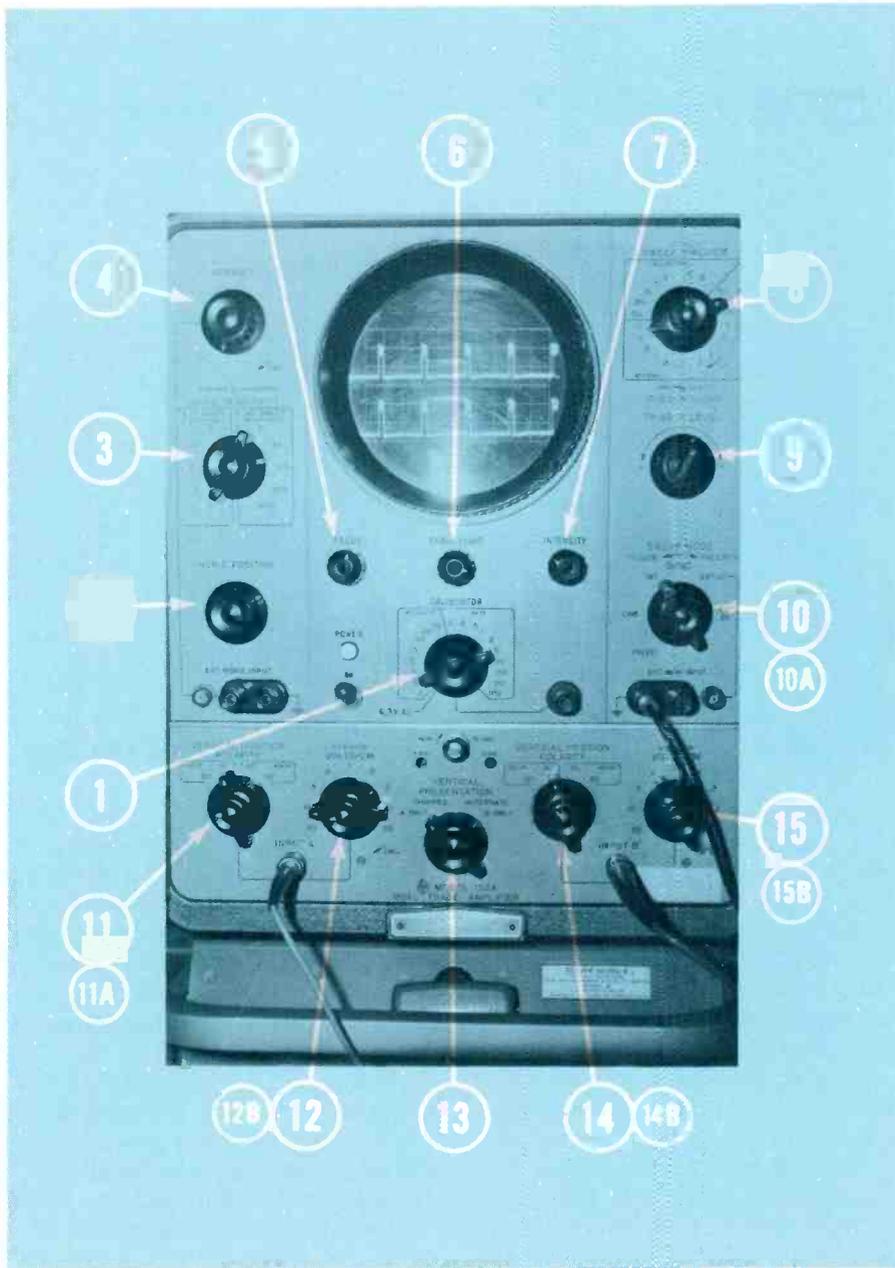


Fig. 3 — Front panel controls on Hewlett-Packard model 150A dual-trace scope.

choice of electronic switching at about a 100kHz rate of electronic switching on alternate sweeps. ("Sweep" refers to the horizontal deflection of the trace.) You can also choose a highgain single-trace, a fast rise or a differential-input plug-in unit. The differential unit provides the difference between two vertical-input signals, rejecting the common-mode signal.

#### A Typical Professional Triggered Scope

Let's look at a Hewlett-Packard model 150A scope using a model 152A plug-in dual-trace amplifier.

The controls and their functions will be explained. It may look complicated but it really isn't. And it's just as easy, or easier, to set up and adjust as an ordinary service scope.

Study the controls shown in Fig. 3. The numbered controls in the photo are pinpointed as follows:

- 1). CALIBRATOR SELECTOR. A nominal 1kHz squarewave is available at the front-panel connector; provides measurement voltages from 0.2mv to 100v P-P.
- 2). HORIZONTAL POSITION. For adjusting horizontal trace position of waveforms on CRT screen.
- 3). HORIZONTAL SENSITIVITY. Makes

it possible to magnify up to 100 times. X1 is the unmagnified sweep position. Also EXTERNAL horizontal amplifier control.

4). VERNIER. Horizontal amplifier vernier control gain.

5). FOCUS. Beam focus control for a sharp trace.

6). SCALE LIGHT. Controls light source for graticule markings.

7). INTENSITY. Controls brightness of beam pattern.

8). VERNIER. Sweep time/cm. Select proper horizontal sweep speed with the sweep time/cm control. Set vernier in CAL position when direct reading of sweep time/cm is desired.

For horizontal TV waveshape set control at 10  $\mu$ s (microseconds).

For the TV vertical pulse set control at 1ms (millisecond) position.

9). TRIGGER LEVEL. Set trigger slope for triggering on positive or negative slope, as desired. You can adjust trigger level to start trace at desired pulse level.

10). SYNC. Set for internal, external or line sync as desired.

10A). SWEEP MODE. Small control. Set this for a triggered or free-running sweep like on a service scope.

Dual trace amplifier plug-in control numbers include:

11). POLARITY. Input A, ac, dc positive up or negative pulse up.



Fig. 4 — Tektronix type 310 single-channel triggered scope.



Fig. 5 — Hickok model 770A scope.

11A). VERTICAL POSITION. Small control moves beam up or down on the CRT.

12). VOLTS/CM. Calibrated ranges for adjustment of vertical amplifier gain.

12A). VERNIER. Permits continuous adjustment of vertical gain.

13). VERTICAL PRESENTATION "A" input or "B" input only can be used. Switch to alternate or chopped for dual-trace waveshape presentation.

14, 14A, 15, 15A). These controls are the same as for "A" channel adjustments.

Since the dual trace amplifier scope permits simultaneous observation of two signals, these two traces can be presented alternately or chopped, depending on the frequencies of the input signals. Chopped presentation is useful for comparing two inputs that require a relatively slow sweep speed. In this presentation the vertical input is alternately switched between channels at a 100kHz rate.

When using either chopped or alternate sweeps for viewing related signals, the scope should be set for EXT SYNC and either the A or B channel waveform connected to the EXT SYNC INPUT terminals. If the two inputs are not related in frequency, however, the scope may be set for INT SYNC. For best results

with internal sync, the two traces should be as close together as possible.

The dual channel amplifier contains a switching multivibrator for switching the two channels off and on during alternate operation. A high negative bias converts the free-running multivibrator to a bistable flip-flop. At the end of each sweep, a signal from the sweep generator switches the multivibrator from one channel to the other, thus providing alternate presentation. This arrangement gives the effect of a dual trace and permits two signals to be compared directly on the scope's screen.

There are, of course, dual-beam scopes available — two electron guns in one CRT and two completely separate isolated vertical amplifiers; no interaction here (lots of fun with a gadget like that). Oh well, we can dream a little, I guess.

### Single-Channel Triggered Scopes

Triggered single-channel scopes can also be put to good use by professional technicians. If you cannot obtain a dual-trace scope or one that does not have provisions for a plug-in amplifier, the single-channel triggered scope may be your answer. Note the Tektronix type 310 small

portable industrial scope shown in (Fig. 4). It has 18 calibrated sweep rates, horizontal 5X expansion and of course, triggered sweep. It also has flat vertical amplifier response from dc up to 4MHz. This is indeed a useful instrument to have around the shop.

Hickok makes a model 770A scope (Fig. 5). It is a rugged accurate instrument — especially designed for professional technicians. It's a versatile instrument and may be used in a large number of applications. Some of the 770A's design features are as follows: 5in. flat face CRT; 18 calibrated sweep rates, accurate to within  $\pm 3$  percent, from 0.5 sec/cm to  $1 \mu\text{s/cm}$  (with 5X expansion to  $0.2 \mu\text{s/cm}$ ); a calibrated vertical amplifier with a sensitivity of 0.01v/cm to 50v/cm; trigger controlled sweeps; and 4MHz response to provide true pulse reproduction.

As with any instrument the operator must become proficient at interpreting the waveforms on the scopes CRT.

The next and concluding article of this series will deal directly with troubleshooting techniques using a triggered-sweep, dual-trace scope. Difficult-to-perform FM stereo and color TV checks will be covered. ■

# SERVICING COLOR TV HORIZONTAL SWEEP CIRCUITS

Learn how to quickly diagnose and eliminate troubles in color TV horizontal sweep circuits

■ The first article of this series (ET/D January 1968) discussed the essential differences between the horizontal sweep systems of B/W and color sets. Preliminary servicing procedures, some trouble symptoms and troubleshooting techniques were discussed. The article ended with a case history concerning an RCA CTC17X chassis. Further case histories will be covered here.

### Case Histories

The screen of this Zenith 25MC36Z chassis would go black when changing channels and the customer said the horizontal output tube had been replaced two times within a brief period. This trouble would not show up

when we made a call to the home, so with the owner's permission, we removed the chassis to the shop.

In the shop we noted a loss of HV and drive pulses when the set was switched to an unused channel. A scope check confirmed that the horizontal oscillator would stop operating and the plate of the 6JS6A would begin to glow red.

All voltages on the 6U10, V20 (see Fig. 1) horizontal oscillator tube were normal and X4, X5 horizontal phase detector diodes checked OK. A fresh 6U10 tube was installed and the set worked perfectly.

A tube tester confirmed that the horizontal control section of V20A was a little weak. Evidently, when the

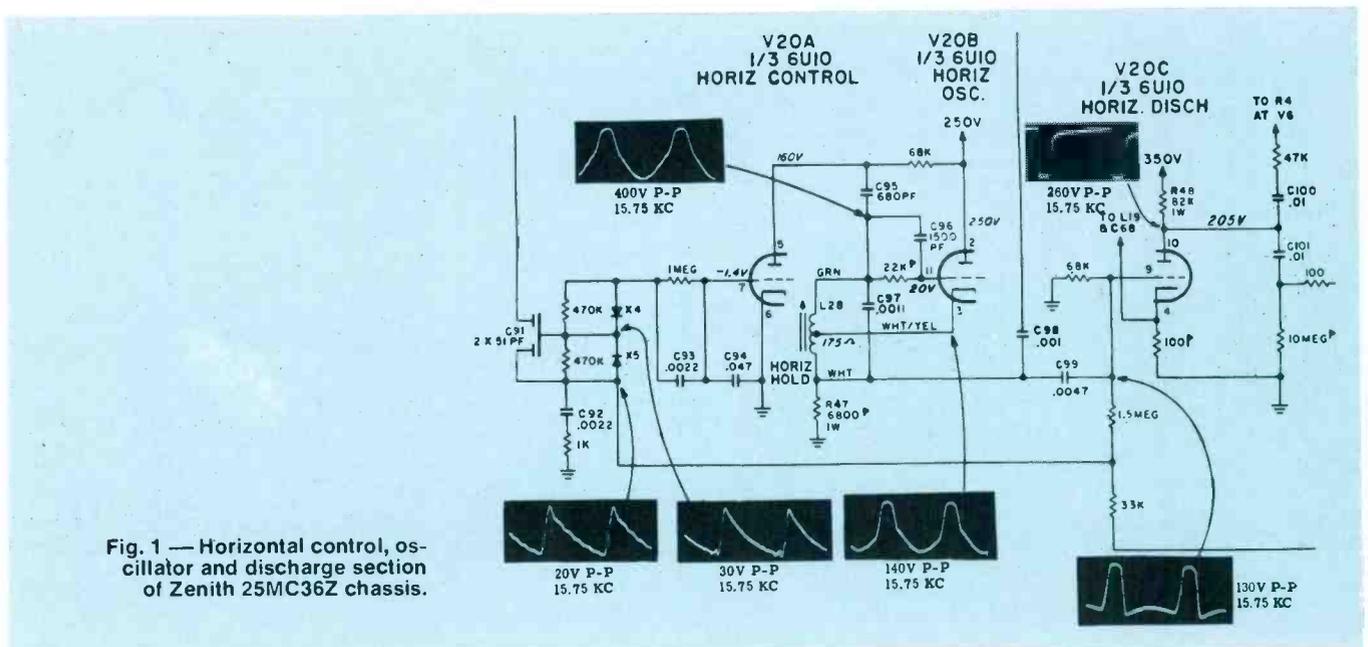


Fig. 1 — Horizontal control, oscillator and discharge section of Zenith 25MC36Z chassis.

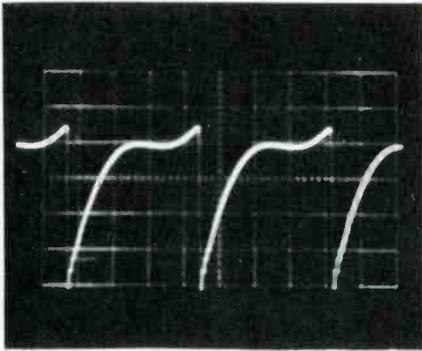


Fig. 2 — Misshaped drive pulse caused by waveshaping network (C603 and R602) being out of circuit. Also, C604 was defective.

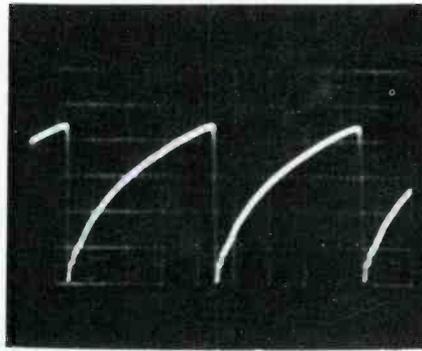


Fig. 3 — Proper drive pulse which existed after making repairs.

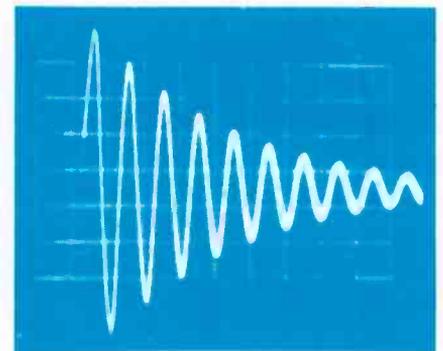


Fig. 5 — Proper ringing waveform as seen on scope.

transmitted horizontal sync pulse was missing, the horizontal oscillator would stop. When tuned to an active channel, the horizontal sync pulse would apparently shock-excite the tube into oscillation.

An unusual drive problem was recently added to our "rare bird" problem file. An RCA CTC10A color chassis had a regular habit of eating up 6DQ5 horizontal output tubes every few days. Several attempts had been made during home service calls to solve this problem but to no avail. The chassis was brought to the shop for observation.

On the bench, this set would operate about 30 minutes and then the raster would vanish. The 6DQ5 plate would then turn bright red. All voltages checked within tolerance while the scope waveforms looked normal. The drive pulse measured correct on the scope at 270v P-P, but a closer look at the drive pulse turned up new evidence.

This closer look proved that the drive pulse was misshaped (Fig. 2) as compared to the correct pulse shape (Fig. 3) shown in the service notes. Further checks revealed that C603 and R602 (waveshaping

network shown in Fig. 4) were actually out of the circuit because of a crack in the PC board. Also, C604 a 0.01  $\mu$  f capacitor across the horizontal sinewave coil, L108, had developed leakage and caused an abnormal sine-wave shape. This combination caused a misshaped drive pulse which made the horizontal output tube draw too much current. This misshaped pulse, however, did not affect the appearance of the picture or raster. Repairing the cracked circuit board, replacing C604 and tuning the sinewave coil (using a scope) for proper shape cooled the tube.

If the horizontal drive is correct, measure the screen voltage, check bypass capacitors and the cathode resistor, if any. If the trouble still persists after this, check the boost and other capacitors in the sweep section. Shorted capacitors will load the sweep section and open capacitors will prevent development of sweep voltage.

If these capacitors check out OK, make a resistance check of all loads on the sweep circuits. A more positive method is to disconnect the leads to the boost, vertical sweep and convergence section one at a time. On some

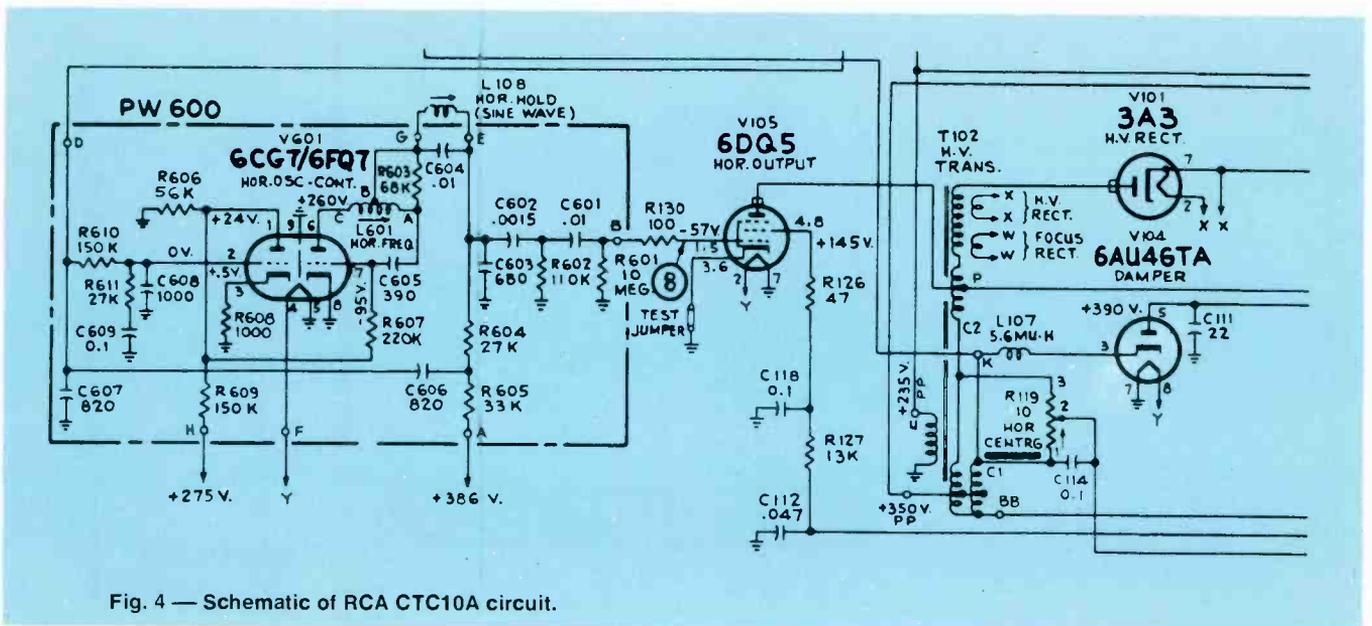
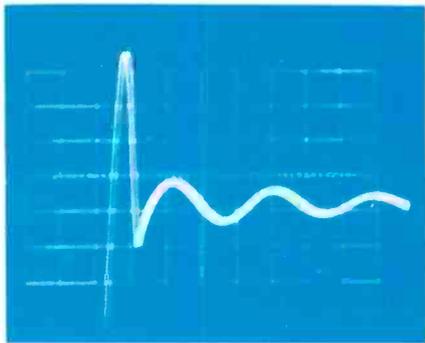
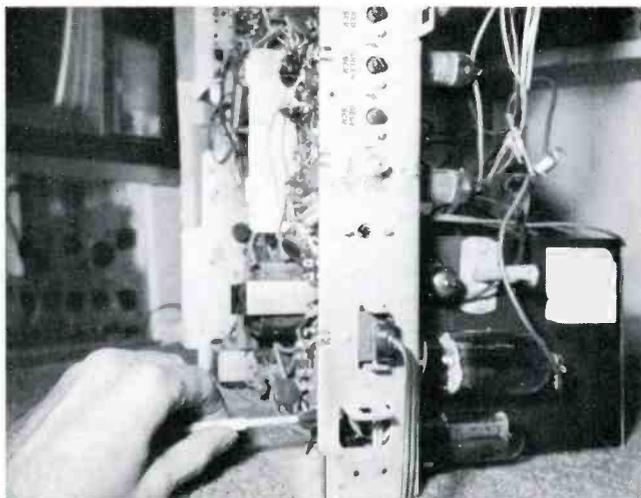


Fig. 4 — Schematic of RCA CTC10A circuit.



**Fig. 6 — This waveform indicates coil is shorted.**



**Fig. 7—Tuning horizontal efficiency coil to resonance by using small lamp.**

sets, don't forget the "boosted-boost" diode and pin-cushion correction circuits. Also, one often overlooked item is the AGC keying pulse from the horizontal sweep transformer winding. Check this pulse with the scope and make certain this keying line is not shorted. If the keying winding is shorted, this can kill the HV sweep.

### Sweep Transformer and Yoke Checks

For checking the deflection yoke, use a variable inductance in place of the horizontal yoke winding. This is a coil that can be adjusted from 10 to 50mh. But if you do not have a variable inductance or a substitute yoke, try this trick — it really works: Slip the yoke off the CRT and place it where the tubes in the set will not heat it. Now switch the set on and let it operate about 10 minutes. Switch the set off and carefully feel the yoke windings. If you detect a warm winding or hot spot, the yoke has shorted turns and is defective. This works equally well for vertical windings.

If all components in the preceding stages mentioned have checked out good, the problem is narrowed down to the horizontal sweep transformer and yoke. A sweep transformer and yoke analyzer can be used for these checks. Since many shops do not have this test gear, and all leads must be disconnected from the coils being checked, other methods must be used. We have found that these analyzers are not always accurate and can give erroneous readings.

The "feel check" will tell you the condition of the sweep transformer, too. Let the chassis cool off. Switch the set on and let it operate about 10 minutes. Switch the set off and feel the transformer windings to see if they are warm. If a slight warmth is detected, the coil has shorted turns and is defective.

### Use Scope for Coil Ringing Check

The best approach to any coil is the ringing check. Use a scope and feed the internal horizontal sweep sawtooth voltage at about the resonant frequency of the coil being checked. Many recent scopes provide a jack on the front panel for obtaining a sawtooth pulse. Scopes that do not have this provision can easily be modified by bringing out a jack connection from the horizontal sweep generator which gives a suitable sawtooth wave. For checking flybacks and yokes just connect a 100pf mica capacitor from the sawtooth jack to the scope's

vertical input. The scope's test leads from the vertical input are then placed across the windings of coil or transformer being checked. A good winding will give you the familiar damped wave pattern while a defective one will not. Any shunting resistors that usually appear across the vertical windings of yokes will have to be disconnected for this check.

For a power transformer, choke coil or vertical transformer check, set the scope sweep at 60Hz. For audio transformers a scope horizontal rate of 5kHz is fine. For TV horizontal sweep transformer and yoke checks, a sweep rate of 10kHz will suffice. The waveform shown in Fig. 5 is from a vertical output transformer being checked. Note the damped wavetrain that proves the coil will ring and is OK. If the coil has shorted turns, a waveshape like that shown in (Fig. 6) will then be seen. Note fast damping of the wavetrain and no ringing takes place. By trying this out on a flyback or yoke you know to be good, you'll quickly learn what settings to use and the correct scope pattern to expect.

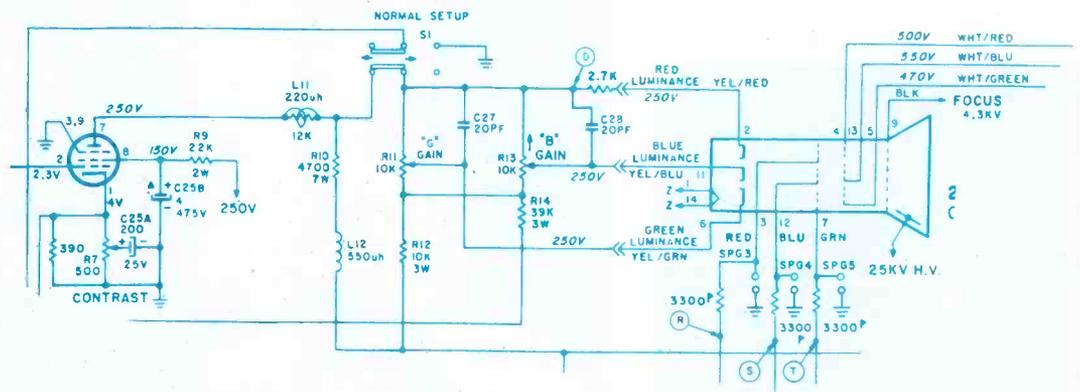
### Output Tube Current

The horizontal output tube cathode current must be checked for proper operation. The current should measure about 190 to 230ma, depending on which color chassis is involved. The cathode current will be slightly less than this on color chassis using the newer pulse-type HV regulator system. If this current is too high, the sweep circuit components and output tube life will be shortened. The horizontal efficiency coil is then tuned to minimum current flow for this tube or consult the service notes for proper adjustment. A fast way to adjust this coil in the field or shop, is to use a number 53 panel lamp in series with the plate cap lead. Then tune for minimum lamp brilliance (see Fig. 7). When the horizontal output tube is replaced, the horizontal efficiency coil should be adjusted for correct cathode current. The tube plate cap should not be disconnected to kill the high voltage. When a cold oscillator tube is installed in a warm set, don't apply power until the set has cooled down, nor pull the horizontal oscillator tube when power is applied to the set.

### Other Sections To Consider

Other sections of the color set that can cause loss of

Fig. 8—Video section of Zenith 25MC36Z showing spark gaps 3, 4 and 5; C25A and B and CRT bias control, R15.



#### AC Line Voltage

110v  
115v  
120v  
125v

#### Adjust High Voltage To

22.4kv  
23.4kv  
24.5kv  
25.4kv

high voltage and are sometimes overlooked is the shunt regulator, CRT and the video amplifier circuits. If the shunt regulator circuit has a defect causing too much current to flow through the tube or the high voltage is not adjusted to the correct value, this can cause loss of high voltage. A good indicator, as to the proper operation of the shunt regulator circuits, is to check the glass of the (6BK4 or 6EH4, etc.) regulator tube. If it is very discolored or black in appearance, the regulator tube has probably been drawing too much current. Check the cathode and grid circuits for component value changes or shorted spark gaps. Then check the cathode current with brightness turned down, and adjust for proper high voltage. If the regulator tube cathode current is below specified minimum when the correct HV is attained, the HV input to the regulator is probably low.

A gassy CRT or leakage and resistance value changes in the CRT and video output sections can cause excessive current flow and kill or reduce the high anode voltage. Some possible components in the video section (Fig. 8) are spark gaps 3, 4 and 5 also capacitors C25A, C25B and CRT bias control, R15. Do not overlook the video and color demodulator tubes and leakage in the printed circuit boards (see article in September 1965 ELECTRONIC TECHNICIAN for these checks). If you suspect the CRT and related circuits, just remove the CRT socket and check for HV return.

The service SETUP and NORMAL switch on the back of most color sets can be used as a handy aid to narrow down the trouble. While checking a set with high voltage loss, just flip this switch to SETUP position and if the high voltage returns, the defect is ahead of the service switch in the video Y amplifier section. If the HV does not return, the problem is in the CRT and cathode bias network or color demodulators.

It cannot be over-emphasized to use an accurate VTVM and HV probe to adjust the high voltage supply to manufacturers' specifications. Also, remember you have to consider the line voltage for this adjustment.

Most service manuals have a voltage chart listing proper HV for various line voltages.

A typical voltage chart for a G-E KC color chassis is shown on the left. Refer to this chart and adjust the high voltage accordingly.

If the line voltage is in between 5v steps, use the nearest lower line voltage for determining the correct high voltage setting. For example, with a line potential of 112v, refer to the chart for 110v, which indicates the high voltage should be adjusted to deliver 22.4kv; 122v equals 24.5kv, etc.

If the anode voltage is not correct, it can cause various other picture defects, premature parts failure and other system malfunctions. An example is vertical roll, jitter and insufficient picture height—particularly on sets that use an amplified sync pulse type circuit that contains plate and cathode feedback circuits. With very high anode accelerating voltage the electron beam stiffens and when you try to attain a complete vertical sweep with this type of circuit, vertical roll and poor lock will result. With the electron beam stiffened because of the much higher anode voltage it is difficult to fill the screen vertically without causing excessive overscan. When there's excessive scan, the loss of vertical hold is caused by the vertical output tube being driven into the positive grid region. Plate saturation then occurs, attenuating the sync pulse which is normally amplified before it is fed back to the oscillator grid. Thus vertical roll results. In other words, the vertical height and linearity controls are adjusted for maximum vertical sweep to fill out the screen, but when you look at the screen, it's not filled out.

#### Other Causes

As you already know, the last video amplifier stages' grid is the source of brightness control in a color receiver. Failure of this tube will kill the raster. A defective regulator, weak high-voltage rectifier, and in some cases a bad blanker tube, will cause serious blooming. Misconvergence will also result when the anode voltage is too high or low.

The horizontal sweep and high voltage section can be rough and tough to troubleshoot and seems to have more than its share of problems.

But if you use the aforementioned troubleshooting sequence to develop a systematic and logic procedure, the problems can be easily solved. It comes down to the process of elimination and keeping a cool and level head. ■

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# The Photoelectric Controls Business

Take another look at this 'cabbage-green' area of the electronics field

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■ Some service-dealers and technicians are not aware of the number of photoelectric systems being used in their own communities. And some who *do* know about them, feel that selling, installing and servicing this equipment is not their "cup of tea." If you're among either group, perhaps you'd better take another look before you reject this substantial and relatively easy source of revenue.

Photoelectric equipment is important to many business and industry establishments and is used in safety devices, counters, sorters, alarm systems, inspecting procedures and a host of others. Equipment failure frequently causes shut-downs, bottlenecks or a direct loss of man-hours. There's a bale of steady money here in preventive and emergency maintenance.

## Most Existing Service Is Inadequate

Obviously, the equipment now installed and now in operation is being maintained—somehow. A group of technicians we know recently decided to find out how. They visited several locations where photoelectric equipment is used and asked some questions. But let them tell the story. . . .

"At one brewery we found 27 photoelectric units. The systems were typical and service methods were common to several other places we visited.

"Several of the units were located

on a semiautomatic elevator system. Cases of beer were loaded upstairs and the elevator was started. A string of photoelectric units signaled the return of the elevator when it was emptied and when the conveyor in front of the elevator was clear. A photoelectric counter was also employed on the outgoing conveyor.

"A 'palletizer' which stacked beer cases in 4 x 6 x 6ft stacks also used a photoelectric system. And finally, a photoelectric foreign-particle detector was used for filled bottles. Filled bottles are twirled in this system to suspend any foreign substance that may be in the bottle. The photoelectric system then "looks" through the bottle and checks its transparency. If the transparency is low, the bottle is automatically dropped from the line.

"We asked what they did when a system 'broke down.' The brewery employed two maintenance men on each shift. If the system 'went down,' one man was called in. Frequently, the trouble was a burned out light-source lamp or some other easy-to-fix trouble. The maintenance men had a good supply of parts to get the systems back in operation quickly. In many cases, however, the entire unit was replaced. The bad unit was then shipped to the manufacturer who repaired and returned the unit. The factory made a flat-rate repair charge of \$25 on the amplifier assembly. Normal delivery time was about six weeks.

How well do the systems work?

"Not so good, we found out. 'They were fine when new, but now they are nothing but trouble,' we were told.

"After further checking, we found that much trouble arose because the equipment was not properly set up. Sensitivity controls were misadjusted, focus was poor (a very critical item) and light conditions had changed since the original installation. In some cases, an ordinary replacement light-source lamp had been substituted for a special lamp which had a controlled filament position.

## What You Can Do

"We approached the maintenance manager with a solution to his problem. Had he tried a TV-radio technician? He had not. He considered him to be 'just a TV-radio man.'

"We gave the manager an estimate of the cost of placing the systems in good working order (about \$15 each). We also gave him an estimate for a service contract for one year on all the systems. Although we had no reason or authority to negotiate further, the contract manager was surprised and is undoubtedly looking for a 'TV-radio man' now.

"How can you get into this kind of a deal? Pretty much the same as we did. Although we ran into some locations that had contracts, many weren't satisfied with their present service. Here's what to do.

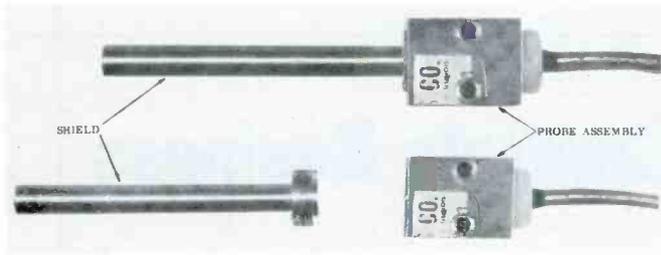


Fig. 1—Probe assemblies having barrel shield installed and removed. The probe contains a sensitive photocell.

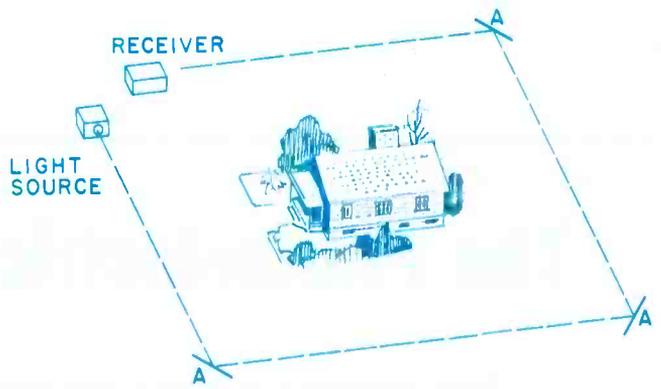


Fig. 2—Perimeter alarm system. Mirrors at "A" are used to "encircle" desired area.

## Photoelectric Controls Business . . .

"Make a list of bottlers (beer, pop, etc.), machine shops (safety devices), packaging operations (cereal, etc.), and even large offices (file safety devices) and concerns like chemical plants located in your area. Check on stores that use photoelectric equipment for door operators, too. Call each and ask the phone operator for the man in charge of electrical maintenance. Try to get his name and title. Explain who you are and that you specialize in photoelectric service. Then ask the maintenance man if he has any photoelectric equipment and if so, who services it. Ask him if he has trouble with the systems.

"Tell him you're available if he runs into trouble. Then ask for an appointment to talk about problems. Also explain that you would like to see the equipment so you can be sure you are 'covered' with the proper parts, service information, etc., in case he needs you in a future emergency. Armed with information about the equipment you will be in a position to present him with a contract proposal.

"Once you get your foot in the door, you can take down model numbers and manufacturer's names.

Then you can request service information from manufacturers.

### Figuring a Price

"In many instances, you will be asked to figure a contract price. Without an equipment history this can be difficult. But rules of thumb exist and can be applied if practical experience in electronic equipment is used as a 'fudge factor.'

"If the equipment uses tubes, you can expect to replace 25 percent of them because of *failure* in a one-year period. That means if you're pricing a service contract on a 12-tube photoelectric system, three tubes will fail during a one-year contract period. It has also been determined that for each failed tube, another *should* be replaced at the same time. Meaning, 50 percent of the tubes will be replaced in a given year. (Actually, all the tubes in a system will be about 30 percent low in emission after a one-year period and should be replaced in critical applications.)

"Since there are three expected tube failures in our hypothetical case, we know three service calls will be made on tubes alone. Double this and you have the number of routine

calls you should write into your contract. You should also write into your contract that when an emergency or trouble call falls in the period of a routine call, you have the privilege of using that time to do routine service work, thus, replacing the routine call.

"Now, calculate the labor costs for the contract by multiplying the number of routine calls scheduled by your rate for a full day. If you charge \$8 per hour for your time, or \$64 per day, you would multiply 6 times \$64 to determine the costs in our example. The basic cost would then be \$384. To this, add 25 percent of the list price for all the parts in the system. This need only be a rounded-off, ball-park figure. Some technicians substitute the list price of all tubes instead.

"In photoelectric equipment, the contract may be written so light-source lamp replacement is not considered replacement service and is not included as a replacement part.

"Be sure to consider your travel time and expenses when quoting contract prices. Also, your contract should include the right to bring all equipment up to par, at the owner's expense, prior to the contract date.

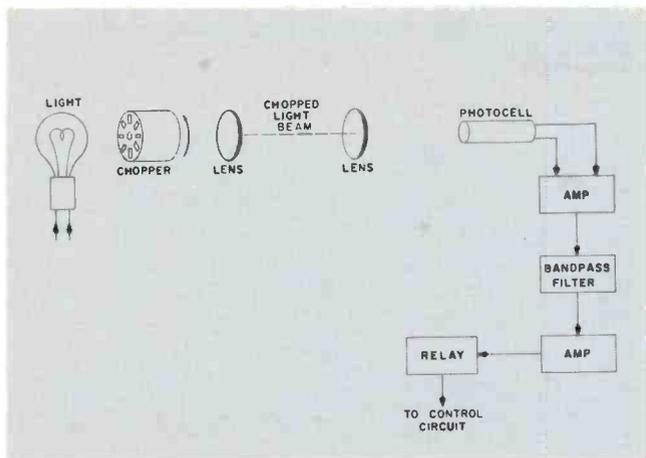


Fig. 3—Mechanical chopper modulates light beam which passes through bandpass amplifier to prevent receiver from responding to ordinary ambient light.

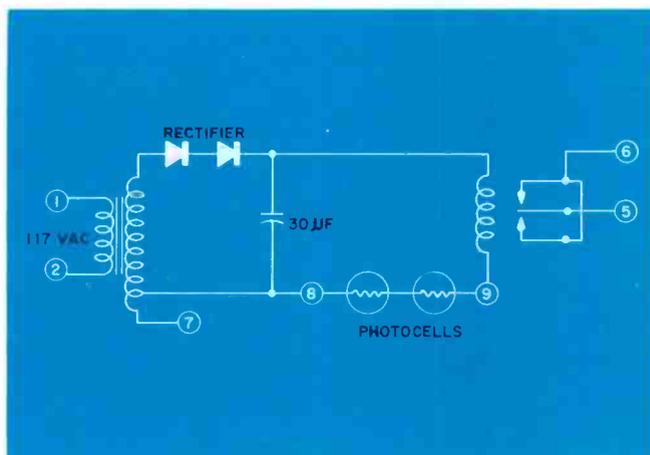


Fig. 4—A system which employs a sensitive balanced relay.

“The contract costs discussed so far apply to a one-system installation at one location. Multiple-system installations should be offered at a reduced rate since you may be able to catch potential trouble on other units while serving a failed unit. One method to calculate the added costs for additional, identical or similar systems is to add the cost for two hours’ service per scheduled call for each system. For example, if we have nine additional units in our hypothetical case, we would multiply six by nine (number of calls by number of added systems) and then by two (number of hours per system) and then by the cost per hour for service (\$8). The added cost then, would be \$864. Adding this to the cost for the first system (\$384), we would have \$1248 for service.

“If we estimated a cost of \$20 for parts for each system, we would add \$200 more for parts for all ten systems. This would bring our total contract price to about \$1448.

“There are several variations on contract pricing: For example, the customer may have to pay for all calls over six per system or be required to pay for all parts. Use your imagination and you should be able

to come up with a contract which will please any prospective client.

“In making up a contract you should understand that many companies do not allow large payments without prior approval of ‘higher ups.’ Consequently, you may have a better chance for approval if you submit your contract as payable ‘the first of each quarter in the amount of \$362’ or \$120.65 on the first of each month. If you have a flair for advertising, you may want to point out that the cost for maintaining a system (in our ten-system example) is only about 40 cents a day—for guaranteed service!” We found this first-hand report interesting and illuminating.

### Service

Actual service work on photoelectric equipment is generally easy. In some industrial and business establishments the jobs are complicated by locations, dirt, etc.

Many photoelectric applications are no more than a light source shining into a light-sensitive cell or tube. Some units use a “barrel” in front of the light-sensitive element to keep ambient light from being a factor (see Fig. 1).

When the light beam is interrupted, an amplifier in the photoelectric “receiver” energizes or deenergizes a relay which controls some other action. The action may be to stop a motor, operate a counter or open a door.

Where a safety device is used to stop a machine, the photoelectric unit may be triggered by too much or too little light. The reason for this is that too much ambient light may keep the circuit open even though the light source in the system is blocked.

In other applications, like perimeter protection, (Fig. 2) high light levels and changing light levels (day, night, headlights) may make a standard light system impractical. A light chopper may be employed to keep the system relatively unaffected by ambient light.

A standard “source” lamp is used but the light beam is interrupted by a motor-driven wheel having slot openings which allow the light to come from the source in pulses. The “receiver” is standard in most respects but a bandpass filter is employed so that only light bursts at the source frequency pass through the filter. All extraneous light

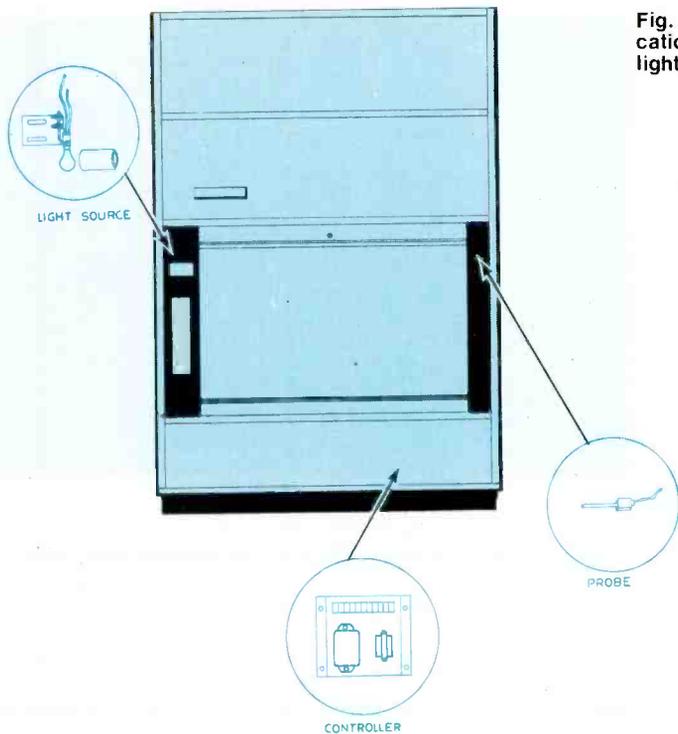


Fig. 5—Balanced relay system is used in a file safety application to prevent the powered shelves from moving when the light beam is obstructed.

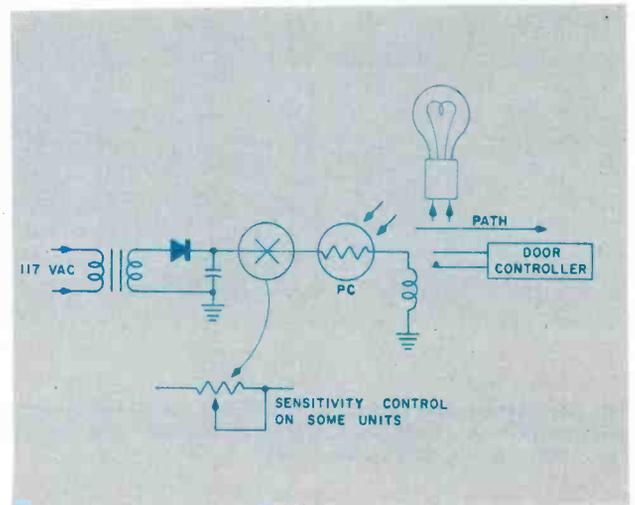


Fig. 6—Schematic of a simple door-trip system. No amplifier is needed for a sensitive relay.

## Photoelectric Controls Business

changes do not affect the receiver.

After the chopped light signal passes the bandpass amplifier, it is detected, amplified and used to operate a relay just like a standard system.

A balanced relay system which operates from too much or too little light is shown in Fig. 4. A very sensitive relay is employed which is neither opened nor closed with normal current flowing through it, but remains balanced. Either more or less light will trip the relay.

Two photocells are shown in this application but one or several might be used. The cells in this system change resistance as the light level changes to allow more or less current to pass through the relay.

The application for such a system is shown in Fig. 5. The unit is a "power file" which has moving file shelves. If the operator's hand or some material obstructs the light beam, the moving shelves are stop-

ped and the system must be reset to start again.

Some systems use infrared light filters at the source so the light is not normally visible. This is often used in perimeter protection systems. If a visible light beam is used, trespassers could go under or over the beam, defeating the alarm.

The two basic photoelectric systems encountered will vary only as to type of pickup cell or tube. In most modern units a solid-state cadmium sulfide type cell will be used. In older systems, a tube may be used. Light changes cause a change in resistance in most light detectors, but in some a voltage is generated which is proportional to the light's intensity.

Get the instruction manuals and maintenance manuals whenever possible and read and understand the recommended setup procedures. When focusing is required, use a piece of white paper and focus the

light on it at the exact spot where the light-sensitive cell or tube will be located. If necessary, rotate the lamp so the filament image falls in the most sensitive area. And don't select just any lamp when a special one is required.

No matter how you look at it, whether you can think in terms of diversifying somewhat into this area or whether you can think in terms of becoming a specialist, one thing is certain: This is a developing and expanding area of the electronics field and photoelectric controls will be more widely used in business, industry and the home as time passes. The primary consideration is to get into it in your locality and built it up in the next few years.

If you can get into just one location by contract or on a call basis, you're all set. Word travels fast, and you'll soon be known as *the* man to call when photoelectric equipment breaks down. ■

Part three of a series

# Antennas— Sans 'Bafflegab' and 'Bushwa'

Learn what the problems are and how to solve them intelligently

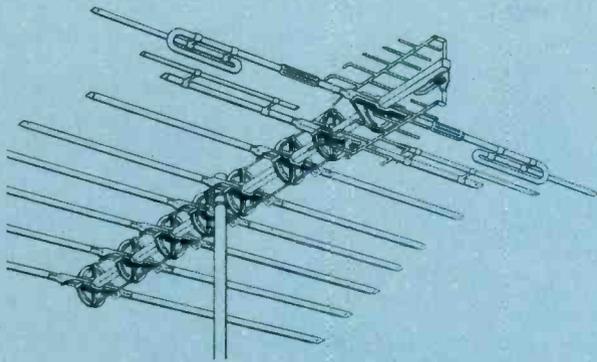
■ The second article of this series (March 1968 *ELECTRONIC TECHNICIAN/DEALER*) covered some essential antenna characteristics. Specifically, polar patterns and gain charts were explored and their importance as guides to selecting antennas was emphasized. It was also pointed out that the antenna's VSWR and front-to-back signal ratios for *each* individual channel to be received were other important factors to be considered in selecting the proper antenna for a particular job or location.

## Other Considerations

A few other factors are involved in selecting the proper antenna for a specific job or location. Many service-dealers, for example, frequently stock one antenna type and use this antenna for all situations — disregarding some fine points involved in selecting the optimum antenna for a given job or location.

To illustrate, we once observed a service-dealer's technicians installing an elaborate, high-gain array in an immediate-area location having prime signals. We conservatively estimated that the weakest of the three VHF channels to be received would provide 10-thousand or more microvolts to the color set's antenna terminals. We later had an opportunity to observe the reception on this set. One channel was moderately "ghosty," despite the fact that no high structures or hills were observable from the roof where the antenna was located. Some diplomatically conducted inquiry revealed that the same antenna was also used by this service-dealer when making installations in the secondary reception area, some 25 miles out from the transmitting station towers; and likewise in fringe areas extending some 50 or more miles away.

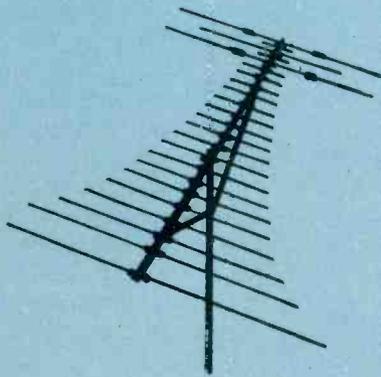
At another house, only a few doors away from this high-gain array, we observed much better reception on a



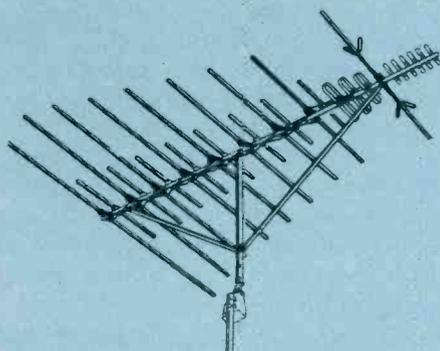
Jerrold VHF/UHF/FM Antenna.



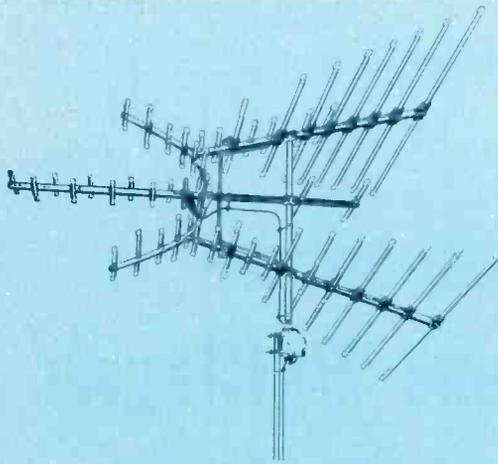
Kay-Townes CPC33G antenna.



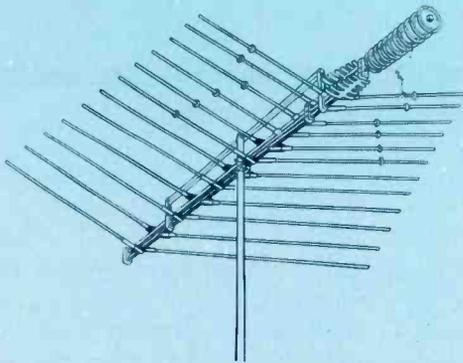
RMS all-channel antenna.



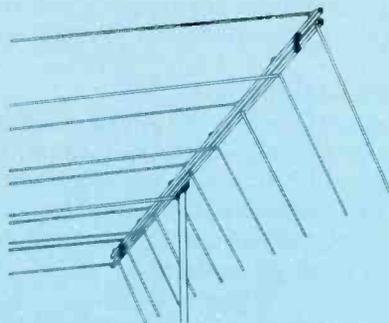
Channel Master 82 channel antenna.



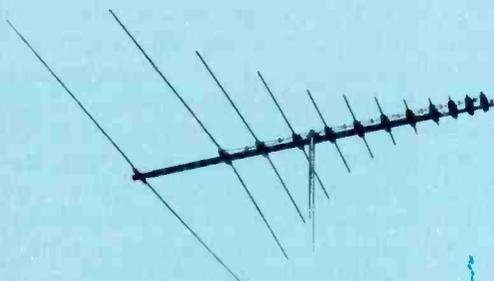
Winegard VHF/UHF/FM SC1000 antenna.



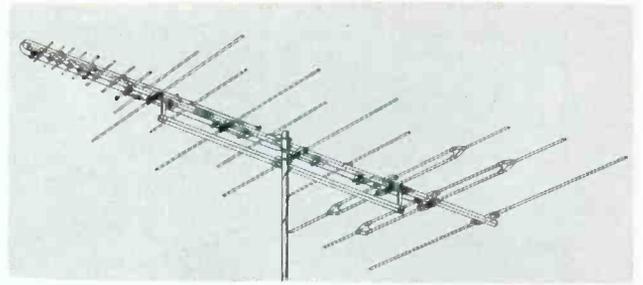
JFD LPV-CL700 VHF/UHF/FM antenna.



Blonder-Tongue VHF/FM antenna.



GC Electronics CM12 VHF/UHF/FM antenna.



S & A Electronics VHF/UHF/FM antenna.

set which used a small, compact, two-element, no-gain-type antenna. The color pictures were clearer, sharper and no ghosts were apparent.

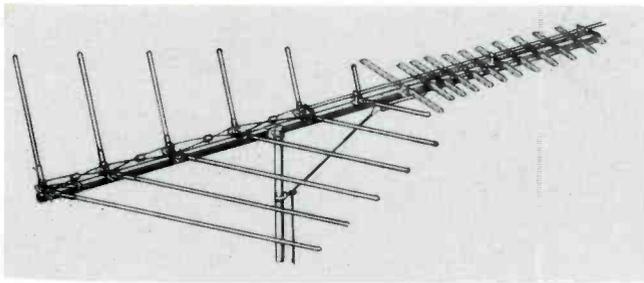
A very high-gain antenna used in the aforementioned situation, even if it has a sharp frontal lobe, can frequently pick up reflected signals from modestly high buildings, water tanks, smokestacks or whatever, when these objects are located within the antennas frontal lobe area. Ghosts will appear a fraction of an inch to the right of the picture elements, creating a "smeared effect" and playing havoc with the reception quality — especially on color reception. But a low-gain antenna will pick up a much weaker ghost signal which will usually be thoroughly overpowered and pushed into the noise area by the direct signal. The secret here, if it can properly be classified a "secret," is to obtain the necessary amount of direct signal to provide consistently good reception and let the ghosts starve to death. This amount of signal generally ranges from  $100 \mu v$  to  $1k \mu v$ .

In a somewhat similar case, we found it necessary to install a padder in the lead-in at the set to attenuate the signal about 10db before good reception was obtained. Installing high-gain antennas under these circumstances is a waste — to say nothing of the unnecessary cost and possible damage to your reputation.

Here, the rule-of-thumb is: Use the antenna that provides about  $1k \mu v$  on the weakest channel (if no ghost reflections are apparent). And remember, depending on where the reflecting points are, a high-gain, sharp front-lobed antenna is not always the one needed to avoid ghosts. Use the antenna which gives optimum results, no matter what it is or looks like. Don't allow your affluent, status-symbol-seeking customers, frequently influenced by do-it-yourselfer type, misdirected consumer-styled advertising, to push you around. You're the doctor. You write the prescriptions and guarantee the best reception possible. After all, *customer satisfaction* is the name of the game we're in.

We have also observed some sad-looking reception in prime-signal areas caused by long,  $300 \Omega$  lead-ins. In these cases, most of the run was made broadside to the transmitting tower. Shielded  $300 \Omega$  or coax cable lead-in, with proper matching, will usually be what the doctor prescribes for this one.

A few years ago we bumped into an old antenna specialist who assured us that he had installed, or helped install, thousands of one-of-a-kind antennas for the service-arm of a prominent TV-set manufacturer be-



**Finney model CS-B2 VHF/UHF/FM antenna.**

tween 1948 and 1953. By 1954 he had saved enough money, together with what he borrowed, to go into the antenna business for himself. He claimed that he made a substantial "bundle" specializing in antennas during the following 10 years. We cannot vouch for this but we did note the Cadillac he took us to his home in (the home was roughly estimated to be in the \$40,000 class). We also noted that the three-car garage in the back (having radio-controlled doors) was stocked with something more on wheels than hobby-horses.

Our host maintained that the all-alike antennas which he installed from 1948 to 1953 — an over-and-under, high-low, matching-stubbed and open-end-trapped monstrosity — gave excellent results in prime signal areas and has never been improved upon except in appearance. The design, he said, followed basic antenna principles and it worked over an area of up to ten miles. It gave customer satisfaction.

He later showed us his inventory of modern antennas. He carried one antenna brand — but he stocked every model the manufacturer made — more than seven different models. He explained that he used each model under different conditions, in different reception areas. His prime-signal-area antenna was a simple, easy to install, two-elemented job — a modern streamlined version of his old antenna.

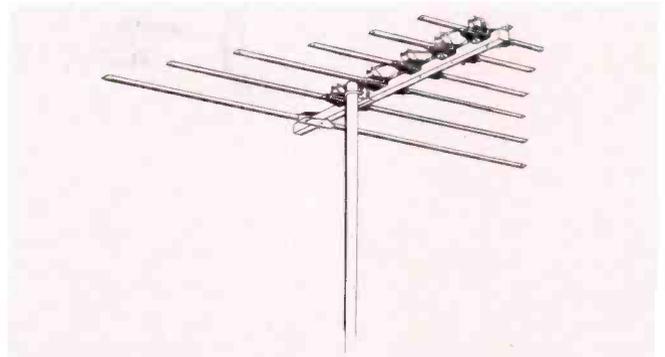
He drove us more than 80 miles out beyond the transmitting towers and showed us scores of antenna installations — a few of which cost more than the TV sets. He explained that most of his customers were furniture stores, department stores, retail chains, large service-dealers and other TV, Hi Fi sales outlets who did not want to make antenna installations. He also explained that many old customers called him direct for repairs or replacements.

So much for what we can learn from the specialists in the business. But back to our own devices.

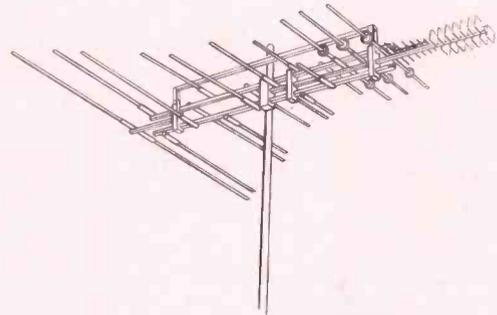
By this time we should have suspected that the highly important factors of antenna *gain* and *polar patterns* for each channel, VSWR for each channel, front-to-back *signal ratios* are not to be considered a set of "mechanical fetishes" designed to substitute for brain-drain.

All these factors taken together are important as guides to selecting the proper antenna for a given job or location. Like the "extras" on an expensive scope — they won't solve your problems unless you know when, where and how to use them.

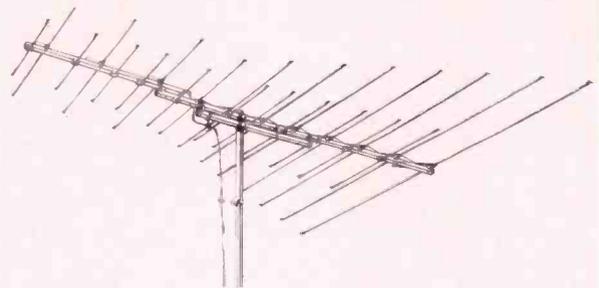
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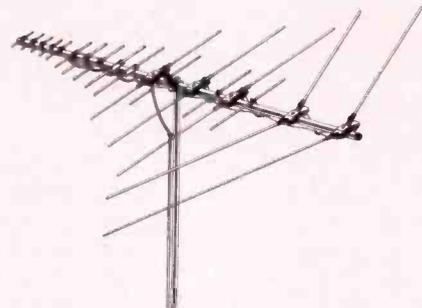
**Audio Tex 32-706 VHF/FM antenna.**



**Zenith UHF/VHF model 973-93 antenna.**



**Antennacraft VHF/FM antenna model CS-1000.**



**Gavin model 1118 VHF/UHF/FM antenna.**

# SOLID-STATE AUDIO

## Know how semiconductor circuits work, how to troubleshoot

■ The first two articles in this series discussed basic solid-state amplifier circuits and types, interstage coupling methods, practical circuits and biasing systems. An attempt was made to lay the groundwork for more detailed circuit coverage, from the troubleshooting viewpoint.

Because various types of modern transistorized audio amplifiers have been designed in recent years, it is essential that we understand these circuits thoroughly.

Many articles and whole chapters in books on electronics servicing have detailed the methodical techniques required to troubleshoot and repair equipment effectively. And these methods and procedures are basically the same for solid-state audio amplifiers.

It has frequently been said that many technicians in the electronic home-entertainment equipment area do not employ organized, methodical and logical procedures in troubleshooting. Considerable evidence exists to point up this contention. For this reason, it may prove helpful to once again, in a brief way, outline these basic principles.

### Troubleshooting Basics

The basic, logical approach to troubleshooting any type of electronic gear, assuming you know the equipment circuits and their functions well, is very simple. But the system must be practiced thoroughly so it becomes a habit—yet leaving room for “reasoning” when it becomes necessary.

The system employs four of the five ordinary senses: Smell, sight, touch and hearing. If you can't hear or see very well, touch can substitute for both.

The ears can determine some symptoms as they appear in the speaker. Touch can reveal other symptoms, like an overheating resistor, for example. Sight can reveal others, like charred, scorched or burned resistors or leaking electrolytics, poor solder joints, hum and distortion as revealed on a scope screen.

It may prove encouraging to say here, especially to the apprentice technician who has no stereo amplifier experience as yet: don't worry about the lack of stereo experience! Both amplifiers in stereo equipment are identical. There are just twice as many of them. But this is fortunate, you can always use the good amplifier to troubleshoot the defective one because both amplifiers seldom break down at the same time.

Trouble symptoms in audio amplifiers and their probable causes must be well known. Common symp-

toms include: low gain (or weak output), distortion, “noisy” output, hum or a completely dead set.

The specific servicing approach hinges primarily on quick voltage or current checks and signal tracing. All you need is a VOM with a low voltage and current scale and a “mosquito”-type noise generator. But let's look at one more practical amplifier and then get down to some trouble symptoms.

Look at the three-stage audio amplifier shown in Fig. 1. It is used in a well-designed transistor radio made some years ago. All transistors are PNP types and the plus side of the power source is grounded. Remember, either the plus or minus terminals of the power supply can be grounded in either NPN or PNP type transistors.

The 1st audio amplifier is an emitter-follower (grounded-collector) circuit. As you already know, this stage has a high input impedance which matches the detector stage.

The 2nd audio amplifier, a grounded-emitter circuit, is transformer coupled to the power amplifier, a push-pull stage biased to operate at class “B.” Both TR1 and TR2 are biased very close to cutoff so no conduction occurs when no signal is being received. Remember, a class “B” stage is biased essentially at cutoff so conduction occurs for exactly one-half of each cycle. And there is zero standby collector current when no signal exists at the amplifier input. This condition, incidentally, causes a degree of crossover distortion (around the zero point between the positive and negative swings) but we will not go into this here. We will mention it at another point in analyzing some specific trouble symptoms.

The base-emitter bias to TR1 is developed from the negative terminal of power source B1, through R29, R30 and the speaker voice coil to the positive side of E1. Base-emitter bias for TR2 is developed from the negative side of power source B2, through R31 and R32 to ground. It should be observed that the voltage drop across the voice coil is the difference between the two bias voltages.

From the troubleshooting viewpoint, it is important to consider the negative feedback circuit. Negative feedback is taken from the junction of R30 to R31 and passes through C23 and R26 and is applied to the first audio amplifier emitter. This is a distortion reducing circuit. And the capacitor, C23, is important because its capacitance value controls to some extent bass boost below 200Hz.

# AMPLIFIERS

them and cut your repair time in half

Equally important from the troubleshooting viewpoint are resistors R33 and R34. They provide a certain amount of dc stability for the amplifier circuit under ambient temperature changes.

## Specific Procedures

We do not intend to attempt the impossible by trying to design a troubleshooting "road map," usually demanded by the would-be professional, a guide for do-it-yourselfers. Every skilled technician, through study and practical experience, works out his own orderly and efficient troubleshooting routine. He does not attempt to follow a "road map" designed by some supposed expert.

But let us take a closer look at solid-state audio amplifier trouble symptoms and a few of the possible causes for these symptoms. We are primarily concerned here with procedures for the "thinking" technician.

We promised in the second article of this series (ET/D, November 1967) to cover some possible trouble faults which may arise in the audio amplifier circuits used in the Motorola TS400 TV chassis. A schematic of this circuit is shown in Fig. 2. The circuit's operation was briefly described in the previously mentioned article. But the service procedures can be applied with equal effectiveness to the radio amplifier shown in Fig. 1 or, for that matter, any other audio amplifier.

The easiest amplifier to troubleshoot is one that produces no audio in the speaker—a dead amplifier.

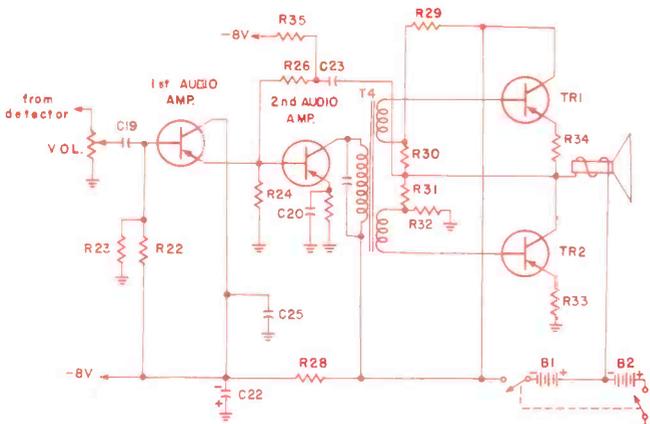


Fig. 1—Class B, solid-state audio amplifier. Courtesy Westinghouse.

The experienced technician may begin logically by checking the power supply voltage. If it is fused, he checks that, too. And he may check for a defective on/off switch. If the power supply is normal, he might then check the continuity of the speaker voice coil by using a VOM or VTVM or he may inject a noise generator signal at the collector of Q13 and cover the output transformer and speaker all at once. (Is it necessary here to remind anyone, except perhaps a few apprentices, that the speaker or its equivalent impedance should be connected across the amplifier output at all times while the amplifier is switched on? Peak inverse signal voltage can "pop" the collector junction of an output transistor.)

If a signal is heard here, then our expert might inject a signal at the base of the audio output transistor to determine its operating condition, including its gain. And he may continue this procedure back to the wiper arm on the volume control.

On the other hand, just as logically, he may begin by injecting a noise generator signal at the volume control wiper arm and continue in the reverse direction, from transistor base to collector and so on to the speaker voice coil. He may even begin at the middle stage of this three-stage amplifier.

Of course, another experienced technician may not bother with signal or noise generators when checking amplifiers in, say, auto radios. He is thoroughly confident of his ability to isolate a defective stage by using a

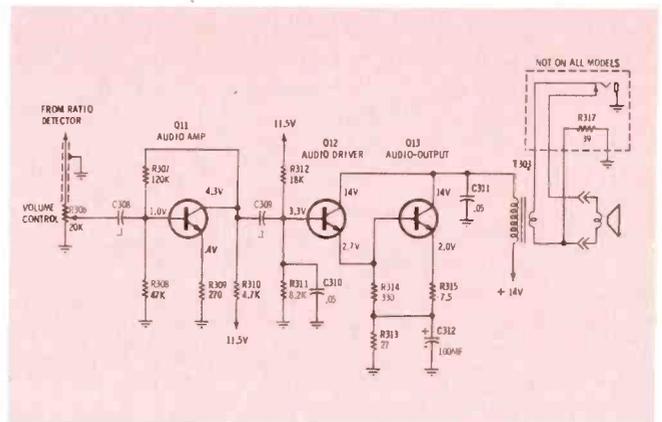
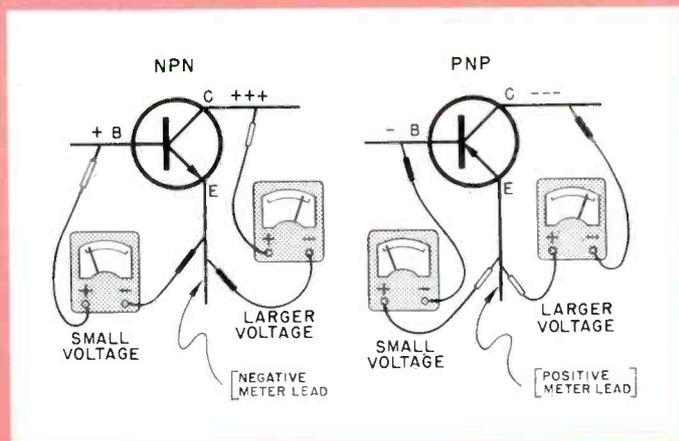


Fig. 2—Audio amplifier system used in Motorola's TS400 TV chassis.

**Fig. 3—How to use a VOM or VTVM when checking the voltages on NPN and PNP amplifier transistors. Courtesy Delco Radio.**



clip-lead with a 10K resistor in series. With the set on, the clip-lead is grounded and the resistor end is touched to the output transistor base. He may "hear" a weak click or he may not. If the amplifier is good, he hears stronger and stronger clicks as he touches the lead to each transistor base, up to the first audio driver base. The volume control is adjusted fully clockwise during these checks.

When the defective stage is isolated, the experienced technician often uses an in-circuit transistor tester to quickly check the transistor in that stage. Of course, depending on circumstances, he may quickly determine if a transistor is "on" or "off" by checking the voltage on the transistor collector. If no voltage shows on the collector, the transistor is probably defective.

Before making voltage measurements, however, our experienced technician determines if the transistor is germanium or silicon, whether NPN or PNP. The correct emitter-to-base bias is approximately 0.2v on a germanium transistor, about 0.6v on a silicon. In making voltage measurements he follows the procedures shown in Fig. 3, using a VTVM. He automatically considers that the *most negative* point in an NPN transistor circuit is at the emitter. He places the VTVM common (black) lead on the emitter and the positive meter probe on the base to determine the positive bias voltage. He follows a reverse procedure with PNP transistors.

If we have not, within a reasonable time (about 10 minutes), located the faulty component or components in this dead amplifier, then we have made a mistake or have overlooked something. And the time involved includes checking suspected components, speaker, power supply, transistors, coupling capacitors and the volume control or open ground leads.

Now suppose we have a weak signal at the speaker. And we may as well include weak and distorted signals here. This is to say, weak signals accompanied by distortion. What do we suspect first? Under normal conditions, transistors are either good or bad. They usually act "go" or "no go." We seldom find a defective transistor in an audio amplifier that allows some signal to pass through it. If the emitter is open or the bias is absent, it shuts off and the stage is dead. The same thing can happen when leakage develops between emitter and col-

lector. The base voltage usually remains constant but the transistor's conduction will rise, producing a larger than normal voltage across the emitter resistor, reverse biasing the transistor and shutting it off as far as signal voltage is concerned.

Depending on the particular circuit, and whether NPN or PNP, we *can* have a condition of partial conduction, with a weak and distorted signal—but that's another story which we won't go into here.

We proceed to check a weak-distorted-signal amplifier first by checking the power supply and the speaker as before. But this time, we substitute the speaker with a good one having the same impedance as the original. We check the bypass capacitors in all dc circuits. Nine times out of ten we will quickly isolate the faulty component—usually a coupling or bypass capacitor, a defective volume control or, occasionally, a defective transistor. When electrolytics are used as coupling capacitors, suspect them first.

Now we come to the problems that most technicians find difficult. What about distortion? That is, distortion when we have good volume from the speaker. Here again we substitute the speaker first. Then scope the power supply for signs of ripple. And if we know our transistor circuits thoroughly, solving this problem is no more difficult than the dead set or low volume problem.

If the signal through the amplifier is distorted but strong after the speaker is substituted and we find no power supply ripple, we go directly to the output transistor and check the emitter-base bias. Remember, we are dealing with tenths of volts here and the linear portion of the operating point on transistors is very narrow. Next come the bypass capacitors in the dc circuits. Give particular attention to C211, the 0.05  $\mu$  f bypass and C312, the 100  $\mu$  f electrolytic shown in Fig. 2. Check the other capacitors shown, including the 0.1  $\mu$  f coupling capacitors. The audio output transformer, T303, may require substitution. Because emitter resistors R313 and R315 are critical, make certain they are within tolerance. Usually, an off-voltage condition on one or more transistor elements will furnish the clue to localizing the cause of distortion.

Additional troubleshooting problems will be explored in part four of this series. ■

# Business Marriages and Cooperative Efforts Pay Off

Merged shops increase sales and solve color TV technician shortage problems

■ Like Chicago, but some 75 miles north of the Windy City, Milwaukee, Wis., sits snug against the west bank of Lake Michigan. And here, as well as in a number of other Midwestern areas, TV-radio service-dealers and technicians are learning about the benefits of corporate marriage.

This story began seven years ago when four men decided to pool their resources to better get their teeth into the Milwaukee electronic home-entertainment sales-service market. They named the new corporation Milwaukee TV.

With two stores, one on Mitchell Street and one on North Avenue, it soon became apparent that a one-store operation was more economical and the Mitchell Street store was closed.

"By concentrating our efforts at the North Avenue store," says Dick Stilson, Milwaukee TV's general manager, "our sales increased steadily and we eventually outgrew our facilities. Two years ago, we moved into this 15,900-sq-ft building." Milwaukee TV now employs 15 people.

## Service Problems Arise

Five years ago, with sales expanding, Milwaukee TV ran into a problem.

"Good technicians, especially col-

or TV technicians, were in short supply, and we were heavily involved in a promotional plan to boost sales further," says Dan Trusell, Milwaukee TV's vice president in charge of sales.

"Fortunately, we were able to obtain the services of Ray Brannon of Brannon TV. He had the personnel for servicing color TV and we were able to back up and sustain our sales program by giving our customers good service. The result was, both companies benefited," Mr. Trusell emphasizes.

Although Mr. Brannon and his technicians have been handling Milwaukee TV's color service work, the company maintains its own B/W service department, under the direction of Carl Orite, service manager. And Carl Orite's B/W service department has grown with the increase in B/W sales. It has supplied the sales department with the efficient backup required for maintaining good customer relations.

"We contract the color TV work out to Ray Brannon," Mr. Orite says. "Although the work is done

Front of Milwaukee TV's 15,900-sq-ft store.





Technician works in B/W service section.



Ray Brannon who operates the color service department in Milwaukee TV's shop.



A small section of Milwaukee TV's sales area, showing comfortable surroundings.



Carl Orite, manager B/W service department at Milwaukee TV.

under our name, Milwaukee TV, it's Brannon TV service. Ray uses our space here and all the test instruments here belong to us."

Mr. Brannon also has his own store across from the new "Y" on 12th Street. He features mostly record players, small radios, batteries and some other items.

"My wife works about four hours a day for me and then I have other help, mostly girls. When something needs repairing, I usually send one of my men down there because I'm too busy here and don't have time to get into my store often," Mr. Brannon smiles.

Our reporter wanted to know if Mr. Brannon considered the Milwaukee TV situation unusual.

"I think there's quite a bit of this kind of thing going on in the industry today. Besides a shortage of good color TV technicians, there're other

problems easier to solve when people get together."

"Under this arrangement," Mr. Brannon continues, "Milwaukee TV can provide better service at a lower cost than I could do the job if I were confined to servicing my own customers. Sales being what they are here, we handle from 35 to 50 service calls a day. I charge Milwaukee TV basically time and mileage. We do quite a bit of out-of-town stuff—servicing over a 100-mile area. By setting up an hourly basis by which we work, I just fill out the number of hours at the end of the week and that's it," Mr. Brannon concludes.

#### Promotion and Advertising

Milwaukee TV carries on an active advertising campaign in both the MILWAUKEE JOURNAL and MILWAUKEE SENTINEL, but does not

carry much advertising on radio or TV. It has had a direct mail program in cooperation with one TV manufacturer, sending out approximately 10,000 letters. Robert Wall, Milwaukee TV's president, indicates that about \$100,000 a year is spent for all forms of advertising—about 6 percent of gross.

Marvin Sadur, Milwaukee TV's secretary in charge of buying, points out that the large assortment of TV sets in stock helps to promote sales.

"We like to give customers as wide a selection as possible. And we feel that by offering six different name brands we have created a "one-stop" shop situation. In other words, they can select just the kind of set they'd like to buy."

Milwaukee TV had gross sales of \$1,500,000 last year. The year previously it was \$1,200,000. ■

## Sells 7 out of 10 Who Enter His Shop

**Suburban St. Louis dealer 'traps them' by offering a wide selection and selling what's on the floor**

■ Selling 7 of 10 people who walk through the front door seems incredible. But not when you visit Lemcke Appliance and TV in the Webster Groves, Mo., suburb of St. Louis.

"I've got them trapped when they come in," says owner Rudy Lemcke, Jr., whose father founded the business 40 years ago.

"Whatever they want, I've got it, and in the brand they most likely mention. I've got RCA, Zenith and Magnavox."

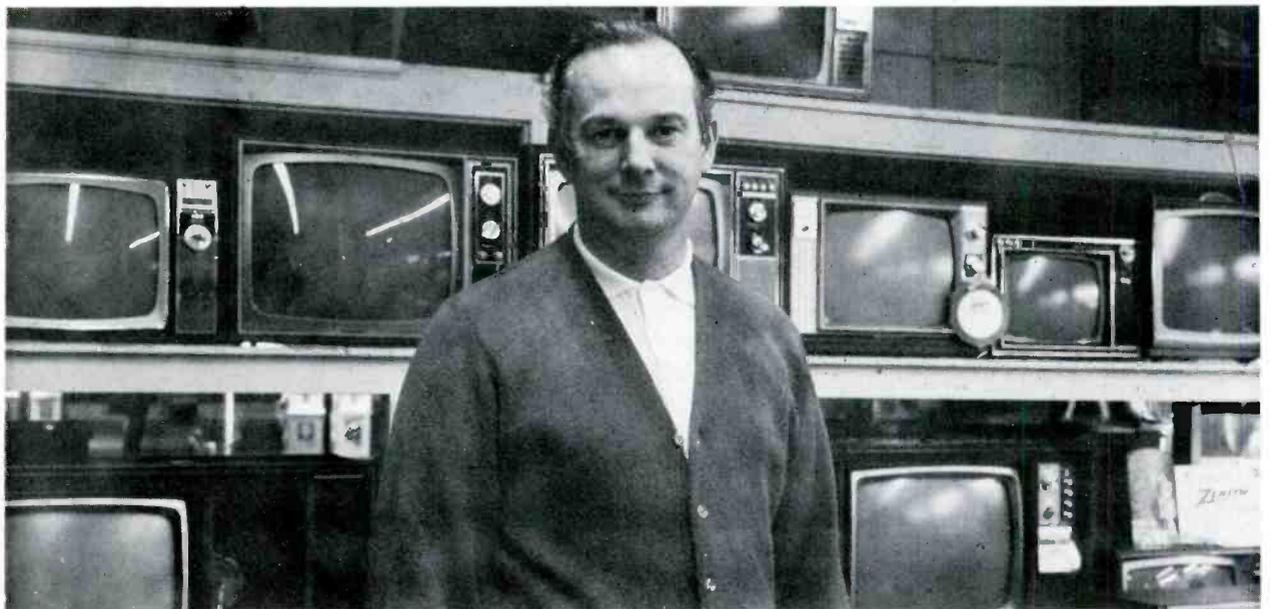
### **Selling What's on the Floor**

But how about the problems of duplicate lines, and possible slow inventory turnover when stocking enough to truly represent every one

of the many lines? Mr. Lemcke solves this by a policy of "selling what you've got. We don't show them pictures of what we don't have on the floor. We go after turnover so we can stock heavily. This policy permits us to buy in quantity for the best deal and pass the savings on to the customer."

Lemcke is a highly successful sales operation in an unusual way. While it has the reputation of being able to meet the prices of any discounter, it has a small specialty shop image — even though it uses some of the mass merchandiser display techniques.

Lemcke does big business in a small location. Its gross is well over \$500,000 annually. And it does



Rudy Lemcke, Jr., son of the founder of the 40-year-old business.



Mr. Lemcke (right) never has to push a customer into a purchase — he can be frank about each model's features because he has so many brands.



Rudy Lemcke sells 7 of 10 customers who enter his store.

this on a sales floor of less than 1000 sq ft. Advertising is less than 1 percent of sales. And location is in the old-fashioned business district of a 30,000 population St. Louis suburb — one of the highest income areas in Greater St. Louis, but one of the least progressive commercially. Moreover, the location is not on a major thoroughfare.

So while Lemcke outsells many a mass merchandiser in TV and appliances, it really has a small-town image. How does it manage to pull the traffic with virtually no advertising and no big location or sign splash?

#### Word-of-Mouth Does It

"It's really by word of mouth,"

Mr. Lemcke says. "Year in and year out we've built a reputation for having low prices on major brands and treating the customer right, so that our name, Lemcke, is spread widely by satisfied customers. People come in and ask for me but that's not always good — means I have to be on the floor just about every open hour and we are open every night until 9 p.m., except Tuesday and Saturday."

While the firm believes in "selling what you have" and concentrating on what's at hand and not on what's in the catalog, no customer is ever pushed into a sale. "I can be frank about the features of any model or brand," Mr. Lemcke says,

"because I've got all the big ones. And I make a point of letting the customer know that I will advise him honestly since there is no advantage for me to push a particular set."

Lemcke has an adjoining building for storage space, equal to the sales floor area, and always full. It buys heavily in advance of every season — big in electronics for fall, winter and spring, then heavy in white goods for summer.

#### Farms Out Service

How about servicing all the many makes? Lemcke maintains no service department of its own,

*Continued on page 88*

# TOSS A BOUQUET TO YOUR 'GIRL FRIDAY'



Your business success  
may depend  
on how she  
answers your phone

■ Toss a bouquet to the girl who answers your phone promptly and pleasantly. She deserves it and she *needs* it.

When she picks up your phone and says, "Good morning, Atom TV Service, may I help you?" believe me, you can never know what's on the other end of the line. The girl, if she's an asset to your business, has a terrific telephone personality and serves your customers as a combination crying towel, mother-confessor and Pollyana. So, encourage her. The success or failure of your business may depend on just how calmly and courteously she answers your phone. In most cases, the customer is already piqued at some imaginary betrayal of his TV set, so she must tread lightly, speak softly but brightly.

## Double-Fun — Double-Trouble

I profess to know only a few of the proper answers. But after answering my husband's phone for 10 years, I've learned two important things: You have to keep cool and maintain your sense of humor!

I've heard that you need to deal with either a person's children or his money before you really learn much about him. Under these circumstances, all pretense goes with the wind—like autumn leaves—so I'd like to add one other thing: His TV set.

When you deal with a customer's TV set you are also dealing with his money and then you have double-fun and double-trouble! Anyone who has served the public can sit for hours and tell funny stories, because, the public is funny—to paraphrase the title of a once popular TV program about "people."

Some of the weird things that have happened to me have also happened to your phone girl and we want you to know about them and why we sometimes get a strange, blank look on our faces when we listen to one of your customers.

## Hysteria on the Line

I had a call one morning from a nearby town. It began normally with the operator saying in her noncommittal tone, "Long distance for Atom TV Service."

I answered in the same tone, "Yes, speaking."

"Go ahead ma'am—ready on your call," the operator said to the calling party.

OK. So far everything was ordinary but then...shwam! This was no longer a normal, noncommittal call because right here Hysteria came on the line. This customer was in tears and almost screaming, "My TV doesn't work! My TV doesn't work! Where is he? Where is he? It's almost time for the wedding!"

There's one thing I do extra well—go blank when faced with panic. So, all I did was wonder if somehow, some way, this woman's TV was providing her oxygen supply. I managed to ask "What wedding?" before the operator, bless her calm heart, came on the line and said, "Ma'am, I'm sure he'll come and fix your TV set as soon as he can." This seemed to calm the lady and then I was able to find out her name, address, the TV trouble

symptoms and which wedding (the one on the "soap opera"). I've always wondered about this one, though. Do you suppose the lady had dialed the operator and said, "This is an emergency call?" Did this account for the operator's helpfulness?

### Complaint Details

Now a word on "getting the nature of a complaint." I've found that a customer will usually begin by telling you all about the symptoms. It seems to relieve most of them or something and most customers actually enjoy telling me how naughty their sets have been acting. I've picked up the doctor's habit of saying, "Hummm. Uh-humm. Well, we'll see what we can do about that." Their descriptions are very nontechnical and confusing but they enjoy telling their troubles, so we listen. Some get pretty long-winded, of course, and go on about how "the picture comes on fine for a minute and then goes blooey to one side and then comes back with a "crackley" sound and then gets fuzzy and blurry." On some of my bad days the old Nick in me almost makes me ask "Has it had a 'BM' today?" But my dedication to money always stops me in time.

Of all the calls we've had over the years, this particular one presented the greatest challenge. At that time we received calls at our home. (Note to budding TV technicians: Never, never operate your shop from your home. Your phone will never shut up night or day, but that is another story.)

One morning very early the phone rang. I glanced at the clock and thought it read 5:30. I stumbled toward the ringing noise and luckily found it. A bright, cheery, early-bird-gets-the-worm voice said to me, "I can't get anything on my TV." I glanced at the clock again and it really did read 5:30. By the greatest effort I managed to make my brain and tongue work and said, "Sir, the TV station doesn't come on the air until 6:30." How's that for a sharp, snappy 5:30 a.m. answer? But then I goofed...without thinking I added, "Do you think that could be the trouble?" Oh, stupid, thy name is Jo.

According to reports from customers, it is almost unbelievable what TV sets will and won't do. A lady called one hot, summer day and said quite calmly, "My TV goes off when I shut the screen door. When I leave the door open it works fine. I can't leave the door open because the flies get in the house." (My devil innervoice said, "Any bats coming in, Lady?" But my dedication to money saved me again.)

One sweet little old lady who owns a B/W set complained, "They are always saying 'The following program is presented in color' and then it isn't in color at all." I hope she keeps saying that to her children and grandchildren. Maybe they will pool their money and buy her a color set and that will make up for the many times she has had to call the technician to come readjust the set the little children mixed up for her.

Have you noticed how business often picks up right after a holiday? And how many of the calls will be to

"straighten up" controls that little sticky fingers have turned and turned? I usually divide these customers into two classes...the ever-loving grandmother and the crabby old aunt types. The crabby old aunt will whine and say, "What is this younger generation coming to. Their mothers don't care what they do." And I am polite to her. The grandmother is another story and my favorite is the one who called me a few days after Thanksgiving and said, "The children broke the picture tube on my set when they were here. My set is on rollers and they shoved it into the wall." I was concerned with the danger of a CRT imploding and she was concerned with making me understand that "it wasn't their fault. They didn't know it would roll" and told me that three times! Granny, we repaired your set with tender, loving care!

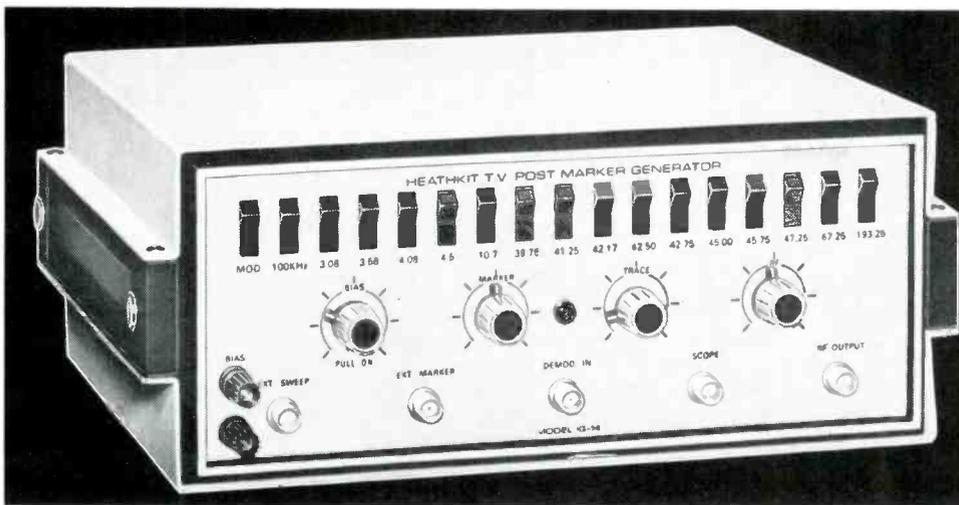
### Knowledge of Psychology Helps

I wish I had taken a few psychology courses in school. It would not only be helpful in dealing with the TV addicts, but it would help me figure some of these people out! Take the one I call the "secret watchers." This one is usually male and claims he "hates television." When he calls he always wants the set fixed "for the children." His children are evidently great fans of the World Series and the National Football league because about the time for the big games he decides to get the set in tip-top working order. It seems to me the ball fans exercise some kind of mystic power over their sets around series- and bowl-game time. They seem to almost *will* their sets to break down a few days before the big day so they can get them checked and all weak tubes replaced beforehand. Then they aren't happy but sit and stew, "Do you think it will last through the game?" (My devil voice says, "If it doesn't, I'll send flowers to its funeral." I hope my money dedication is fail-safe.)

Then among the "psycho problems" I would like to be able to understand is the one I call the "Picture Tube Complex." And again I have them divided into two classes...the CRT Negative and the CRT Positive. The CRT Negative will call and say, "My set isn't working. Do you think it is the picture tube?" Or they will say, "The audio went off on my set. I think it must be the picture tube." Any time their set blurps, snaps, snizzles, flubs or fizzles they pale and have visions of a picture tube bill.

The CRT Positive is just the opposite, of course. He will call and say, "My set takes a long time to get a picture and then it is dim. It must have a *little* tube out" or "I've had this set eight years and have never had a bit of trouble with the picture tube so I know that couldn't be it." (Devil voice say *something* !)

So...shop owners, are you beginning to see what we "phone answerers" go through? And please note that I've only mentioned funny and puzzling calls we get. You should hear me talk about some of the *mean* ones! Come to think of it...make my bouquet two dozen rare orchids because my phone is ringing right now. —Jo Schaffer. ■



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**No Trace Distortion.** One of the big values to using a post marker generator like the IG-14 is that markers are injected after the sweep signal passes through the set being tested, thereby eliminating the 'scope trace distortion usually found when injection or absorption type marker generators are used.

**Crystal-Controlled Markers For Any TV Alignment Task.** Four marker frequencies are provided for setting color bandpass, one marker for TV sound, eight at the IF frequencies between 39.75 and 47.25 MHz, and markers for channel 4 and channel 10 picture and sound carriers for checking tuner RF response. With the ability to use up to six markers at once, such as picture and color carriers at 6 dB points, corner marker and trap frequencies, alignment is fast and precise. Trap alignment is just a matter of selecting the appropriate trap frequency, applying the 400 Hz modulation, and tuning the trap for minimum audio on a scope or meter.

**Easy FM IF and Discriminator Alignment.** The IG-14 provides *visible* markers at the 10.7 MHz center frequency plus 100 kHz markers on each side . . . visible because they are applied to the trace after detection and so are not attenuated by the discriminator. Use of harmonics, fully explained in the manual, provide tracking markers as well.

**Trace and Marker Amplitude Controls . . .** on the front panel permit using a regular service type 'scope instead of a wide-band, ultra-sensitive model . . . and stage alignment is easier.

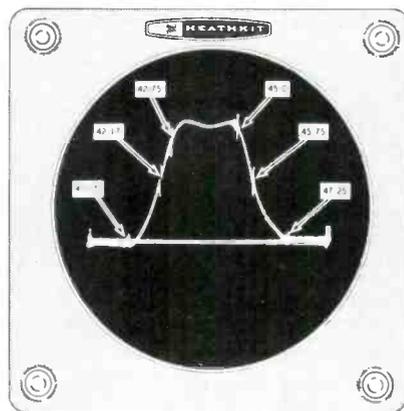
**Variable Bias Supply . . .** 0 to 15 VDC @ 10 milliamps is isolated from chassis so you can use positive or negative bias.

**New Look . . . Circuit Board Construction.** Handsome low profile, "stackable" cabinets in the new look of Heath instruments . . . finished in beige and black. Easy-to-build layout with two circuit boards.

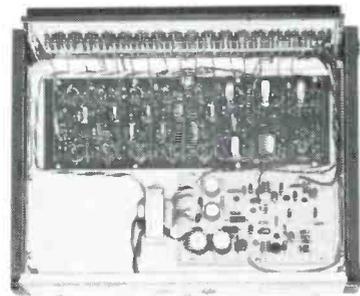
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**IG-14 SPECIFICATIONS—Crystal Marker Frequencies:** 3.08, 3.58, 4.08, 4.5, and 10.7 MHz @ .01%; 39.750, 41.250, 42.170, 42.500, 42.750, 45.000, 45.750, 47.250, 67.250, and 193.250 MHz @ .005%. **FM Bandwidth Marker:** 100 kHz. **Modulation:** 400 Hz. **Input Impedance:** External sweep, 75 ohm; External marker, 75 ohm; Demodulation input, 220k ohm. **Output Impedance:** RF output, 75 ohm; Scope output, 22k ohm. **Bias Output Voltage:** Variable from 0 to 15 VDC @ 10 MA. Isolated from chassis for either negative or positive bias. **Type of Marker:** "Birdie." **Controls:** Bias voltage with AC on/off; Trace size; Marker amplitude; RF output; Modulation on/off; Markers, individual switches for each frequency. **Semiconductors:** Transistors: (16) 2N3692; (6) 2N3395; (3) Silicon diodes; (1) Zener diode, 13.6-V. **Power requirements:** 105-125 volts, 50/60 Hz AC @ 7.5 watts. **Net weight:** 8 lbs.



**SIX MARKERS SIMULTANEOUSLY.** The scope trace above shows how six markers can appear at the same time. Note the trap markers, 6 dB points, and picture and sound carriers . . . all on one trace with the IG-14.



**EASY TO BUILD.** Note how everything except the front panel switches and controls mount on two circuit boards . . . even the crystals.



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## Radio 700

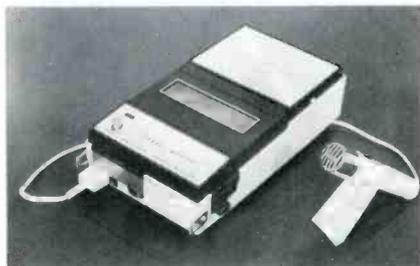
Announced is the "Magellan," model YK377, a six-band AM/FM radio having shortwave, longwave and marine coverage. It has 18 transistors, six diodes, automatic frequency



control, slide rule vernier tuning, dial light, tone control, separate regular and fine tuning controls and a 6 x 4-in. Alnico V speaker. Other features include two ferrite rod antennas, tuning meter and battery condition indicator, 44in. telescopic antenna, and a built-in ac charger converter which permits the radio to be operated on 117vac and also charges the batteries. The radio has a walnut-grained finish with aluminum grill and diecast handle and comes equipped with batteries and earphone. Retail \$99.95. Admiral.

## Cassette Recorder 701

A compact, lightweight cassette recorder, model 6303, is announced. Equipment supplied with the recorder includes a remote control pencil-type microphone and stand, accessory case, earphone, carrying strap and a prerecorded demonstration tape



cassette. The demonstration cassette provides the purchaser with a wide range of examples of the unit's recording and playback capabilities on voice and music. In addition to the adapter-charger, other optional accessories are a remote control foot switch and a direct recording patch cord kit. Weight is 2 lb 10oz with batteries installed. Suggested list \$54.95. Channel Master.

## Portable Color TV 702

Two new 1968 color TV portable roll-about models are introduced. Models CD50P1 and CD55W are said to feature advanced "Color Bright 85"



picture tubes having 180sq in. viewable screens. Both sets feature automatic degaussing, color level monitor, illuminated channel indicators, and 5in. oval front-mounted speakers. Sylvania.

## Cardioid Microphone 703

Announced is a cardioid dynamic microphone, designed for nightclub singers, musicians, entertainers, tape recording and interview work, indoor and outdoor bandstands, schools, churches and high-quality public address systems. The unit may be handheld or stand mounted and includes a built-in wind/breath/pop screen that suppresses unwanted noises. Designated 650A (deluxe), the microphone features an on/off switch that can be locked in the ON position, when needed, and a brass roll-off switch which allows the performer to reduce feedback, subdue excess instrumental bass tones from 400Hz down and reduce rumble. It also has an easily changeable output impedance of 150/250Ω or 20K and an output level of -56dbm/10dynes/



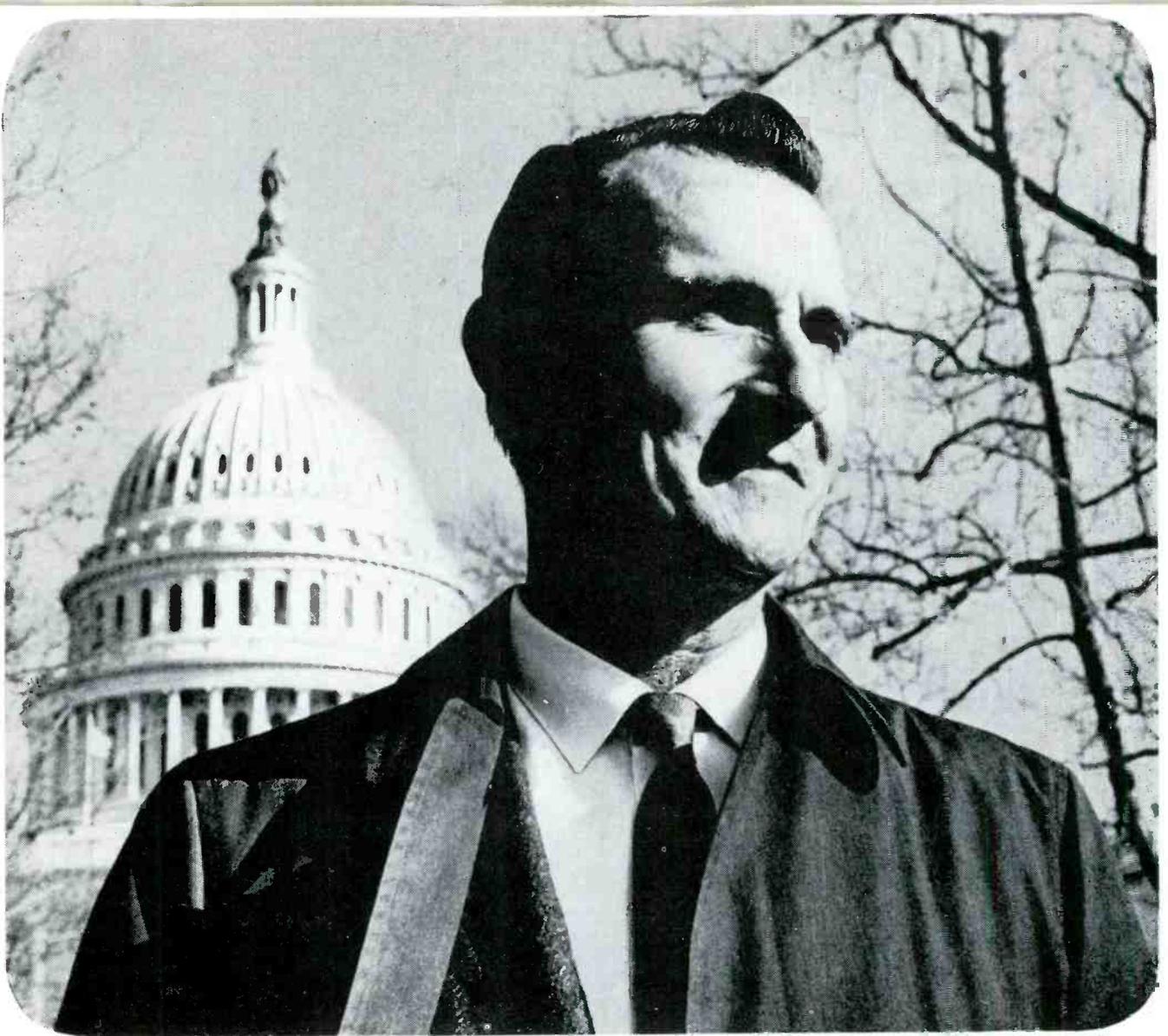
cm<sup>2</sup>. Average front to back ratio is 20db, according to specifications. Altec Lansing.

## Stereo Tape Recorder 704

Announced is a solid-state, four track, stereo tape recorder which features three separate heads for erase, record and playback. It is said the unit will record sound with sound and



sound on sound. The unit includes two separate control panels and monitoring speaker. It is complete with all accessories, two microphones, 7in. reel, 7in. take-up reel, output cords, ac line cord, splicing tape and lubricating oil. Suggested retail price \$349.95. Selectron.



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Jerry Peake Co., Inc., Washington, D.C., has installed over 185,000 antennas in the last 18 years in the Washington, D.C. area. He relies on both JFD LPV-CL Color Lasers and LPV-TV Log Periodics — like other professionals — to get performance people expect from a professional.

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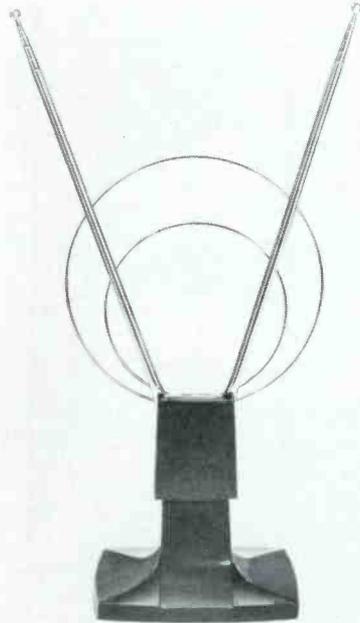
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**Indoor Antenna 705**

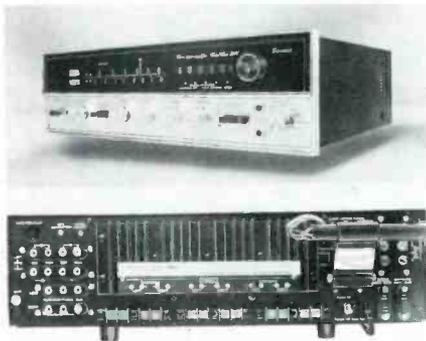
An indoor 82-channel antenna model 500 is announced. The unit features a vertical design and rotating scanner plus a dual UHF loop, high-impact polystyrene base and brass dipole



plated with stain finish chrome. The rotating scanner is said to enable the user to aim for best pictures without moving the base. A deep felt pad on the base protects furniture from scratches. Separate leads are included for VHF and UHF channels. Leads are terminated with heavy-duty connectors for fast, secure connection to the TV set. The antenna also works well for FM stereo. It is available in walnut or sandalwood finish. List \$9.95. Gavin.

**Stereo Receiver 706**

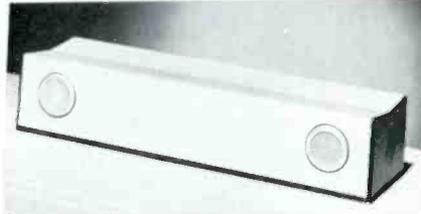
Announced is the model 5000, a 180w AM/FM, stereo receiver featuring all-solid-state design. The unit contains four integrated-circuit components in the IF section, plus a FET FM front end. Specifications include



180w IHF music power providing 75w channel of continuous power at 4Ω. FM tuner sensitivity is 1.8μv (IHF); selectivity better than 50db at 98MHz; stereo separation better than 35db. The amplifier section provides a flat frequency response from 10Hz to 50kHz, the manufacturer says. Sansui.

**Ultrasonic Intrusion Alarm 707**

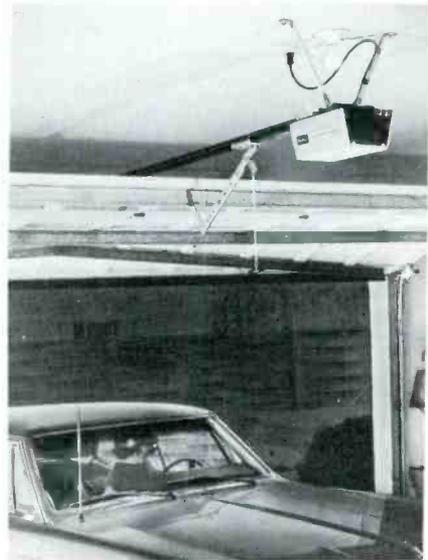
Announced is an ultrasonic intrusion alarm for homes, apartments, offices and commercial establishments.



It is said the Model A1 alarm will protect an entire room or the equivalent open space, indoors or out. Suggested list is \$97.50. Euphonics.

**Garage Door Operator 708**

A solid-state, gear-driven chain drive garage door operator is introduced which is said to be especially



suitable for single or double sectional garage doors. A radio coding technique is used with each receiver to discriminate against signal disturbance, except for its own distinct triple combination of signal and pause. Perma-Power.

**Cartridge Player 709**

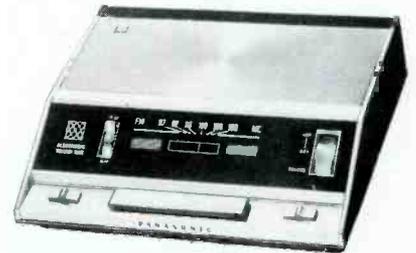
A compatible four- and eight-track home stereo cartridge player system is announced. The unit has fully automatic cartridge and track selection and features separate enclosed speakers. Cabinet and matching speaker enclosures are of walnut-finish wood. Specifications indicate that wow and



flutter is less than 0.25% RMS, output power 12w (6w channel); signal-to-noise ratio better than 45db, frequency response 70Hz to 10kHz and channel separation 35db. Craig.

**Automatic Tuning AM/FM Table Radio 710**

Announced is the model RE6125, "Carmel," an AM/FM radio having automatic electronic tuning. A me-

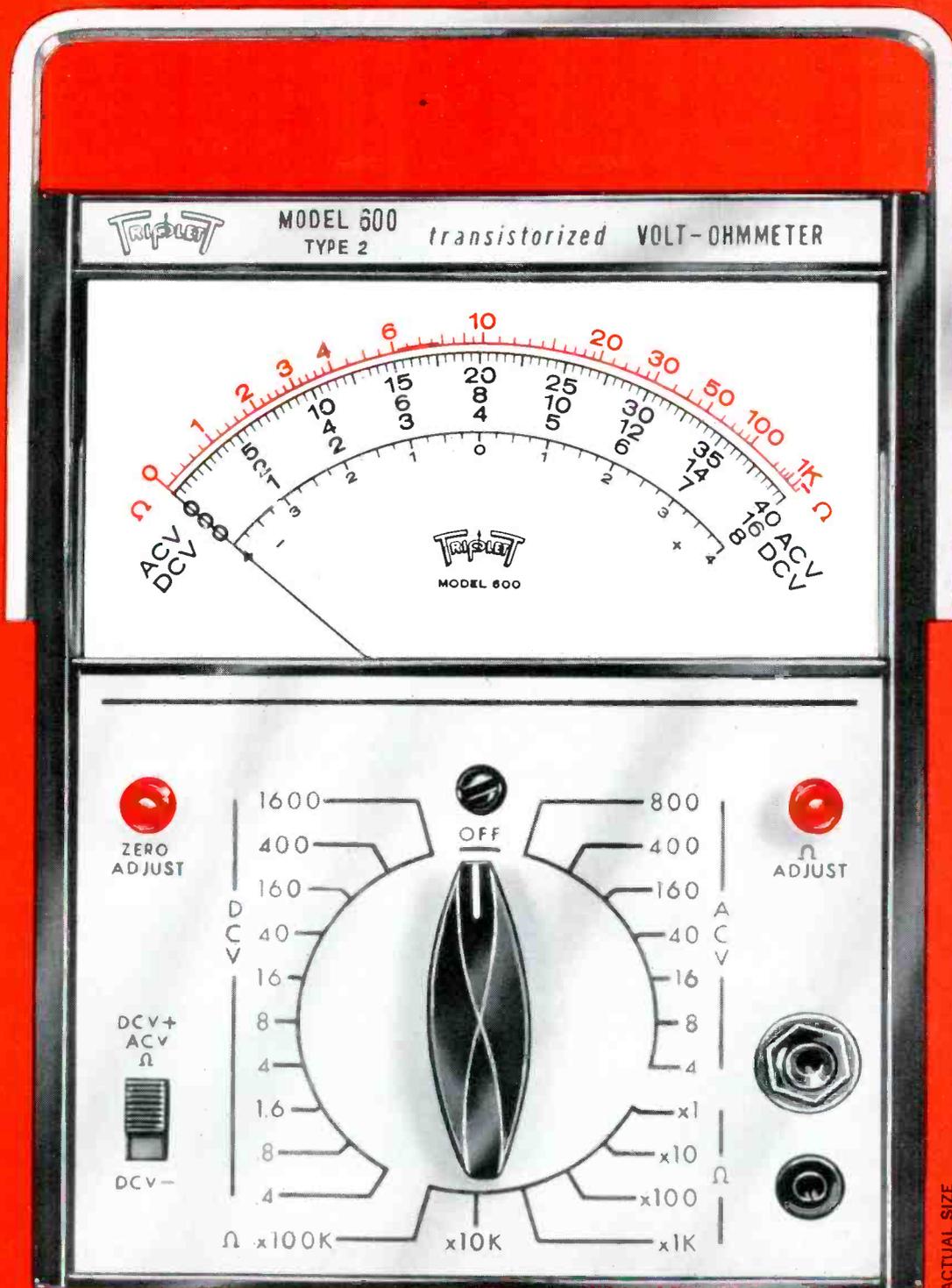


chanical tuning system permits the listener to tune in any station automatically by simply depressing a tuning bar. Panasonic.

**Columnar Speakers 711**

A line of portable columnar speakers reportedly range from 18 to 200w. Specifications indicate that these speakers have a 120deg horizontal dispersion, 18deg to 45deg vertical dispersion and 120Hz to 10kHz or 40Hz to 18kHz frequency range. List prices for 20-in. and 72-in. Sizes are \$77 and \$430 respectively. Temple.





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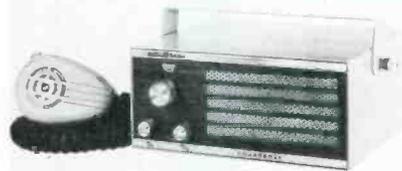
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**CB Transceiver 712**

Announced is a 23-channel, all-solid-state CB transceiver which is said to have a patented "Pulse Eliminator"



ator" which reduces interference from engine ignition, electric motors, appliances or fluorescent lights. Price \$199.95. Squires-Sanders.

**Automatic Turntable 713**

Announced is an automatic turntable which features an antiskating device combined with an exact adjustment dial to compensate for stylus shape and friction. Other features include a cartridge shell that accepts all cartridges with an exact slide-fit mounting, single-lever command center, lever controls start, stop repeat, cuing and lift; automatic start and



automatic shutoff in either single play or with a stack of records. An automatic scanning device is said to measure the diameter of any record and adjust the tonearm accordingly. Has four-pole, four-coil induction motor. Price \$129.95 (less base and cartridge). Elpa.

**CB Transceiver 714**

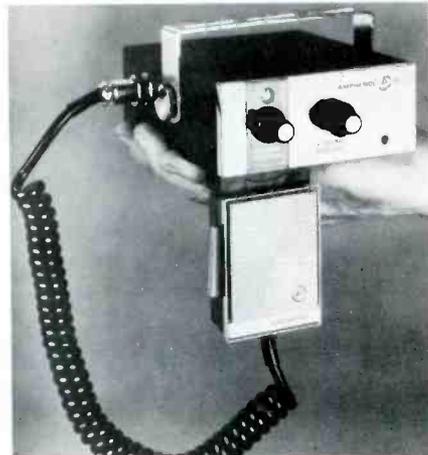
A 23-channel solid-state CB transceiver is announced which is said to be the smallest all-channel comparable unit on the market. It also carries a 10-year guarantee. The unit has an



incoming signal indicator which lights automatically when receiving S6 or stronger signals, an illuminated channel selector, auxiliary speaker jack, modulation indicator and single-knob tuning. Size: 5¾ x 6¼ x 1⅞ in. Price \$149. Courier.

**CB Transceiver 715**

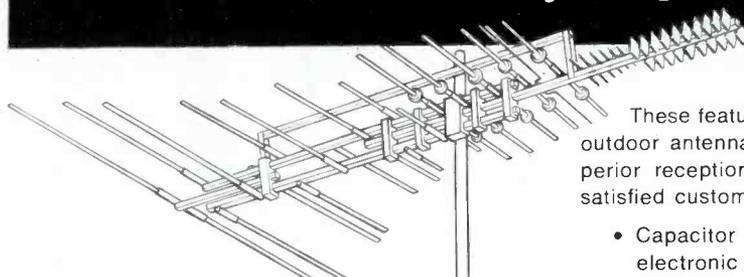
Announced is a ruggedly constructed solid-state CB transceiver which is said to provide the full 5w of RF



allowed under FCC law for effective HELP program communications. Designated the model 750, the receiver is said to have a sensitivity rating of

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<p><b>LOW-FREQUENCY AMPLIFIERS</b>                  Transistor Characteristics                  Circuit Considerations                  Thermal Considerations                  Distortion                  Negative Feedback                  Basic Amplifiers                  List of Selected Circuits</p>	<p><b>SWITCHING CIRCUITS</b>                  Basic Flip-Flop Designs                  Symmetrical Circuits                  Triggering Methods                  Blocking Oscillator Designs                  Direct-Coupled Transistor Methods                  Negative Resistance Circuit Methods                  Other Circuit Methods                  List of Selected Circuits</p>	<p><b>POWER CONVERTERS</b>                  Basic Transistor Oscillator                  Other Connections for Basic Circuits                  Starting Circuits                  Basic Power Converter Designs                  De-Spiking Networks                  Transistor Selection                  Transformer Selection and Design                  Modified and Improved Circuits                  Regulators and Protective Circuitry                  Thermal Considerations                  List of Selected Circuits</p>
<p><b>HIGH-FREQUENCY AMPLIFIERS</b>                  Equivalent Circuits                  Power Gain and Stability                  Neutralization                  Noise                  Automatic Gain Controls                  Tuned Amplifier Interstages                  Video Amplifiers                  List of Selected Circuits</p>	<p><b>LOGIC CIRCUITS</b>                  Basic AND-OR Gates                  Counters and Shift Registers                  High Speed Gating                  List of Selected Circuits</p>	<p><b>SMALL-SIGNAL NONLINEAR CIRCUITS</b>                  Modulators                  Mixers and Converters                  Detectors                  Frequency Multipliers                  Frequency Dividers                  List of Selected Circuits</p>

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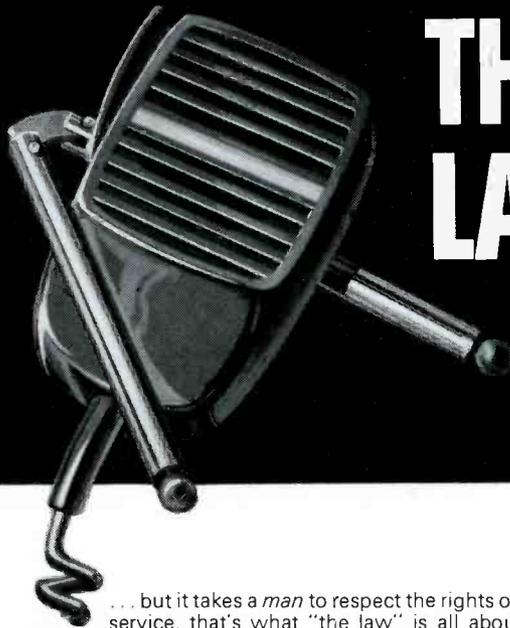
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T-58

for more details circle 149 on postcard

# ANY NUT CAN BREAK THE LAW:



... but it takes a *man* to respect the rights of others. And in the citizens radio service, that's what "the law" is all about, of course—simple, common-sense rules to help insure *the right of all to communicate*.

Maybe most of the real problems are created by that small Obnoxious Minority. But aren't *all* of us a little too windy at times? A little too quick to make that next call? A little too willing to work that beautiful skip signal "just this once"?

Let's *all* come out of our shells and get cracking on the whole problem. Start by re-reading Part 95. Resist the temptation to stretch your nickels into dimes. Use your call numbers. And respect the "unwritten law" of Channel 9 for emergencies.

If we *really* discipline ourselves, the Federal Communications Commission will have plenty of time to crack down on the Nuts.

## **ELECTRONIC INDUSTRIES ASSOCIATION**

2001 Eye Street, N. W. Washington, D. C. 20006 Citizens Radio Service Section



of  $0.5 \mu v$  for  $10db \frac{S+N}{N}$ . Features include an adjustable squelch control, an effective automatic noise limiter (ANL) to minimize ignition whine and associated electrical interference and "hash" generated by passing vehicles. Price \$79.95. Amphenol.

### Electric 'Youth' Organ 716

A portable electric chord organ is announced which has 25 numbered and color-coded treble keys, giving it



a two-octave range and six easy-touch chord keys. Its acoustically designed cabinet is ivory-colored high-impact polystyrene,  $19\frac{1}{2} \times 8\frac{5}{8} \times 10$  in. Weighing only 17 lb, the organ can be easily carried from room to room and plugged into any ordinary household outlet, it is said. Price \$24.95. G-E.

### Stereo Units 717

Announced is a complete line of quality stereo Hi Fi units in accent furniture. The line is called the "Custom Duet" series and consists of 20 different units with or without Multiplex FM. Cabinets are said to be genuine hardwood and handcrafted of



specially selected veneers and hardwood solids. Decorator-designed doors provide distinctive grain patterns and shadings, the manufacturer says. Embassy.

# There has never been a better color-bar generator than the RCA WR-64B... until now!



The RCA WR-502A CHRO-BAR color-bar generator is all solid-state, battery operated... Provides color bars, dots, crosshatch, vertical lines, horizontal lines, blank raster... has rock-solid stability. It's the greatest yet. The CHRO-BAR. \$168.00\*.

RCA Electronic Components, Harrison, N. J.

\*Optional Distributor resale price. Prices may be slightly higher in Alaska, Hawaii and the West.

# RCA

... for more details circle 131 on postcard

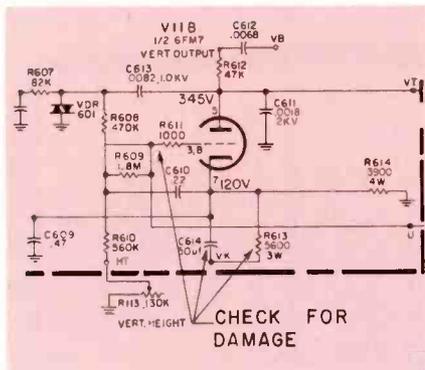


# COLORFAX

## GENERAL ELECTRIC

### Color TV Chassis KC/KD — Vertical Sweep Failures

You should be aware of secondary component damage which may occur in a color set when a 6FM7



vertical tube fails. The extent and nature of the secondary damage will vary, depending on the nature of the tube failure.

In case of a 6FM7 failure, the

following components should be checked for damage and replaced if necessary.

1. R130, 680 may be overheated.
2. R611, 1K may be overheated.
3. R613, 5.6K may be overheated.
4. C614, 50  $\mu$ f may be showing leakage at lugs.

In addition, it should be noted the CRT phosphor may be damaged in 3-4min. if the set is operated at high brightness without vertical sweep.

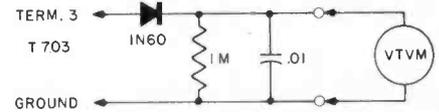
## MAGNAVOX

### Color TV Chassis T924 — Color AFPC Adjustment

There have been reports of difficulty in obtaining proper operation after performing the AFPC adjustments as outlined in service manual No. 7297. Rotation of the tint control in some cases may result in a change in picture brightness, a loss of color sync or even

loss of color. To prevent this, disregard the original adjustment procedure and proceed as follows:

1. Connect a color bar generator to the antenna terminals and adjust the receiver for a normal color bar pattern.
2. Set the tint color to its approximate center.
3. Ground the burst amplifier grid, pin 2 of V706.



4. Connect a VTVM to the color killer grid, pin 9 of V706 and set it to read a negative dc voltage.

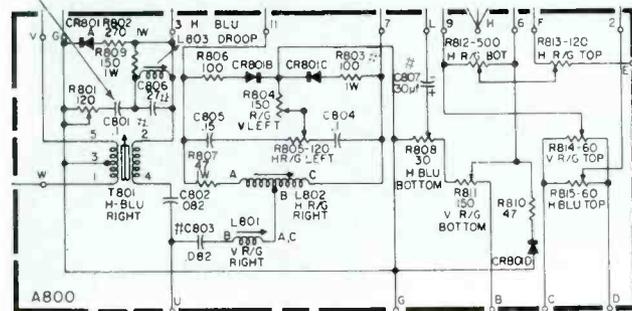
5. Adjust the burst transformer T702 to obtain a minimum negative dc voltage reading.

6. Adjust the 3.58MHz oscillator trimmer, C743 so the color bars stand still or just drift by slowly on the screen.

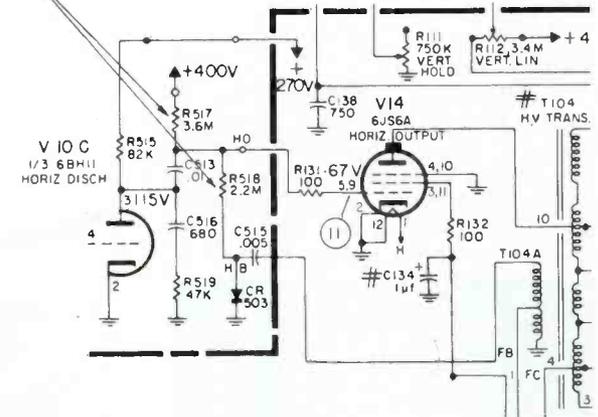
7. Remove the ground from the burst amplifier grid and connect the VTVM through the detector network shown, to terminal 3 of the oscillator plate transformer, T703.

8. Rotate the tint control to either extreme and adjust T703 (correct peak is with the slug located close to the

CHANGE TO  
.082  $\mu$ f  $\pm$  20% 200V



CHECK VALUES  
OF RESISTORS

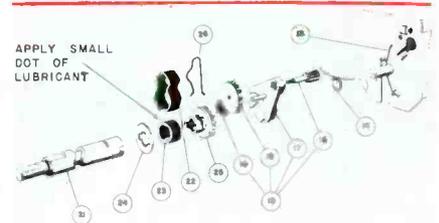


## General Electric

### Color TV Chassis KC/KD — Service Information

**Failure of R801 Blue-Left Convergence Potentiometer.** Failure of this component will probably be caused by overloading which may occur in rare cases because of tolerance building up in other circuit components. **Correction:** When replacing R801, change value of C801 from .1 to 0.082  $\mu$ f  $\pm$  20%, 200v. This corrects tolerance build up and will reduce current through R801. **Insufficient Width:** Measure the horizontal output tube, V14, grid voltage. This is normally about -67v  $\pm$  20%. If it reads higher

than normal, sometimes as high as -100v, output will be substantially reduced. **Correction:** Disconnect R517, 3.6M and measure its value. If it is not correct, sometimes as high as 6M, it must be replaced. While disconnected, also check the value of R518 which should be 2.2M. Replace with correct value. **Excess Stiffness or Drag in Fine Tuning of ET86X263 and ET86X274 VHF Tuners.** If fine tuning shows excessive stiffness, item No. 22 and 23 in the exploded view, these items require lubrication. **Correction:** Apply



to item 23 a small dot of lubricant containing molybdenum disulfide, which prevents seizing and galling. (Do not use tuner lube or oil, since excessive slipping will result.)

circuit board) for approximately -9v on the VTVM. Rotate the control to the other extreme and check the voltage reading. Adjust T703 so an equal voltage reading is obtained at both extremes of the tint control.

9. Adjust the tint control to the point where a "dip" is noticed in the VTVM reading (approximately -7v — this is the electrical center of the control. With the control set at this point, ground the grid of the burst amplifier (pin 2, V706) and reset C743 so the color bars stand still or drift slowly.

10. Remove the detector network and the ground from the burst amplifier grid. Check the tint control operation. The color bar shift, either side of the proper color setting, need not be equal so long as it will shift at least one bar on either side.

## MOTOROLA

### Color TV Chassis TS915/919 — Noise Protection, Sync and AGC Circuits

Shown in illustration, is the complete sync, AGC and noise immunity circuits. Very similar to circuits used in conventional B/W receivers, the bias arrangements and circuit layout are quite simple.

The noise separator is cut off for all signals at sync tip amplitude and lower by a threshold potentiometer. Only noise pulses having an amplitude higher than the sync pulses cause the separator to conduct. The separator output contains noise spikes separated from the composite video signal. There is no phase inversion of the noise because of the common base arrangement at the separator. The following noise inverter amplifies the positive input noise spikes and inverts them to negative polarity. Recombining with the original video signal at the 2nd video amplifier emitter, the original positive-going noise spike is canceled by an amplified and inverted negative spike.

The keyed AGC circuit is familiar. Using horizontal sync pulse amplitude as an indicator of signal strength, the AGC gate conducts when the horizontal sync and the collector pulse coincide. The extent to which the gate conducts is a function of sync pulse amplitude. Conduction charges an 8  $\mu$ f capacitor negatively at the base of a PNP AGC amplifier. A coupling diode prevents capacitor discharge. The capacitor charge is proportional to signal strength, and causes the AGC amplifier to conduct proportional to signal strength. With conduction from collector-to-emitter in this PNP stage, a positive voltage proportional to signal strength is developed across a 720  $\Omega$  collector load resistor for

# Check these CHRO-BAR color bar generator features...on the fingers of one hand

## ...if you count two to a finger and one for the thumb...

1 rock solid stability 2 portability (battery operated) 3 all solid-state (silicon transistors) 4 rugged (cast aluminum case and brushed aluminum panel) 5 crystal control (4 crystals) 6 sound carrier provided 7 provision for spare battery (switch selection, battery meter) 8 gun killer (switches and leads) 9 all new circuit design. It's the greatest yet. The CHRO-BAR. \$168.00\*

RCA Electronic Components, Harrison, N.J.

\*Optional Distributor resale price. Prices may be slightly higher in Alaska, Hawaii and the West.

# RCA



... for more details circle 132 on postcard



the change was made at the factory or during prior service.

**Replacement of Silicon Rectifier in Power Supply CTC20.** If it becomes necessary to replace the bridge rectifier (part # RF34720) in the low voltage power supply, it is suggested to use four separate silicon rectifiers, available from Olympic kit # PP61054 or equivalent. Installation instructions are included in the kit. After installation of these rectifiers a hum bar may appear. To remove the hum bar, visible only under certain field signal conditions, there should be two 0.01  $\mu$  f 500v capacitors added to the circuit as follows:

Add a capacitor from B+ low voltage rectifier output to ground. This capacitor should be a 0.01  $\mu$  f 500r.

Another capacitor is added from the color-on indicator circuit (point "Y" of SR102) to ground.

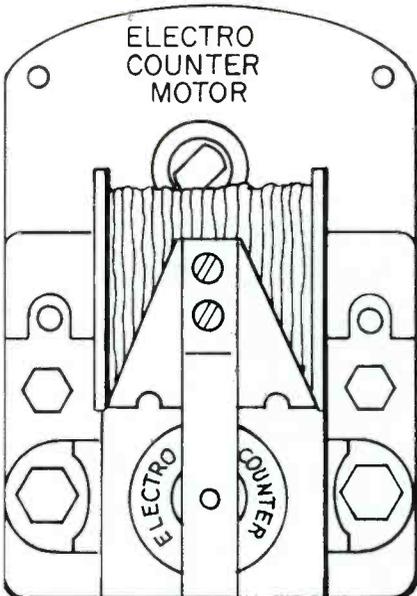
These capacitors are also furnished in the kit PP61054 with detailed installation instructions. The diagram shows the two added capacitors in their respective circuits.

## RCA VICTOR

### Non-remote Power Tuning CTC30 Chassis — Channel Skipping

Some models with nonremote power tuning may occasionally skip channels. The following corrective action should clear this problem.

**Condition "A."** Where there is a tendency to skip a VHF channel and an Electro Counter motor is used,



replace "leaf switch" S1002, stock number 115497. **Condition "B."** Where CR1202 diode has failed and an Electro Counter motor is used: (1) Add 10  $\mu$  f capacitor C1201 — if it is missing, stock number 118832. (2)

*Continued on page 89*



# And check this special CHRO-BAR color bar generator introductory offer... the carrying case is free

From now till June 28, when you buy an RCA CHRO-BAR we'll throw in a carrying case FREE. After that it'll cost you \$7.50\*. Check with your RCA Distributor today for details. For complete specifications, write RCA Electronic Components, Commercial Engineering, Department E46-WD 415 South Fifth Street, Harrison, N.J.

\*Optional Distributor resale price. Prices may be slightly higher in Alaska, Hawaii and the West.

# RCA

... for more details circle 133 on postcard

# NEW PRODUCTS

For additional information on products described in this section, circle the numbers on Reader Service Card. Requests will be handled promptly

## Telephone Answering Unit 718

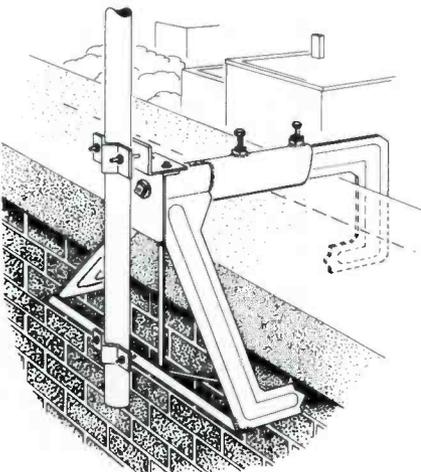
What is said to be an all-purpose cartridge telephone answering unit, called "Minatronics 520," is announc-



ed. The unit employs an endless tape contained in a snap-in cartridge onto which both incoming and outgoing messages may be recorded, according to the maker. It is said the unit is not wired into telephone company lines. It carries a one-year warranty policy. Minatronics.

## Parapet Mount 719

A parapet mount is announced for TV, FM and CB antennas. It is said the installation is performed from the roof side of the parapet by tightening one clamping bolt, eliminating the hazards of leaning over the parapet wall or working high on a ladder. The adjustable upper mast holder allows vertical positioning of mast. It is said only one adjustable wrench is required for mounting. Unit is made of heavy-gage embossed steel,



arc welded for extra strength and rigidity and hot-dip galvanized for corrosion resistance. No holes are necessary in parapet or roof. The mount is adjustable to accommodate parapet walls from 4 to 13in. thick. South River.

## Offset Ratchet Kit 720

Five handy "pocket size" tool kits for all-purpose and special uses are designed for assembly, disassembly and repair problems for tool-and-die makers, electronics technicians, aircraft mechanics, appliance repairmen and others. It is said they easily drive slotted, Phillips and socket head screws ranging from 0.050in. up to 5/16in.



Standard 1/4in. square drive sockets may also be used with the ratchet handle or versatile adapters may be used with any standard 1/4in. drive ratchet handle simply by fitting them into any standard 1/4in. hexagon socket. Chapman.

## Square Wave Generator 721

A compact, general-purpose square-wave generator is announced. The unit has a frequency range from 1Hz to 10MHz and less than 15ns rise- and fall-times. Its all solid-state circuitry supplies squarewaves with amplitude controllable from 0 to 5v P-P into a 50 Ω load. Frequency is selectable in seven decade ranges. A vernier selects the exact frequency desired within any one of the 10-to-1 frequency ranges. A dc voltage adjustable between -1.2 and -13v gives frequency control over a 10-to-1 range. Hence, the instrument qualifies fully as a voltage-con-



trolled oscillator. Source impedance is 50 Ω. This, it is said, preserves the clean waveshape by absorbing reflections from impedance mismatches on the output cable. The model 220A measures 5 1/3 x 3-7/16 x 11 5/8in. Price \$195. Hewlett-Packard.

## Pocket Burnisher 722

A pen-type pocket burnisher/cleaner, using relay-actuated equipment for the communications, telephone and electronics industries is announced. It is said to be designed for all type contacts — silver, platinum, gold, palladium, tungsten, molybdenum — all precious metal contacts. Adjustment of the flexible blade — length and rigidity — is possible by varying depth in chuck. The burnisher is said to be nonresidual and leaves no grit or dust on the contact. Over-all length: 5 1/2 x 3/8in; available in two types. Jonard.



### Relay Tool Kit

723

A 15-piece relay tool kit is announced which contains carefully selected tools for electronics and telecommunications technicians. Kit contains tools necessary for adjusting,

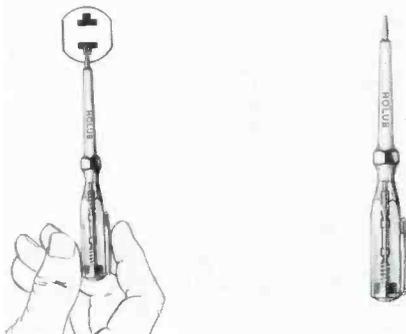


servicing and calibrating all type relays. All tools are said to be made of high-quality carbon steel, with heavy chrome plating. Dielectric tools permit adjusting and repair on "live" equipment without stopping operation, it is said. Leather zippered case is engineered for maximum protection of each tool, insuring long-lasting performance. Price \$34. Jonard.

### Screw Driver Test Light

724

Announced is a tool that can be used as a screw driver and electrical tester. Two models are available. One model is for 12 to 60vac/dc which is said to give reliable checks on low



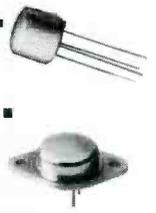
voltage circuits, relays, transformers, batteries or to set thermostat controls. The removable 18 in. test lead has a banana-type jack on one end and alligator clip on the other. The second tool is for 90-250vac. It is used for testing circuits, switches, cords and motors. The unit is said to work on one side of the line only. Both tools include a handy pocket clip. Over-all length is 5in. Holub.

### Flutter Meter

725

A flutter meter, said to offer professional quality and accuracy at low cost, is introduced. The model 8150,

## Test this signal transistor at 1mA collector current... and this power transistor at 1Amp collector current... or any collector current you select, from 20µA to 1 Amp with the **WT-501A in-circuit/out-of-circuit transistor tester**



Battery operated, completely portable, RCA's new WT-501A tests transistors both in-circuit and out-of-circuit, tests both low- and high-power transistors, and has both NPN and PNP sockets to allow convenient transistor matching for complementary symmetry applications. The instrument tests out-of-circuit transistors for dc beta from 1 to 1000, collector-to-base leakage as low as 2 microamperes, and collector-to-emitter leakage from 20 microamperes to 1 ampere.

Collector current is adjustable from 20 microamperes to 1 ampere in four ranges, permitting most transistors to be tested at rated current level. A complete DC Forward Current Transfer Ratio Curve can be plotted. Three color-coded test leads are provided for in-circuit testing, and for out-of-circuit testing of those transistors that will not fit into the panel socket.

See your Authorized RCA Test Equipment Distributor, or write RCA Electronic Components, Commercial Engineering Department E46-WA, 415 South Fifth Street, Harrison, New Jersey.

Extra features... RCA reliability... for only \$66.75\*.

\*Optional distributor resale price. Prices may be slightly higher in Alaska, Hawaii, and the West.

# RCA



... for more details circle 134 on postcard

## NEW PRODUCTS

is designed for audio service centers and other audio applications. The unit is said to be specifically designed for



applications where professional quality and accuracy are mandatory and where economic considerations are important: audio and video tape transports, phonograph turntables, motion picture equipment, dictating equipment and industrial rotational equipment. The instrument features automatic input level indication and advanced solid-state construction. Micom.

### Burglar/Fire Alarm 726

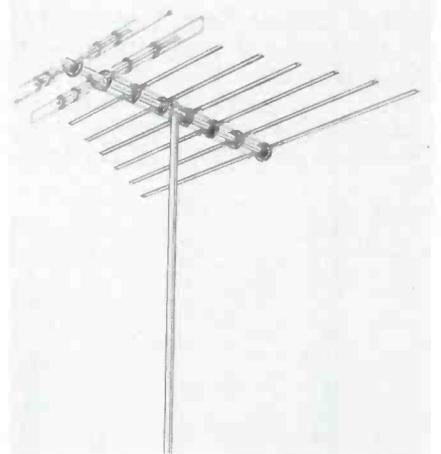
A burglar and fire alarm, model SW391, is announced. Designed to protect home or business against fire



and theft, the system operates 24-hours a day on a built-in power supply. No power is used unless alarm is activated. Kit includes meter type siren, fire sensing switch, door or window switch, master switch, door override switch, terminal block, battery holder and 100ft of wire. Complete with instructions, \$19.98. Olson.

### TV Antenna 727

Announced is a 300  $\Omega$  rooftop TV antenna that can be readily converted to 75  $\Omega$  performance by using a snap-



on transformer. The "Paralog 300 Plus" is designed for VHF and FM. Jerrold.

### Hex Key Wrenches 728

An array of hex key wrenches — 40 sizes in all — is announced. Included in the selection are long hex key wrenches, the ideal tools for getting at hard-to-reach socket-head screws frequently encountered by service technicians. The size of the wrenches ranges from short to long to extra-long to foot-lengths. There are 13 wrenches in the short series, 13 in the long series, nine in the extra-long series and 7 in the foot-long series. Wrenches are made of high quality nickel-chrome-molly steel, precision



# HELP!

## ...Yours When You Reach For Tools By CHANNELLOCK

Whenever you want to hold, cut, strip, drive, grip, bend, pull, twist, straighten, tighten or loosen . . . man, you need help! The kind of help that not only gets the job done faster *now* but year after year as well. The kind of help you get only from hand tools by Channellock. Doubt it? Take hold of a Channellock tool.

See and feel the fine-polished drop-forged steel . . . the precision-machined, smooth-working moving parts . . . the skillfully hand-honed cutting edges. You'll know then why Channellock is the favorite brand with men who know good tools and won't tolerate less. Men like you.

TOOLS BY  
**CHAN NEL LOCK**  
MEADVILLE, PA.

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drawn from selected billets to meet the most exacting requirements and to insure long life, according to the manufacturer. They are unconditionally guaranteed, the manufacturer says. Prices range from 10 to 75¢. Vaco.

### Amplified Bridger 729

Announced is an amplified bridger, the model SL6410, said to be the first amplified bridger available in the master TV antenna industry. It provides an output from a main or through-line with no signal loss in the through-line, the manufacturer says. The unit is solid-state and ideal for large buildings and multi-building installations, it is said. Specifications indicate a frequency range of 20-216-



MHz, 470 to 890MHz; impedance 75  $\Omega$ ; isolation between through line and tap, 35db; through-line loss less than 1.0db; output gain, VHF, 1db UHF, -1.5db; tilt control range, VHF, 5.5db; dimensions; 2 5/16 x 2-5/16 x 1 1/2 in. List price is \$37.50. JFD.

### Desk-Top Consoles 730

Three new desk-top outlet box consoles, designed to provide a greater degree of control for instruments and equipment, are introduced. Available in three different sizes having 4, 6 or 8 "U" ground outlets, each is controll-

# Here's a remarkably stable, completely portable, all solid-state, battery operated voltmeter. Naturally it's an RCA VoltOhmyst®

Eliminate warm-up time! Eliminate zero-shift that can occur in tube-operated voltmeters! RCA's new WV-500A VoltOhmyst is an all solid-state, battery operated, completely portable voltmeter that is ideal for service, industrial, and lab applications. Seven overlapping resistance ranges measure from 0.2 ohm to 1000 megohms. Eight overlapping dc-voltage ranges measure from 0.02 volt to 1500 volts (including special 0.5 dc volt range), ac peak-to-peak voltages of complex waveforms from 0.5 volts to 4200 volts, and ac (rms) voltages from 0.1 to 1500 volts. Input impedance of all dc ranges is 11 megohms.

All measurements are made with a sturdy, wired-in, single-unit probe with fully shielded input cable. The probe is quickly adapted to either dc measurement or ac and resistance measurement by a convenient built-in switch. And an accessory slip-on high-voltage probe is also available to make possible measurements up to 50,000 dc volts.

See your Authorized RCA Test Equipment Distributor, or write RCA Electronic Components, Commercial Engineering Department, Section E46-WB, 415 South Fifth Street, Harrison, New Jersey.

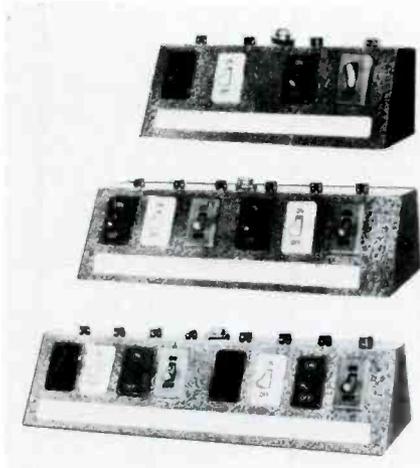
Solid-state reliability and convenience for only \$75.00\*.

\*Optional distributor resale price. Prices may be slightly higher in Alaska, Hawaii, and the West.



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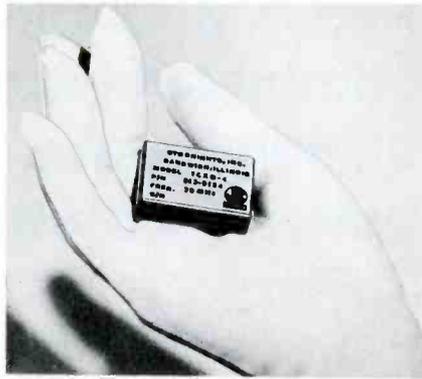
## NEW PRODUCTS



ed by its own switch and pilot light. The units are rated at 15a, 130v and are available with choice of circuit breaker or fuse, and with 6- or 15-ft neoprene cord-set. Size 2 $\frac{3}{4}$  x 2 $\frac{3}{4}$  x 7 $\frac{1}{2}$  to 11in. Prices range from \$12.95 to \$21.50. Waber.

### Crystal Oscillator 731

A compact temperature compensated transistorized crystal controlled oscillator is announced. Designed for



PC board mounting, the model JKTC-XO-4 is available with any output frequency between 6 and 20MHz over a temperature range of -55°C to +85°C at stability of  $1 \times 10^{-5}$ , the manufacturer says. The temperature compensating circuit is said to eliminate the need for a crystal oven — reducing warm-up time to zero and lowering input power to 100mw maximum @ 12vdc. Size is 1.5 x 1.0 x .40in. max. CTS Knights.

### Work Viewer 732

A work viewer is announced which has the following specifications, according to the manufacturer: Objects viewed can be moved up, down and sideways under the lens and always remain in focus without manipulating

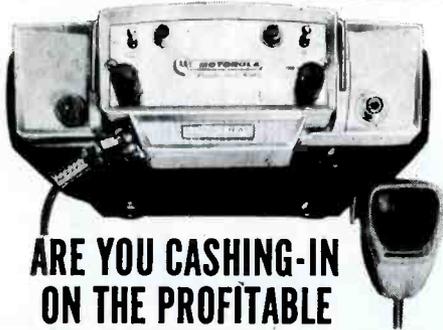
the instrument; provides the observer with 48sq in. of panoramic viewing area without distortion; provides large area for group viewing when necessary; produces distortion-free mag-



nification; maintains complete depth of field without distortion; permits objects to be moved through all focal depths and distances while remaining in sharper focus. Knobs tilt the lens to any desired working angle. Size 11 $\frac{1}{2}$  x 9 $\frac{1}{2}$ in. Ednalite.

### Panel Lamps 733

Announced are 15 different styles of low-voltage miniature lamps, serving as replacements for most popular



## ARE YOU CASHING-IN ON THE PROFITABLE 2-WAY RADIO SERVICE BUSINESS?

- ★ Motorola will train you for this rewarding, elite profession
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## NEW COAX LINE SPLITTER

### for Color TV



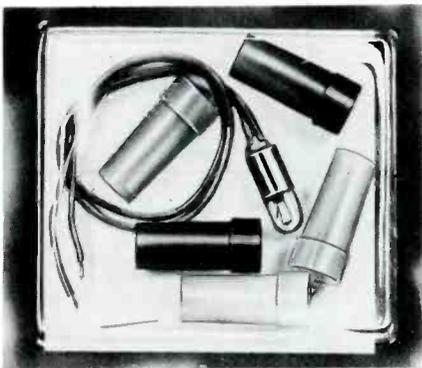
The Mosley M-22 two set, and M-24 four set 75 ohm coax splitters for color TV/FM Stereo distribution systems. High inter-set isolation, low insertion loss. Models may be combined to provide any number of lines for larger amplified systems. Solderless. Easy installation.



• Write Dept. 159 for FREE detailed brochure.

**Mosley Electronics Inc.** 4610 N. Lindbergh Blvd.,  
Bridgeton Missouri 63042

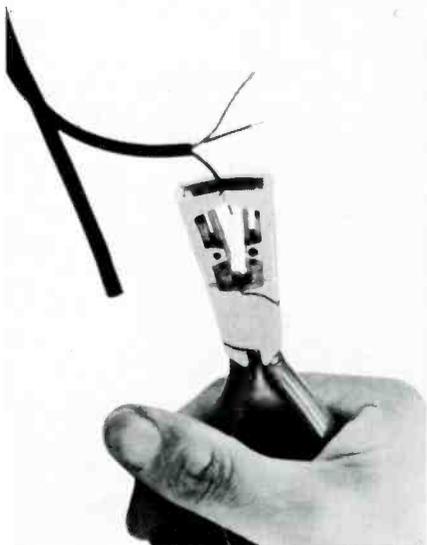
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brands of tape recorders, Hi Fi and other electronic equipment. Each lamp is blister-packed with 5 snug-fitting jewel caps in assorted colors (red, white, blue, green and amber). Lamp styles include fuse type, pig tail, neon and complete assemblies with 6-in. leads. Voltages range from 2 to 28v; current from 20 to 300ma.

### Wire Stripper 734

A self-adjusting wire stripper, accommodates all sizes of wire from AWG 8 to 24 without any ad-



justment by the user, it is said. The stripper has 11 narrow cutting blades in each jaw. Each blade "floats" in its own spring mounting, so they close around the wire in a circle as the handle is squeezed. Cutting tension is provided entirely by the spring action in the blades—not by the amount of squeeze given the handle. Telvac.

### Mini-Tools 735

Announced is an enlarged line of small tools in pop-out plastic kits for improved tool organizing. It is said the line was designed for exact assembly and fine adjustment of miniaturized solid-state assemblies, small instruments and other small assemblies. Manufactured of heavy industrial plastic, the roll-type holder takes up a minimum amount of space in pocket

**We took our WA-44C  
Audio Generator,  
transistorized it, made  
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easier to use...  
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The RCA WA-504A Sine/Square Wave Audio Generator—transistorized for stability and dependability—provides a tuneable AF signal that's ideally-suited for service, industrial, laboratory, education and hobby use. Frequency range extends from 20 Hz to 200 kHz. New solid state circuit design uses 6 transistors—including MOS FET oscillator circuit—and 2 diodes... assures stability (Amplitude variation  $\pm 1.5$  dB, total harmonic distortion of sine wave less than 0.25%).

The WA-504A is useful in a wide range of applications, including direct measurement of frequency response characteristics of audio amplifiers; testing speakers and enclosures; finding impedance of LC combinations; determining frequency of vibrating or rotating bodies, etc.

Ask to see WA-504A at your Authorized RCA Test Equipment Distributor, or write RCA Electronic Components, Commercial Engineering Department E46-WC, 415 South Fifth Street, Harrison, N.J.

\*Optional Distributor resale price. Prices may be slightly higher in Alaska, Hawaii and the West.

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## NEW PRODUCTS



or tool box. Top bends back and tools pop out for easy selection, it is said. The 29-pc master set includes 5 miniature wrenches, 4 regular and 2 Phillips screw driver blades, awl, 5 spline blades, 5 nut drivers, 5 hex keys with a jeweler's and a plastic universal handle that holds all the blades in the set. Entire weight of set is 1/2 lb. Hunter.

### Hammer/Drill 736

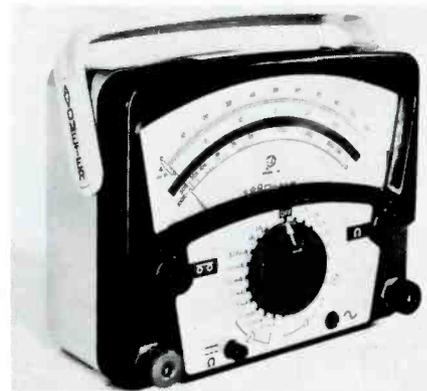
Announced is a hammer/drill for drilling masonry and concrete for installation of anchors for hanging pipe,



ducts and lighting fixtures. The No. 816 hammer/drill features an exclusive insulated shift collar for easy and safe conversion from hammer to drill action. Black & Decker.

### Multimeter 737

Announced is a multimeter, model 16, which has 36 ranges and features 20K  $\Omega/v$  sensitivity. Included are ac



current ranges and ultra-stable metal film resistors having an accuracy of 1%. It is said the meter is fully protected by a velocity actuated cutout in addition to solid-state protection of the rectifier and fused resistance ranges. The unit has a full 5in. mirrored scale. Whittaker.

### ERRATUM

March 1968 Page 48 table 1 should read  $\mu\text{sec/in.}$  switch positions 3, 4, 5, except switch position 3, inch Div. x 5 and Cm. Div. x 5 which is correct.

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ELECTRONIC TECHNICIAN/DEALER

**Tuner Cleaner/Lubricant 738**

To combat the growing difficulties of air pollution problems, a "Super 100" tuner cleaner and lubricant is



announced. It is said the substance cleans the delicate wafer contacts and connections of tuners and then coats them with a protective lubricant, guarding them for extended periods against usual dust and dirt, but also against cutting particles contained in grime, or acidic moisture in air or any other air-borne pollutants, it is said. Injectorall.

**Mobile Antennas 739**

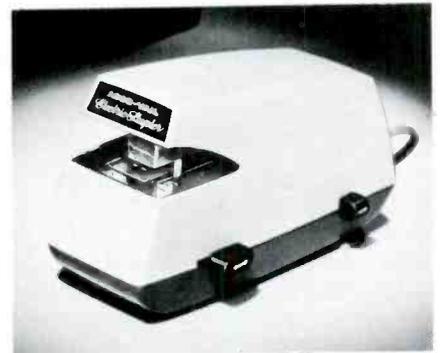
Announced is a line of "low profile" CB mobile antennas called the Hellcats. The line features a mounting device called the "Claw" (patent applied for) that is said to enable the antenna to be mounted in any existing



hole from 3/8 to 3/4 in. The line also features an etched copper loading coil that is photographically etched instead of printed. A triple moisture seal is included in the housing. The antenna whip is 17-7 PH stainless steel. The line includes four models; roof mounted, truck lip mounted, magnetic mounted and a shorty rooftop model. High-Gain.

**Electric Stapler 740**

Announced is an electric stapler which the manufacturer says will staple up to 120 times a minute. En-



gineered for heavy use, it will staple 15 to 20 sheets of paper and uses standard 3/8 inch staples. It is said. Price \$29.95 postpaid. Stadri.

# How to break into the big money servicing 2-way radios!

HOW WOULD YOU LIKE to start collecting your share of the big money being made in electronics today? To start earning \$5 to \$7 an hour... \$200 to \$300 a week... \$10,000 to \$15,000 a year?

Your best bet today, especially if you don't have a college education, is probably in the field of two-way radio.

Two-way radio is booming. Today there are more than five million two-way transmitters for police cars, fire trucks, taxis, planes, etc. and Citizen's Band uses—and the number is growing at the rate of 80,000 new transmitters per month.

This wildfire boom presents a solid gold opportunity for trained two-way radio service experts. Most of them are earning \$5,000 to \$10,000 a year more than the average radio-TV repair man.

**Why You'll Earn Top Pay**

One reason is that the U.S. doesn't permit anyone to service two-way radio systems unless he is licensed by the FCC (Federal Communications Commission). And there aren't enough licensed electronics experts to go around.

Another reason two-way radio men earn so much more than radio-TV service men is that they are needed more often and more desperately. A two-way radio user must keep those transmitters operating at all times, and must have them checked at regular intervals by licensed personnel to meet FCC requirements.

This means that the available licensed experts can "write their own ticket" when it comes to earnings. Some work by the hour and usually charge at least \$5.00 per hour, \$7.50 on evenings and Sundays, plus travel expenses. Others charge each customer a monthly retainer fee, such as \$20 a month for a base station and \$7.50 for each mobile station. A survey showed that one man can easily maintain at least 15 base stations and 85 mobiles. This would add up to at least \$12,000 a year.

**How to Get Started**

How do you break into the ranks of the big-money earners in two-way radio? This is probably the best way:

1. Without quitting your present job, learn enough about electronics fundamentals to pass the Government FCC Exam and get your Commercial FCC License. Then start getting practical experience in servicing two-way radio systems in your area.
2. As soon as you've earned a reputation as an expert, there are several ways you can go. You can add mobile radio maintenance to the present services offered by your shop, or start your

own separate mobile radio business. You might become a franchised service representative of a big manufacturer and then start getting into two-way radio sales, where one sales contract might net you \$5,000. Or you may be invited to move up into a high-prestige salaried job with one of the major manufacturers.

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**PRACTICAL COLOR TV SERVICING TECHNIQUES.** By Robert L. Goodman. Published by G/L-Tab Books, 295 pages, soft cover. \$4.95.

It should be stated at the outset that the author of this book, Bob Goodman, is an outstanding, knowledgeable technician—especially in the area of applying modern concepts to servicing electronic home-entertainment equipment—particularly in color TV and

stereo. Some sections of this book have already been published in *ELECTRONIC TECHNICIAN/DEALER* (in edited, rewritten form, that is) and some sections are still on hand to be published in a similar form. We find only one problem with the book: It was set in type almost exactly as the author wrote it and the original manuscript received little support from the publisher's editors. The volume, filled from beginning to end with juicy, troubleshooting chunks of meat, could have been improved immeasurably by the experienced hand of an understanding editor. But it sags under the weight of ambiguity, "localized" language, redund-

ancy, hackneyed technical phrases. This is only natural. Engineers and technicians are notoriously poor communicators. They know what they are talking about but they find it difficult to communicate their knowledge to readers. They make poor editors also, if not properly trained. They need the support of knowledgeable "presenters" who can objectively translate over-abundant verbiage, technical jargon, cliched expressions, ambiguous constructions into simple-worded, clear sentences which communicate maximum information. Despite these and other flaws, we can wholeheartedly recommend the essential contents of this book, not only for apprentices, but for all technicians who are now, or hope to become, experts in the area of color TV servicing.

**NO MORE GUESSWORK!**



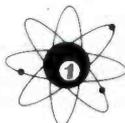
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**NEW WAYS TO DIAGNOSE ELECTRONIC TROUBLES.** By Jack Darr. Published by G/L Tab Books. 287 pages, soft cover. \$3.95.

This is by far the best written and organized book we have seen for a long time. It contains few ambiguous, involved sentences, little technical jargon, no redundancy. It is written in a crisp, fast-moving style seldom seen in a technical book. And what about the contents? The first two brief chapters get to the nub of the subject in short order. Strictly oriented to the troubleshooter, a chapter on Using Schematics follows. Then come Power Supplies, Special Power Supplies, Horizontal Sweep and High-Voltage Systems, Servicing the Horizontal Output Stage, Color Sweep Circuit and High-Voltage Problems, Vertical Oscillator and Output Stages, The Picture Tube and Its Circuits, Video Amplifier Stages, Video IF Amplifiers, Tuner Circuits, AGC Circuits and Sync Circuits. Despite the absence of some minor, unimportant editorial polishing, the book will certainly prove helpful to both the apprentice and the pro and doubtless inspire many technicians to approach their work in a more creative manner.

**RCA LINEAR INTEGRATED CIRCUITS.** Published by Radio Corp. of America, Electronic Components and Devices, Harrison, N. J. 07029, 352 pages, soft cover. \$2.

Although this book is addressed primarily to design and application engineers, it contains much information which may prove informative and helpful to those alert technicians who would like to "keep up" with integrated circuit developments. The section "Description and Applications" will be especially helpful in becoming sufficiently familiar with

ICs to know how to handle them during servicing procedures. The "Technical Data" section lists a number of ICs now going into TVs and radios made by this manufacturer, including a listing of important parameters for each IC. We believe a copy of this book should be in every service shop and that technicians should be encouraged to study it.

**UNDERSTANDING AND USING YOUR OSCILLOSCOPE.** Published by Allied Radio Corp., Chicago, Ill. 60680, 127 pages, soft cover. 75 cents.

The knowledge explosion—the need to know—has created an exponentially increasing flow of technical books unseen before in this country's history. And, for reasons we cannot go into here, 90 percent of these books—including college texts—are filled with at least 25 percent redundancy, hackneyed and clichéd technical jargon, ambiguous phrases and are additionally characterized by low-level editing. But the demand could not be met if the authors and editors spent more time on them. And *production* is the name of the game—hang the quality!

This little book, although not of the highest quality, is better than most. It can prove helpful to both apprentice and pro. And, for the money, it is one of the best book bargains we've seen for a long time. Its seven chapters cover the essentials of the history of the cathode-ray tube, basic oscilloscope principles, interesting scope applications, scope tests and measurements, scope types, auxiliary equipment and scope test-instrument kits. We recommend this book to every technician who needs the type of information it contains.

**SYLVANIA TECHNICAL MANUAL.** Written and published by Sylvania Electric Products Inc., Electronic Components Group., 624 pages, soft cover. \$1.50.

The major portion of this book, 522 pages, is devoted to electron tubes used in AM and FM receivers, color and B/W TV sets. Characteristic curves are frequently included along with tube schematics and characteristic tables. Also included are industrial and military CRTs (11 pages), semiconductor diodes (15 pages), photo-sensitive semiconductors (4 pages), a foreign electron tube and semiconductor replacement guide (22 pages) and general data on electron tube theory and applications. This book may be of value to experienced electronics technicians who are either engaged in developing new circuits, or who need tube specifications or tube testing instruments.

THE BEST ANTENNA INSTALLATIONS START WITH . . .

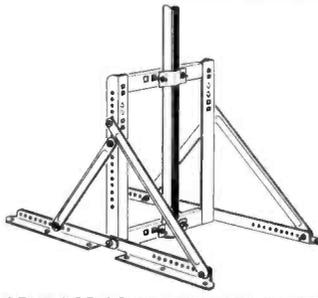
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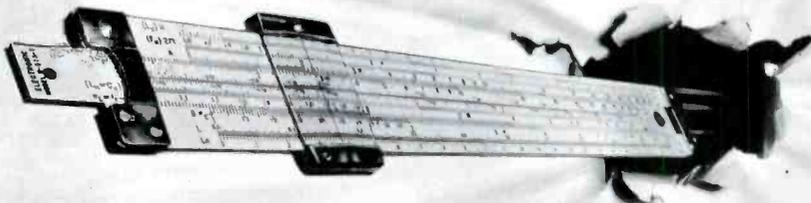
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# New Dual Purpose OSCILLOSCOPE / VECTORSCOPE

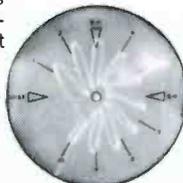


**NOW — YOU CAN HAVE BOTH IN ONE INSTRUMENT:**

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The PS148 wide band scope is identical in features and specifications to the PS127. In addition, it provides a vectorscope for complete simplified troubleshooting and alignment of color TV chroma circuits. Now, you can view the vector patterns as recommended by Zenith or display the standard "S" pattern as recommended by RCA. Both methods are at your fingertips with the PS148. Now, for only \$20.00 more than the PS127, you can view vectors and still own a deluxe wide band scope for all other work. Why pay many times more?

- Converts at the flick of a switch on rear panel from a professional wide band scope to a large 5-inch vectorscope. All vectorscope connections and controls are located on rear for ease of operation and to prevent color demodulator circuit loading.
- Simplified instructions for using the vectorscope in color TV chroma circuits and for troubleshooting and alignment are packed with each instrument.
- Comes with special vectorgraph screen which shows exact degree of chroma demodulation; also includes viewing hood.
- Use with any standard 10 bar color generator, such as all Sencore, RCA, etc. Use your present color generator and save money.
- Vectorscope connections on PS148 rear also speeds up other work where direct connections to the CRT deflection plates are required; such as, modulation checks and lissajous patterns for communications or lab work.



Typical Vector pattern

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# NEWS OF THE INDUSTRY

## Launch Nationwide CB Promotion

The nation's first industry-supported national advertising and public relations program to expand the market for citizens two-way radio equipment became a reality recently as industry leaders met in Chicago to put the finishing touches on plans.

The coordinated educational program, which will use television spots, radio, magazines, newspapers and store displays, is the brainchild of the Citizens Radio Section of the Electronic Industries Ass'n. (EIA). Initial fund-raising goals have been reached, the section announced, and the campaign is expected to be launched early this spring.

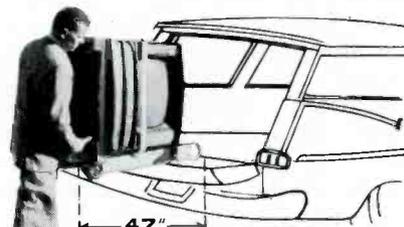
Separate programs will be aimed at educating the public at large by emphasis on safety and convenience through ownership of CB equipment; improving operating procedures and techniques among the present CB user groups; and gaining understanding and cooperation from governmental and public service organizations.

## IC Sales Climb

U.S. factory sales of semiconductor integrated circuits (ICs) totaled \$228 million during 1967, climbing 53.5 per cent from sales of \$148 million during 1966, the Electronic Industries Assn.'s Marketing Services Dept. reports.

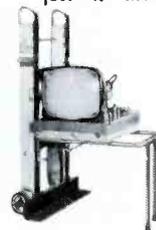
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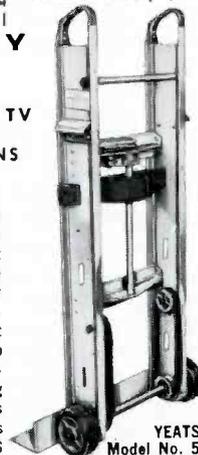
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Snaps on or off.  
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Designed for TV, radio and appliance men who make deliveries by station wagon or panel truck... the short 47 inch length saves detaching the set for loading into the "wagon" or pick up. Tough, yet featherlight aluminum alloy frame has padded felt front, fast (30 second) web strap ratchet fastener and two endless rubber belt step glides. New folding platform attachment, at left, saves your back handling large TV chassis or table models. Call your YEATS dealer or write direct today!



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Height 47"  
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**NATESA Launches X-Radiation Training Program**

The National Alliance of TV & Electronic Service Ass'ns. (NATESA), announces it is launching a program of intensive training on the three systems of high voltage regulation, which is followed by written exams. Each member proving his capability by passing the test and by signing a pledge to fully check horizontal regulation on every service call, will be awarded a NATESA Safe Servicer Certificate which will assure the public's safety. Failure to fulfill the pledge will void the certificate.

NATESA indicated that the program is being instituted to counteract the fears of some technicians who have been "disturbed by unfair innuendos meant as an escape for some set producers that X-ray dangers are due in large part to improper service practices by independent servicers."

**Color TV Sales Up**

The Electronic Industries Assn. announces a rise of 29.5 percent in color TV distributor sales in January 1968, compared to the same month in 1967. Sales of 405,753 units contrasted favorably with 313,442 units sold in January 1967.

**FTC Discourages TV Service Assn's Standard Rate Schedule**

The Federal Trade Commission (FTC) was recently requested to render an advisory opinion with respect to the legality of a trade association preparing and distributing a standard rate and service pricing manual for common use by electronics service-dealers in dealing with the general public.

It was represented that a major problem in the industry is the lack of guides by which the public can determine whether prices charged for various repair services are fair and equitable. This lack has led to many customer complaints and to fraudulent operations by unethical service-dealers. The association took the position that a standard rate schedule would protect the public and free ethical service-dealers from unjust accusations.

The commission advised that it could not give its approval to the proposed common use of a standard rate and service pricing manual by com-

**"I was TROUBLE-SHOOTING  
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Showed Me What Color Waveforms  
Really Look Like."**



**Technicians everywhere are talking about the PS127 5" Wide Band Oscilloscope. Try one and you, too, will send us comments like these—**

"So easy to use! With my Sencore scope I can read high or low frequency signals without band switching. As easy to use as a voltmeter."—R. L., Portland, Ore.

"I've only had my PS127 a couple of months, but it's more than paid for itself already with the extra jobs I've been able to handle."—S. O., New Orleans, La.

"With the direct peak-to-peak readout I can compare voltage readings to those on the schematic without wasting valuable time setting up my scope with comparison voltages."—J. M. F., Plymouth, Michigan.

"Those Sencore exclusives really sold me, like the extra 500KC Horizontal Sweep range and the free high voltage probe."—D. N., Brooklyn, N.Y.

You'd expect a wide band scope of this quality to cost at least double."—W. L., Chicago, Ill.

"With the PS127, I find I can trouble-shoot those tough ones twice as fast as before—especially color TV."—F. C., Burlingame, Calif.

"Once I compared the specs, I knew Sencore had the best buy in scopes. We now have three PS127's in our shop."—J. S., Ft. Lauderdale, Fla.

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peting home-electronics service-dealers. Although the adoption and dissemination by the association of such a manual may be motivated by a purpose to remove evils affecting the industry, it appears to go further than is reasonably necessary to accomplish the desired result. Even though use of such manual be accompanied by disclaimers, there is im-

PLICIT therein too grave a danger that it will serve as a device through which service rates and fees would become uniform and stable throughout the industry. While adoption of a means likely to create competitive uniformity in terms of service pricing may be a convenience to trade association members, this factor is far outweighed by the benefits to the public of the intense competition between competing service-dealers and it is this competition which the law protects, the commission said.

The commission notes that, in conformity with its policy concerning

publication of digests of advisory opinions, this news release is the only material of public record. The advisory opinion itself and all background papers are confidential and are not available to the public.

### Antenna Specialists Names Rep

Logan Sales Co. of Redwood City, Calif., is appointed northern California sales rep for The Antenna Specialists Co., according to an announcement by Bob Beebe, A/S director of sales.

Located at 463 Brewster Ave. in Redwood City, Logan Sales will handle the entire line of citizens two-way, amateur radio and industrial communications antennas and accessories.

### Dual, Field-Effect Transistor Sales Rise

Dollar sales of dual and field-effect transistors during the first seven months of 1967 rose 59.1 and 6.4 percent, respectively, over sales during the same period in 1966, according to figures released by the Electronic Industries Assn.'s Marketing Services Dept.

### Electro-Voice Adds Cartridges and Needles to Line

Robert Shene, product sales manager of the Electro-Voice cartridge and needle division announces that 121 cartridge models and 93 needle models have been added to its line in the past year. These models are included in the recently published needle and cartridge catalog-cross-reference guides, available only through the company's sales representatives and distributors.

### Nelson Joins Michigan Magnetics

John E. Nelson has joined the engineering staff of Michigan Magnetics, Vermontville, Mich.

He comes to Michigan Magnetics from Arvin Industries, where he was chief engineer. He has also been a project engineer at Control Data and engineer at IBM.

Michigan Magnetics is a division of VSI Corp.

### Workman Develops New Solder Dispenser

The Workman Electronic Products Co., Sarasota, Fla., has developed a new 60/40 rosin core solder which is packaged in a 1/4 lb dispenser. The dispenser was designed for both shop and tool-caddy use.

## New idea in sound columns from Argos ...serves up superb voice and music



Beautiful new solution to those small, multiple-use locations where full-size Sound Director columns can't be justified — yet the situation calls for prestige, faithful sound reproduction and versatility.

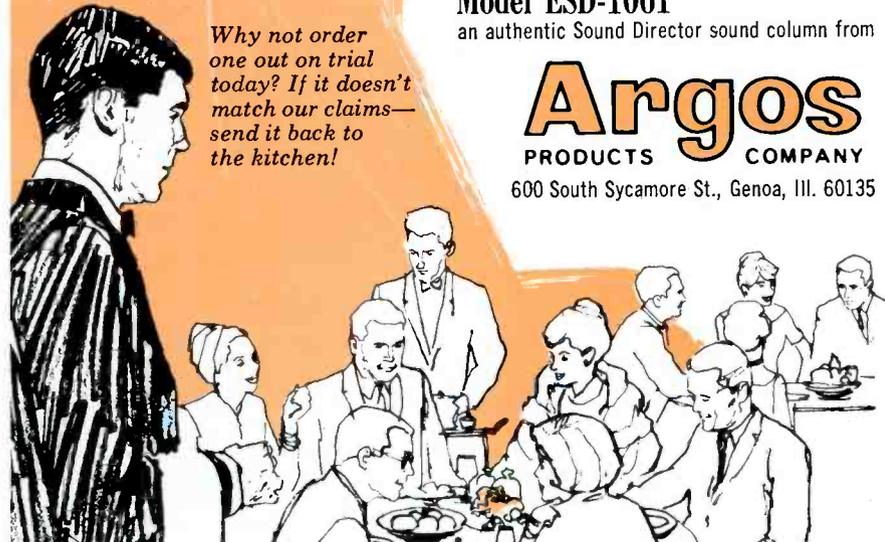
Especially suited to restaurants, club rooms, schools and offices up to 60 feet, where speech quality may be critical one day and music the next.

Unique contemporary "art frame" cabinetry in hand-rubbed, oil-finished genuine walnut. Six speakers, 16 ohms impedance. Response from 100 to 12,000 cps at 30 watts.

**Model ESD-1061**  
an authentic Sound Director sound column from

**Argos**  
PRODUCTS COMPANY  
600 South Sycamore St., Genoa, Ill. 60135

*Why not order one out on trial today? If it doesn't match our claims—send it back to the kitchen!*



... for more details circle 106 on postcard

## NEW ENDECO Desoldering Kits

MODEL  
300-K  
KIT  
SHOWN



All you need to handle almost any desoldering and resoldering job!



Kit 300K includes the famous Endeco pencil desoldering iron Model 300, six different size tips (.038 to .090) for any job, tip cleaning tool, and metal stand for iron . . . all in a handy lifetime steel storage box. \$17.75 net. Model 300K-3 with a 3-wire cord \$19.55. Also: A similar kit for military users, and Kit 100K with large Endeco desoldering iron Model 100A.

SEE YOUR DISTRIBUTOR OR WRITE



**ENTERPRISE  
DEVELOPMENT  
CORPORATION**

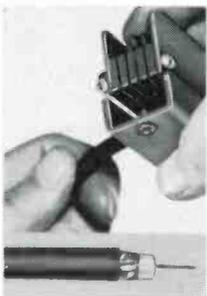
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### Now! Prepare Co-Ax Cable in 5 Seconds!

R-SERIES CO-AX CABLE STRIPPER\*



Accurate cuts are easy:

(A) Open tool, place CO-AX cable in groove and while closing -

(B) Rotate tool around cable, cutting jacket, shield and dielectric.

(C) Special Shield Dressing Fitting prepares braid for easy cable insertion in tap-off or connector.

\*Pat. Pending

Here's the only tool made that offers you simultaneous cutting of jacket, shield and dielectric! It's fast, precise, time-saving, trouble-free and versatile! Uses inexpensive razor blades.

**Model R-100** —Prepares RG59 cable for "F" and "C" fittings, tap-offs, splitters, couplers, PL259, etc.

**Model R8/11** —Prepares RG8, RG11 cable for PL259 fittings, cable splices, etc.

**Model R58** —Prepares RG58, RG58AU cable for PL259, phono plugs, etc.

**Model R6/CAC**—Prepares .275" all-channel cable for "F" fittings, tap-offs, splitters, couplers, etc.

Only \$4.95 guaranteed.

See it at your Distributor/Dealer or write  
**UNITED TEL-TRONICS COMPANY**

Allison Park, Pa. 15101 412/443-6200

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MAY 1968

## CATALOGS AND BULLETINS

### Test Accessories

A 44-page catalog is announced which covers electronic test accessories. It includes banana plugs, adapters, patch cords, cable assemblies with a wide selection of connectors and cables; test probes, tube socket and conversion adapters, socket savers and breadboard sockets. Pomona.

### Audio Connectors

A catalog describes a line of audio connectors, specifications, detailed drawings and application hints for single and multiple conductor connectors. Switchcraft.

### Recording Tape

The "Recording Tape Guide," an informative, easy-to-read poster providing concise information on sound-recording tape, is being offered to service-dealers without charge. Measuring 14 x 20in. the guide provides at-a-glance information on recording time at various speeds, preferred speeds for music or speech, tape lengths and base-material. A table provides the recording time for all popular tape lengths — from 150 to 3600ft — at speeds ranging from 15/16ips to 7½ ips. Audio Devices.

### Silicon Diodes

A 48-page catalog contains descriptions, ratings and specifications for Zener voltage regulator diodes, voltage reference diodes and low power silicon rectifiers. International.

### Hand Tools

A 28-page catalog contains 144 full-color illustrations, plus specifications for a complete line of pliers, nippers, cutters, revolving punches, aviation snips, standard snips, adjustable wrenches, pocket knives, compound action pliers, scissors, snips, shears, holding forceps, chisels, punches and awls. Boker.

### UHF Antennas

A four-page folder describes a line of add-on UHF antennas. Kay-Townes.

### Two-Way Radio

A bulletin describes a line of solid-state two-way mobile radios. G-E.

### Intrusion Alarm

A two-page brochure describes an ultrasonic intrusion alarm system for home and business. Euphonics.

## NOW... a complete color bar generator for the pro's.



Amphenol's NEW Deluxe Color Commander, Model 865, incorporates advanced features for your protection against obsolescence . . . and to save you time!

Three color patterns: (1) exclusive single-bar, (2) exclusive three-bar, (3) familiar ten-bar gated rainbow. Plus, six line and dot patterns. To top it all off— instant pattern stability from 0° to +125°F without using old-fashioned heaters. True AC/DC operation.

The simplified controls on the Color Commander reduce the time you must spend working on the customer's set and increase the number of set repairs you can complete. *That means more profit for you!*

Other features that separate the Amphenol Deluxe Color Commander from other color alignment equipment: color coded control panel. Two preset channels. Built-in gun killers with lead piercing clips. Laminated gloss-epoxy circuit boards. Storage space for leads and tools. Automatic shut-off. Luggage-type case measures 8¾" wide, 7⅝" high, 5½" deep and the whole unit weighs only 4¼ pounds. Runs on AC line or batteries.

There's a lot more you'll like about the Deluxe Color Commander. Only \$189.95. Stop at your nearest Amphenol distributor and ask to see it. Don't know who your Amphenol distributor is? Write Dept ET3-58 Amphenol Distributor Division, 2875 S. 25th Avenue, Broadview, Ill. 60153. We'll give you his name.



**AMPHENOL**

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5-CHANNEL MIXER-PREAMP, MODEL E-5P

## NEWCOMB



10 WATT E-10B

## PATHFINDER P.A.



20 WATT E-20

## ECONOMY LINE



40 WATT E-40

## PUBLIC ADDRESS



75 WATT E-75

## AMPLIFIERS

NEWCOMB AUDIO PRODUCTS CO.  
Dept. ET-5 12881 Bradley Ave.  
Sylmar, California 91342

Gentlemen:

Please send immediately a free copy of your Catalog No. PF-7 describing in depth your Pathfinder P.A. line.

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_

STATE \_\_\_\_\_ ZIP \_\_\_\_\_

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## Antennas

*Continued from page 51*

### Special Problems

The rapid growth of color TV and FM/stereo equipment sales continues to pose reception problems for service-dealers and technicians throughout the country. These problems are complicated by a public whose discriminating demands appear to increase in proportion to its growing affluence.

Few localities exist where good color and FM/stereo reception can be had with "rabbit-ears," set-mounted single or double dipoles and built-in antennas — except in the "prime-prime" signal areas. We have observed some impossible reception a stone's throw from transmitting towers on these antennas.

The proper antenna is also essential for FM/stereo in fringe areas or any area where monophonic reception is marginal. A higher field strength is required for the same audio quality below the full limiting level of the receiver. The effective signal difference between monophonic and multiplex signals is around 20db. And, here again, reflections can destroy the stereo effect through phase-shifted signals. Let's look a little closer at this one.

A three-degree phase shift between the original 38kHz subcarrier and the reconstructed subcarrier in FM/stereo equipment will limit the channel separation to 30db. But we frequently get much more shift than this.

In many localities it is common to find reflected signal paths ranging from two to ten miles more than the direct signal path. Average RF signals travel one mile in 0.186372μs. Suppose we are receiving an FM/stereo signal from a station 15 miles away. A water tower off to one side gives us a reflected signal that travels 20 miles. A difference of 5 x 0.186272, or 0.931060μs exists between the arrival times of the two signals.

Because the pilot frequency determines the reconstructed subcarrier phase, we will base our calculations on the phase change in reference to wavelength. By dividing frequency into velocity, we get 9.83 miles. Let's round this off to 10 miles. Because the reflected signal is traveling five additional miles, or half a wavelength, we can see that the two signals reaching the receiver will be about 180deg out of phase. Don't jump to the conclusion, based on this out-of-phase condition, that the two signals will cancel and allow no signal to reach the frequency doubler in the multiplex decoder. Remember, the reflected signal is much weaker than the straight-path signal. But your customer's equipment can easily have lock-in trouble with the frequency doubler, intermittent switching of channels and even "motor-boating" caused by loss of sync. The stereo effect can be completely destroyed. Here again, your prescription calls for the proper antenna to reduce or eliminate multipath signals. Your best bet is an optimized installation.

How can you come up with the antenna which will give you optimum results? You can do it if you use a field-strength meter on a few preliminary probings — using a variety of antenna types. Use the antenna which will give you only the amount of signal required for consistently good reception under all weather conditions. And if you're playing around with antennas for UHF — check out the signals when the leaves are on the trees (in cases where trees are between the antenna and the transmitting antenna. Also, under fog conditions if fog is prevalent in your area).

A forthcoming article will cover a few more specific problems you can expect to be confronted with in various reception areas, from immediate to deep-fringe. ■

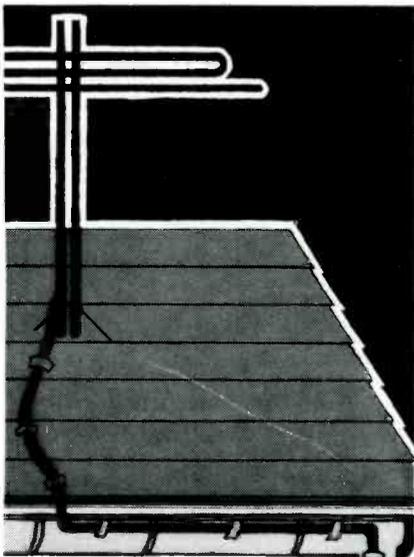
## 7 out of 10

*Continued from page 58*

but provides an exclusive service. "We use the service department of Sutton's Appliance, which does work only for us," Mr. Lemcke emphasizes. "And the customer gets the same kind of service we would

## MOVING?

Be sure to let us know your new address. Please enclose a complete address label from one of your recent issues.



## when the cable goes down the gutter... does the picture go down the drain?

Not with Columbia Wire's new ultra-low loss shielded Permafoam transmission cable! You can tape it to the antenna mast... run it along gutters... tape it to downspouts... lead it in by the quickest, easiest route... and there's **never any pickup interference!** And the antenna terminals are already installed for you... so you get the job done faster than you ever have before... easily terminated Shielded Permafoam cable makes set hookup more profitable. Ask for a spec sheet at your distributor.



Available in 50', 75' and 100' coils — 500' spools and 1000' reels.

# COLUMBIA

WIRE PRODUCTS COMPANY  
2850 Irving Park Rd., Chicago, Ill. 60618

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provide directly. I always tell them to call me if they have any problems with the set they have just bought — they would be calling me anyhow. Then I relay the information to Mr. Sutton, who does the repair and bills the customer himself."

Only direct transactions between Lemcke Appliance and the Sutton repair service is for setup and 90-day service. On a color set this costs Lemcke \$20. Sutton's does the Lemcke service on some brands (Zenith and Magnavox) but turns RCA over to factory service.

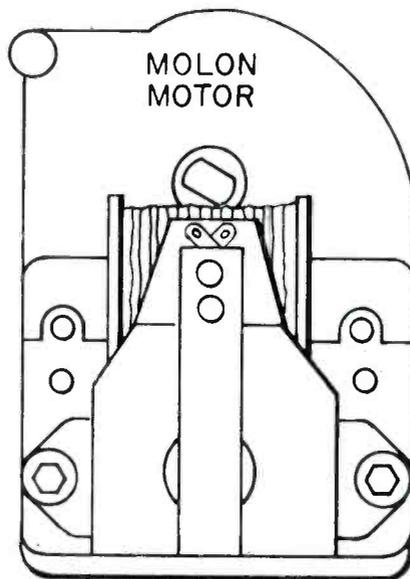
"We are very happy with the personalized exclusive service arrangement we have," Mr. Lemcke smiles. "We have had the same arrangement — Sutton's — for 15 years."

Lemcke has two salesmen, one delivery man, a bookkeeper and the working owner — five in all who account for well over \$500,000 in annual sales including white goods. That may not be an industry record, but it's a pretty good average of well over \$100,000 per employee. And service problems are handled by working closely with a specialist firm. ■

## COLORFAX

*Continued from page 73*

Replace S1002 switch, stock number 115497. (3) Replace CR1202 diode, stock number 116052. **Condition "C"**.



Where there is a tendency to skip a VHF channel or jam and a Molon motor is used, replace motor with Electro Counter motor stock number 119680.

## Amphenol's new 857 tests for second anode leakage to CRT gun structure.



Have you ever checked a color CRT that read "good," but actually the tube was bad? Now you can check for that hidden problem—internal high voltage leakage—at actual operating voltages... right in the customer's home. The CRT Commander, Model 857, can test every performance characteristic of a picture tube. Black and white or color.

There are many outstanding features that set the CRT Commander, Model 857, apart from the rest. It's the only CRT tester that functions as a voltmeter capable of measuring 0 to 1000, 0 to 5000, to 50KV (DC) with optional 857-9 probe. It's the only CRT tester that performs 2nd anode test. It reads gas direct on sensitive 50 u/amp meter. The CRT Commander rejuvenates tubes, too. Tubes you may have thought were beyond hope. The CRT Commander comes in a professional luggage-type case. Only \$99.95.

See the new CRT Commander, Model 857, now. Write for all the details and the name of your local distributor. Dept. ET4-58, Amphenol Distributor Division, 2875 South 25th Avenue, Broadview, Illinois 60153. Then go to your Amphenol distributor.



# AMPHENOL

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The **NEW**  
NO. 800  
**TUN-O-LUBE**  
**TUNER CLEANER**  
*Specially*  
**FORMULATED**  
FOR **TV-TUNERS**  
USING **NUVISTORS &**  
**TRANSISTORS**  
**NO TUNER DRIFT**

NO. 800  
\$1.98  
DEALER  
NET

Nuvistors and Transistors are highly sensitive to drift from ingredients in most ordinary TV tuner cleaners. Drift has been found to cause call backs and expensive tuner repairs. For over 18 months CHEMTRONICS has been formulating and testing this new cleaner in both the lab and field. Under the most critical test, there has been NO DRIFT on scope patterns. We invite you to try this test yourself.



*Another First*  
**SUPER**  
**FROST AID**

Cools Faster • Leaves  
No Liquid Residue

SUPER FROST AID is a faster  
circuit freezer, designed to  
locate intermittent compon-  
ents, without leaving a  
liquid residue.

No. 1550

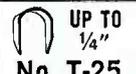
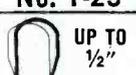
**CHEMTRONICS**

BROOKLYN N. Y. 11236  
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## AUTOMATIC STAPLE GUNS

For Fastening Any  
Inside or Outside  
Wire Up to 1/2" in Diameter

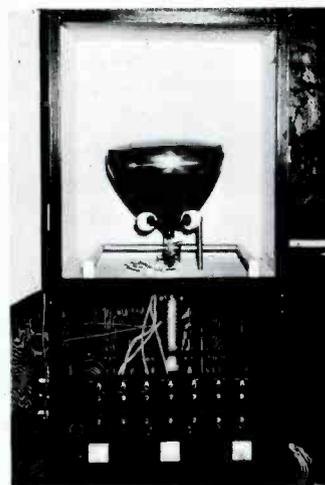
 UP TO 3/16" <b>No. T-18</b>	<ul style="list-style-type: none"> <li>• Telephone wire</li> <li>• Intercom wire</li> <li>• Bell wire</li> <li>• Thermostat wire</li> </ul>
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 UP TO 1/2" <b>No. T-75</b>	<p>Tapered striking edge gets into close corners!</p> <p>Available in: <b>Brown, Ivory, Beige, Monel, Bronze, Natural</b></p>

**ARROW FASTENER COMPANY, INC.**

Saddle Brook, N.J. 07663

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## CRT Rebuilder



Rebuild your own CRT's. Av-  
erage cost B/W \$1.50—Color  
\$8.50 Easy to operate.  
Requires only 4x8 feet of space.

*Increase your income by \$1,000  
or more, per month.*

*Supplies for your first 50 pic-  
ture tubes free!*

FINANCING AVAILABLE

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5234 N. Clark St., Chicago, Ill. 60640  
Phone 312-465-2881

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ELECTRONIC TECHNICIAN/DEALER

# The name of the game was hide and seek.

The good color picture hides. The viewer looks for it. And sometimes it takes quite a while to find. The good sound drifts, and between rotor

and tuning dial the search for a perfect stereo balance begins again.

Well now all that time-wasting and bother is over. Because CDE invented the Autorotor™ system. It's more than an ordinary rotor. Buttons are easily set for clear, bright, perfect color pictures. And pure stereo sound. There are five and they allow you to pre-set 10 to 15 channels. Leave one channel and whenever you choose to return to it, just press the button again.

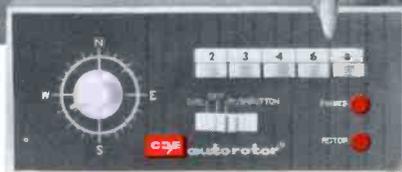
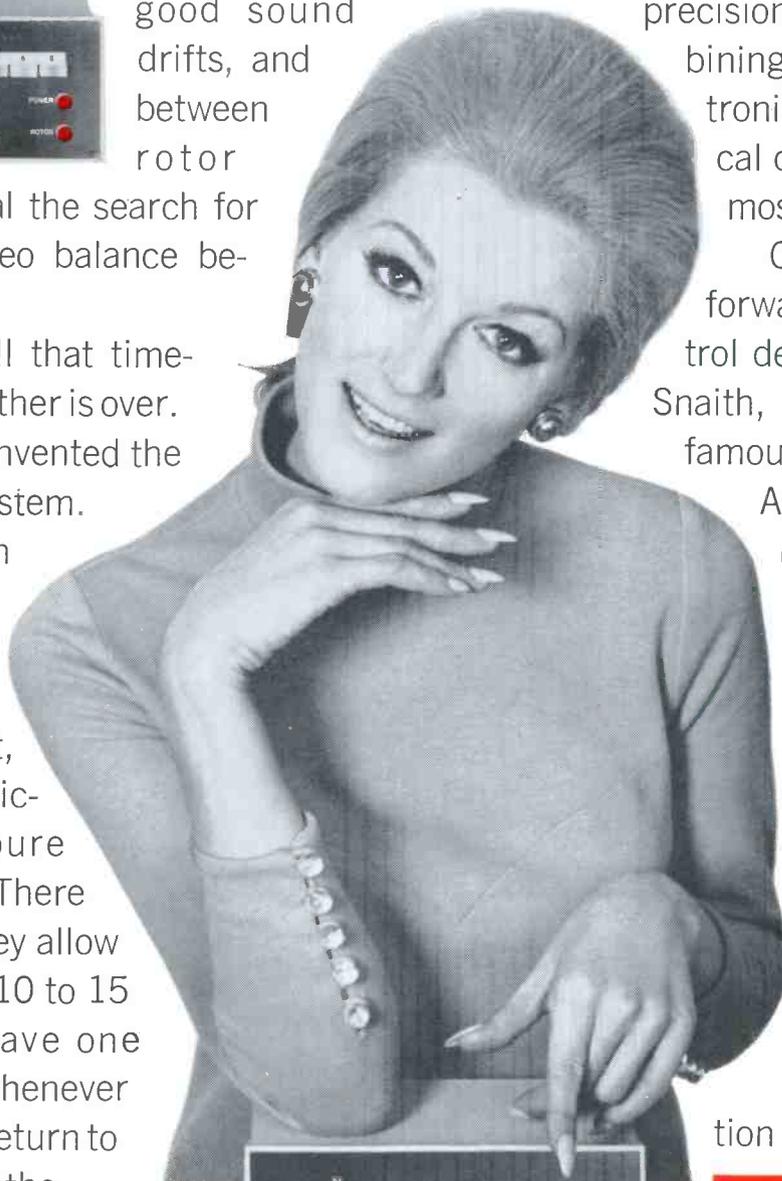
CDE's famous heavy-

duty Bell Rotor gives you high repeatability and no antenna drift. It's an all-solid-state, silent operation. The Autorotor system's precision is within 1° and combining it with pushbutton electronic control, not mechanical control, makes it today's most advanced rotor.

CDE took another step forward in the Autorotor control design. They had William Snaith, of Loewy-Snaith, world famous designers, create the Autorotor console. He made it attractive. Made it so you can place it on a table top or shelf without it being an eyesore.

This is the story you can tell your customers to sell the top-of-the-line in rotors. The latest advance from the quality house of rotors — Cornell-Dubilier.

For complete information on new Autorotor write:



**CDE** **CORNELL-DUBILIER**

50 Paris Street, Newark, New Jersey 07101  
Be sure to ask: "What else needs fixing?"

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# How to improve your trouble-shooting of transistorized circuits!

RCA prepared this Guide specifically to keep you abreast of the latest transistor technology in the electronic service industry.

Chapters include:

- Transistor Amplifier Principles
- Basic Amplifier Considerations
- Transistor Radio Circuits
- Transistor Television Circuits
- Servicing Transistor Circuits

When you understand transistorized circuits, you trouble-shoot faster and more accurately, a fact your customers will appreciate.

Available with your purchases of RCA Entertainment Receiving Tubes from your participating RCA Tube Distributor.  
RCA Electronic Components, Harrison, N. J.

## RCA

RCA Transistor Servicing Guide 1A1673.

