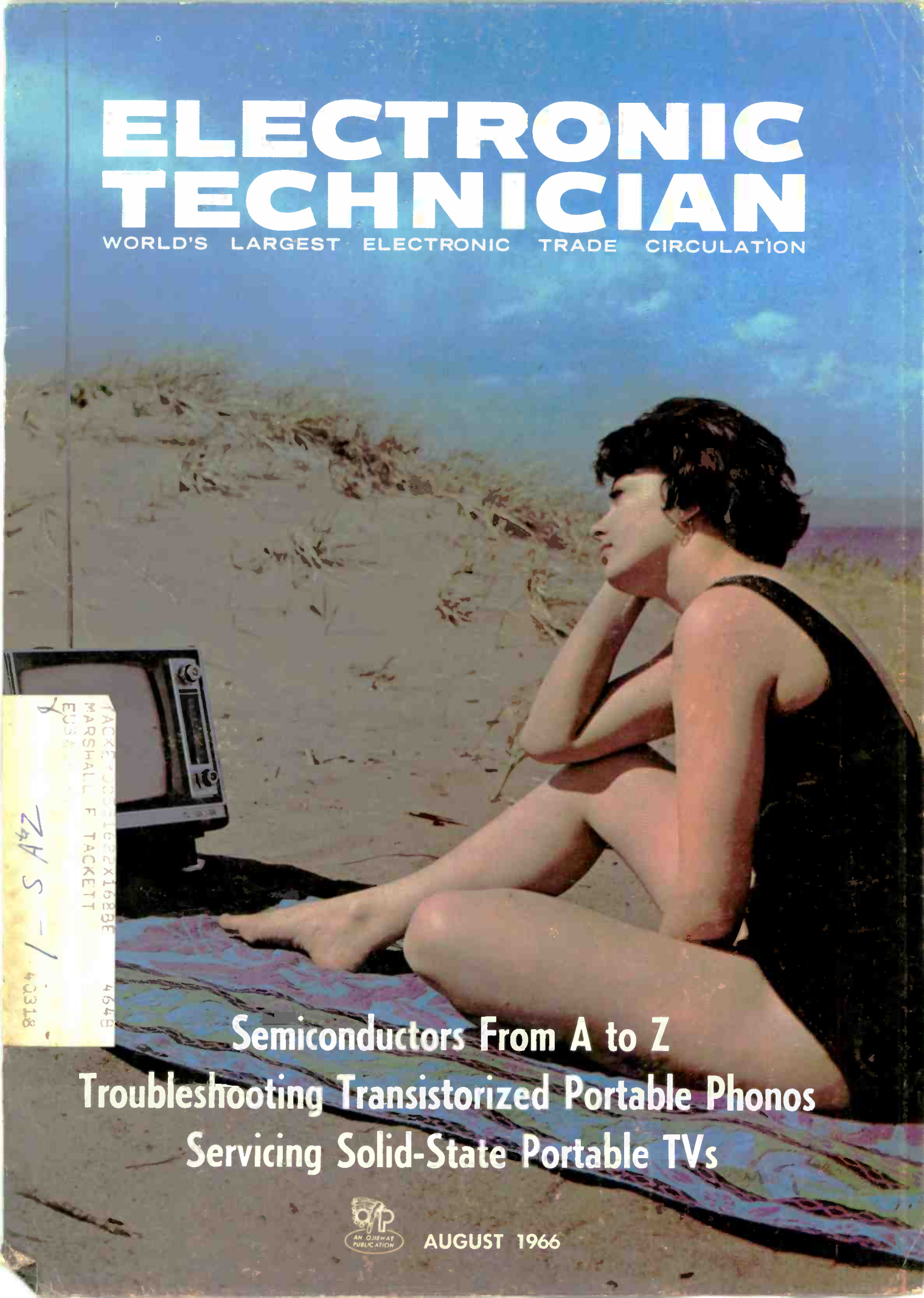
ELECTRONIC TECHNICIAN

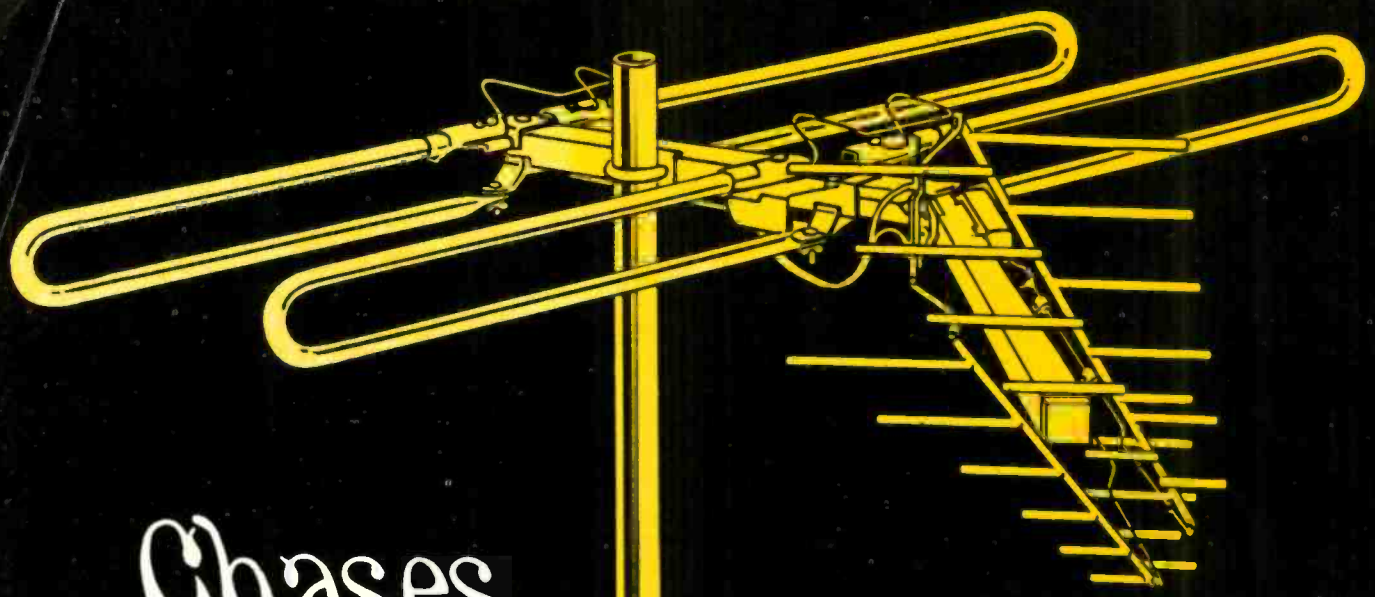
WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION



Semiconductors From A to Z
Troubleshooting Transistorized Portable Phonos
Servicing Solid-State Portable TVs

AN OJIBWAY PUBLICATION

AUGUST 1966



Chases ghosts out of town

In the city you don't need a very powerful antenna. Generally, your problem is too many signals rather than not enough. But strong signals bouncing off tall buildings cause multiple images, commonly known as ghosts. Faint ghosts may not bother black-and-white pictures much, but they're intolerable in color.

Jerrold Metrocolor antennas are especially engineered to solve the problem of metropolitan reception. They reject reflected signals and minimize standing waves. Metrocolor antennas are as effective in preventing ghosts and color smears as many of the bulkiest, most expensive fringe-type antennas. Also, they're made to match Coloraxial cable, a must for color TV.

There are two Metrocolor models: Model MCX-82, covering all UHF-VHF and FM channels, lists for $29.95; Model MCX-13, for VHF and FM only, lists for $16.95. Cash in on the BIG city antenna market with Metrocolor antennas. They chase the ghosts right out of town, and leave the profits for you. Talk to your Jerrold distributor today, or write Distributor Sales Division.

NEW JERROLD

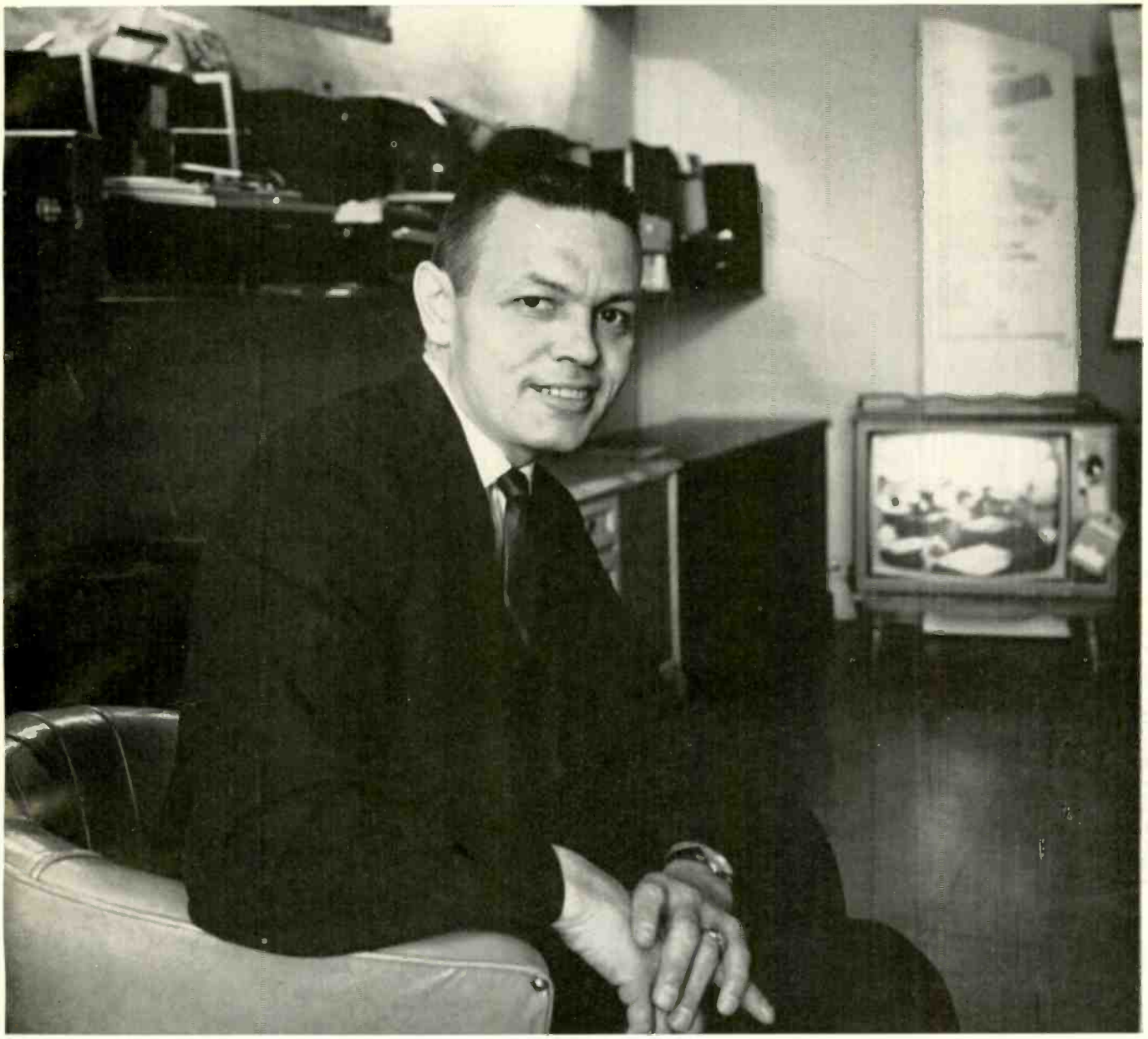
metro color™

82-CHANNEL ANTENNAS

FROM JERROLD ELECTRONICS CORPORATION, 401 WALNUT ST., PHILADELPHIA, PA. 19105

. . . for more details circle 117 on postcard

T and H Service & Sales gets the Action-People*. Do you?



"Many of our customers have told me they found us through the Yellow Pages," says Ted Wainscott, owner, T and H Service & Sales, Inc., Anderson, Indiana. "Experience has taught me that we should be in the Yellow Pages to reach our best prospects. I also think the size of our ad and the fact that we stress service helps attract customers. Take a good look at our ad and you'll see we pack it with information. I think that's what people want when they pick up the Yellow Pages — facts. We consider the Yellow Pages one of our most valuable sales aids. I know it helps us."

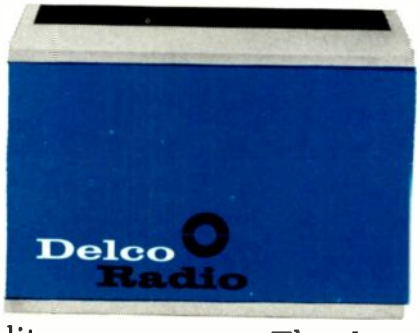
Advertise for action... Yellow Pages

Display ad (shown above) runs under TELEVISION. Call your Yellow Pages man to plan your program. Find him in the Yellow Pages under: ADVERTISING — DIRECTORY & GUIDE.

*The 3 out of 4 busy Americans who shop the Yellow Pages way.

This part speaks for the whole radio.

This box speaks well of you.



To the listener, the speaker is the most important part of the radio. Reason enough that it be of the highest quality and reliability. And when it says Delco on the box you can be certain you've got it: genuine OEM quality.

Delco Radio Parts are designed by engineers who specialize in automotive radios. Delco Radio speakers, for example, provide greater efficiency and sensitivity per ounce of magnet than any other speakers built. And since nearly half the cars on the road have Delco Radios as original equipment, you are assured of a vast pre-sold market.

Doesn't it make sense to stock the best for your customers?

They know Delco's reputation. So, the next time you reorder, remember your United Delco Supplier. He handles the most widely advertised, merchandised and recognized name in the parts business.

Why not let Delco Radio speakers say something nice about you?

GM United Delco

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

AUGUST 1966

VOL. 84 NO. 2

ELECTRONIC TECHNICIAN

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION

AN OJIBWAY PUBLICATION

OJIBWAY PRESS, Inc.

Ojibway Building, Duluth, Minn. 55802

AREA CODE 218 727-8511

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Sales Offices:

NEW YORK: Ron Kipp, 25 W. 45 St.
New York, N.Y. 10036
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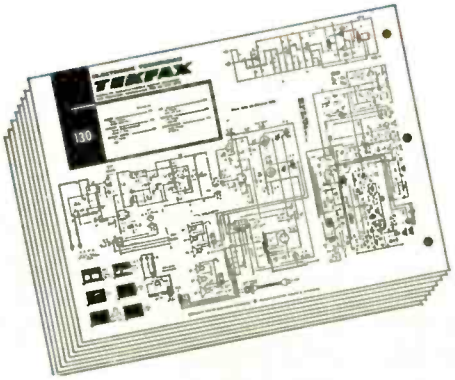
Cover

The 'lonely girl on the beach' is passing away with the electron tube. She 'totes' her solid-state TV from-car-to-beach and, between cool dips, diverts her thoughts with a variety of absorbing telecasts.

FEATURES

DEPARTMENTS

TEKFAX — 16 PAGES OF THE LATEST SCHEMATICS



Group 168 — August • 1966

DUMONT: TV Chassis 120837-A, 120846-B, 120847-B

RCA VICTOR: TV Chassis KCS162 Series

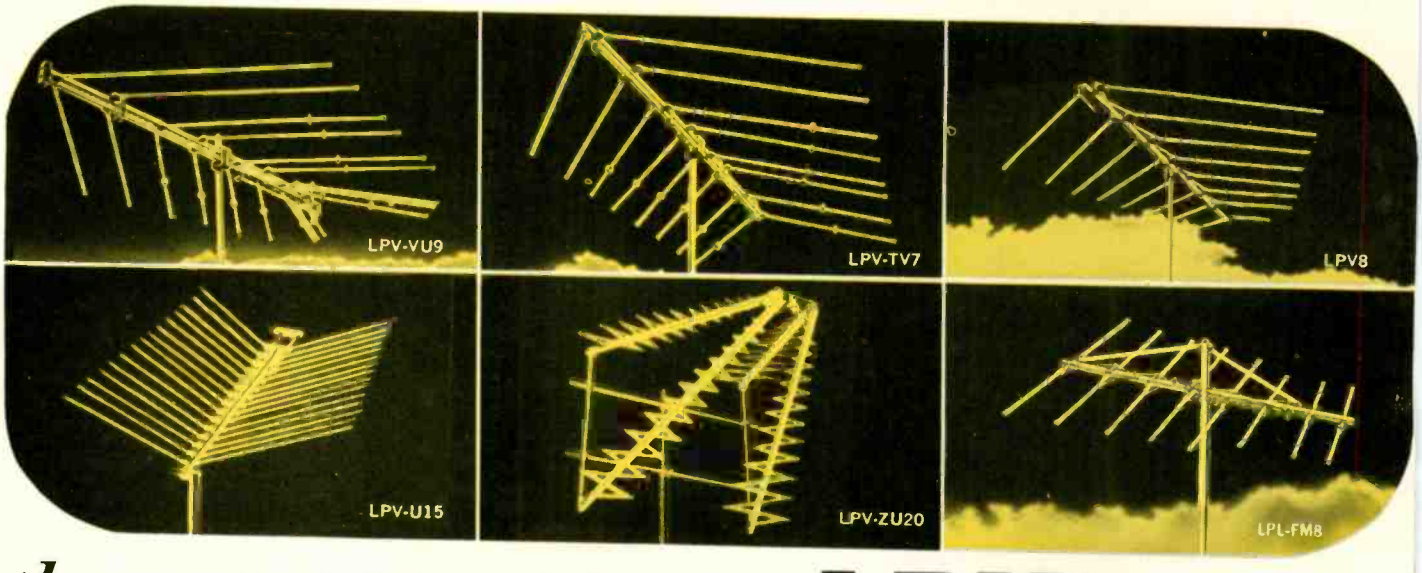
SEARS-SILVERTONE: TV Models 7110, 7111, 7114, 7128, 7131

SYLVANIA: Color TV Chassis DO5 Series

WESTINGHOUSE: TV Chassis V-2496 Series

ZENITH: Color TV Chassis 23XC36

What does JFD® have that other TV antenna manufacturers wish they had?



the JFD® LPV® COLOR LOG PERIODIC

Mr. Dealer:

Don't let other antenna makers "snow" you with claims of how **their** antenna "break-throughs" work so sensationally you hardly need a TV set to get a picture.

They've got little choice.

Ever since the LPV Color Log Periodic was introduced by JFD back in '62, our competitors' engineers have been going around in circles.

They've copied it down to the rivets.

They've camouflaged their use of the log periodic principle with terms such as "energy distribution."

They've imitated its name by calling theirs "V-log," "Super-log" and ..... -log.
(fill-in-yourself)

They've tried to equal its performance with "half-size" compacts—(but you can't send a midget to do a man's job—this just doesn't work.)

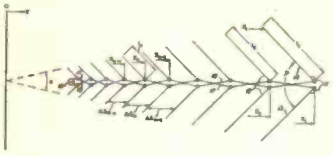
They still don't know whether to knock it . . . fight it . . . join it . . . or how to live with it.

We say **the proof of it all is the picture your antenna delivers to your customer's set. That** is where the JFD LPV Color Log Periodic conclusively demonstrates its basic performance superiority.

If you're looking to give your customers the **finest** and **truest** color . . . **crispest** black & white . . . **more** VHF and UHF channels . . . even better FM **stereo**—don't compromise **your** professional reputation with "antenna-compromises." Rely on the patented JFD LPV Color Log Periodic as do so many tens of thousands of knowledgeable service-dealers.

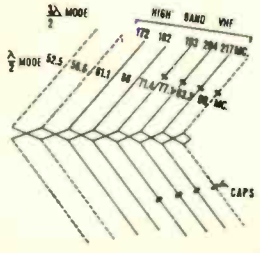
We don't expect you to take **our** word for it either. Let the **picture** (and your **profits**) be the proof.

Exactly WHAT the JFD LPV Color Log Periodic has that other so-called antenna "break-throughs" would like to have!



- ONLY the JFD LPV delivers genuine **frequency-independent** performance. The **entire** antenna (not **part** of the antenna as in other ordinary antennas) responds to **every** channel.

$$\frac{L_{(n+1)}}{L_n} = \tau$$



- ONLY the JFD LPV follows the **patented log periodic** design of the University of Illinois Antenna Research Laboratories.

- Only the JFD LPV uses **Cap-Electronic** (capacitor-coupled) elements. This permits (1) precise and independent tuning for optimum performance in **both** fundamental **and** harmonic modes—**plus** (2) increased capture area—**plus** (3) directors tuned to perform on **all** bands, not just one. The result is **higher** gain, **narrower** directivity, **higher** front-to-back ratios for brilliant color, better-than-ever black & white—on channels 2 to 83.

ADVERTISED IN LIFE

NATIONALLY ADVERTISED IN LIFE. Month after month, 32 million readers of LIFE are being exposed to the reasons why the JFD LPV works best.

JFD Color ANTENNA

COLORFULLY ADVERTISED OVER TELEVISION. Spectacular motion-picture commercials in full-color are pre-selling millions of present and prospective color TV owners.

25 DIFFERENT LPV LOG PERIODICS TO CHOOSE FROM. Interested in VHF? . . . UHF? . . . VHF/UHF/FM? Whether it's just **one** band or **all**, town or country, you get the precise antenna-answer when you make it an LPV Color Log Periodic. Interested in more facts? Just write us.

MERCHANDISED IN DEPTH. Banners, direct mail, newspaper mats, radio/TV commercials . . . you name it JFD's got it to help you sell your way to top antenna profits.

• A WORD ABOUT OUR PATENTS . . . **Eleven** different U. S. patents and patents pending embrace the scientific advances of the JFD LPV—**more** than any other outdoor TV antenna. Our competition's attorneys are burning the midnight oil trying to find loopholes and ways to circumvent this patent protection which assures you of getting **the only** genuine antenna designed according to the **original patented log periodic** design of the famous **University of Illinois Antenna Research Laboratories.**

**AT THE MOMENT OF TRUTH THE PICTURE IS THE PROO
WHY JFD LPV COLOR LOG PERIODICS WORK BEST!**

JFD ELECTRONICS CORPORATION

15th Avenue at 62nd Street, Brooklyn, N.Y. 11219
JFD International, 64-14 Woodside Ave., Woodside, N.Y. 11377
JFD Canada, Ltd., Canada

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EDITOR'S MEMO

Serving Best

There's an old saw about "He who tries to serve everyone serves no one." ELECTRONIC TECHNICIAN has been urged from time to time to include broadcast engineering, circuit designing, medical electronics, lab engineering, ham radio and many other specialized areas of the electronics field in its editorial content. We've even been urged to include do-it-yourself construction type articles.

The electronics field is very broad and many magazines now cover various specialized areas of that broad field. We intend to continue serving professional home-entertainment product service-dealers and technicians in those areas in which they derive their total incomes. Any magazine that attempts to serve *everyone* will fail to serve *anyone* — and it doubtful if such a magazine would be around very long.

We have been urged to include radio, CB, auto radio, tape recorder, Hi Fi and other equipment schematics in the 16 pages of TV schematics which appear every month in ET. But an overwhelming majority of readers have repeatedly indicated that every inch of TEKFAX is extremely valuable to them as it is. They have requested that we do not cut, mangle and water down these pages with other schematics. There are literally thousands of other schematics which cover radios, phonograph amplifiers, Hi Fi equipment, CB radios, regular two-way equipment and other gear.

We couldn't do justice to any one schematic area if we ran a "potpourri" of schematics covering the entire home-entertainment and communications industry. Because of the number of schematics involved, we can do justice only to the TV area — and we are now doing just that.

During the past year or so we have improved the value of TEKFAX by including important scope waveforms, parts lists, service notes and other important data. We have published the latest solid-state and color TV schematics which every technician will soon need. Those who have been receiving ET for the past five years or longer now have close to 90 percent of all the basic schematics needed for day-to-day work.

ELECTRONIC TECHNICIAN is sensitive to the needs of its readers. We will continue to serve those needs to the best of our ability.

we looked into your future, then created the "little corporal," a most remarkable CRT tester.

B & K has done it again . . . put you a "jump ahead" by looking into your future . . . your problems, *your* needs. This is the "Little Corporal," the CRT Rejuvenator and Checker, designed to provide maximum obsolescence protection by providing continuously variable voltages for all CRT elements. You can make the most accurate possible tests, even on future CRT types, because the heater voltage is metered and is continuously variable from 0 to 13 volts with any tube heater current. And, using the required adaptors, you can test and correct all tube, transistor or integrated circuit black and white and color picture TV tube troubles (including GE 11" color and imported color tubes) in a few minutes . . . in the home or on the bench . . . without removing tubes from the TV set.

You can give new life to weak or inoperative picture tubes—prove to your customers their need for new tubes.

The "Little Corporal," another product of B & K electronic innovation, carries the B & K Professional Servicing Equipment emblem, your assurance . . . your customers' assurance . . . that you use the finest equipment made.

Model #465, Net: $89.95.

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Where Electronic Innovation Is A Way of Life

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LETTERS TO THE EDITOR

A 'Tough Dog?'

Here's one that gave us some difficulty. I think it can be classed in the "Tough Dog" category. Our experience may help some other readers.

An RCA color chassis, CTC10AB, came into the shop with what appeared to be a simple video or AGC problem. The screen showed a raster but no video or sound.

A check revealed the AGC voltage was too high on pin 5 of the 6DT6A keyed AGC and noise inverter tube. It was also noted that pin 2, the cathode of this tube, was about 10v too low. It should have checked +14v.

After making a number of circuit checks according to "Hoyle," we discovered that a heater bypass capacitor on the 6GM6 2nd IF amplifier was shorted. This caused the B+ voltage at the junction of R145 and R146 (22K and 33K respectively) to be low. B+ 275v feeds through R145 and R146 goes to one end of the AGC control, R133, connected in the cathode of the AGC keyer tube. And this junction is also connected to the filament winding of the transformer that furnishes 6.3v to the 2nd video IF tube, shunt regulator and the CRT. The voltage at the aforementioned junction was very low — about 20v.

If you encounter AGC trouble in this chassis, check to see if R145 is overheating and also measure the voltage at the junction of R145 and R146. It should be about 180v.

BOB GOODMAN
Alexandria, La.

Needs Tape Recorder Schematic

I need a schematic for a Grundig tape recorder, TK819, but I can't locate them in this country. I've heard they have a service station in Brooklyn, N.Y., but I think they're hiding behind "the tree." Can any ET reader help me?

PAUL CHRISTIE
Elmhurst, N.Y.

Needs Antique Schematic

Can any one help me with a FADA model 76PC schematic, chassis No. 7600-214 ac/dc circa 1939?

OWEN A. FRASER
New York, N.Y.

Incompleted Yoke

I had a call on an Admiral color TV set. The customer complained that only channel 7 could be received. Channel 2 was intermittent, losing horizontal sync with color and sound being received. Then color and sound would fade, leaving only faded lines. After I had substituted RF, AGC and sync tubes I noticed a slight arcing which was located in the yoke. After removing the yoke's rear plate I discovered that the 1000pf capacitor connected to terminal 10 had never been soldered. When the capacitor's lead was soldered to this terminal all the trouble on channel 2 cleared up.

ROBERT CHRISTIAN
Union City, Ind.

Dwell-Tachometer

In reference to Mr. John Holloman's letter requesting service data for the AT-162 Dwell-Tachometer, we can provide schematic and any replacement parts needed. Or, if he prefers, the instrument can be sent to our laboratory for repair. We specialize in unique equipment and test instrument repair.

ALVIN G. SYDNOR
Altron Electronics Co.
1309 Jefferson Ave.
Woodlyn, Pa. 19094

WHY risk your reputation with "just-as-good" capacitors?

When you pay little or no attention to quality in tubular replacement capacitors, you leave yourself wide open for criticism of your work . . . you risk your reputation . . . you stand to lose customers. It just doesn't pay to take a chance on capacitors with unknown or debatable performance records when it's so easy to get guaranteed *dependable* tubulars from your Sprague distributor!

There's no "maybe" with these 2 great SPRAGUE DIFILM® TUBULARS!

The ultimate in tubular capacitor construction. Dual dielectric . . . polyester film and special capacitor tissue . . . combines the best features of both. Impregnated with HCX®, an exclusive Sprague synthetic hydrocarbon material which fills every void in the paper, every pinhole in the plastic film *before it solidifies*, resulting in a rock-hard capacitor section . . . there's no oil to leak, no wax to drip. Designed for 105°C (220°F) operation *without voltage derating*.

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Molded Tubular Capacitors

The world's most humidity-resistant molded capacitors. Tough, protective outer case of non-flammable molded phenolic . . . cannot be damaged in handling or installation. Black Beauty Capacitors will withstand the hottest temperatures to be found in any TV or radio set, even in the most humid climates.

DIFILM® ORANGE DROP®
Dipped Tubular Capacitors

A "must" for applications where only radial-lead capacitors will fit . . . the perfect replacement for dipped capacitors now used in many leading TV sets. Double-dipped in rugged epoxy resin for positive protection against extreme heat and humidity. No other dipped tubular capacitor can match Sprague Orange Drops!

For complete listings, get your copy of Catalog C-616 from your Sprague distributor, or write to Sprague Products Company, 65 Marshall Street, North Adams, Massachusetts 01247

SPRAGUE®
THE MARK OF RELIABILITY

WORLD'S LARGEST MANUFACTURER OF CAPACITORS

68-4100

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LETTERS TO THE EDITOR

Harmon and Morse CB

A letter of inquiry appeared in the June 1966 issue of ET regarding the manufacturer of a CB receiver. Harmon and Morse Radio, Inc., is located at Northeast corner of Holden and North streets, Warrensburg, Mo. 64093. Until the middle of 1965, they were located in Holten, Kan.

REX J. SANDIDGE
Chief Electronics Technician
Instructional Resources Center
Central Missouri State College

Best and Quickest

Thank you for the quick reply and the suggestions you made regarding the problem of the 1X2B tube going bad in that RCA TV chassis KCS98A.

I now have −19v drive on the 6DQ6 tube with 9v on the cathode and with the width coil adjusted for minimum cathode current of 90ma. The 1.8Ω current limiting resistor is OK. The 1K resistor was replaced, also the width coil and flyback. I have substituted a 1AX2 tube in place of the 1X2B because it has a higher voltage and current specs. I also checked the current to the 2nd anode and it was about 1ma. I am still not certain if the changes I have made are going to do the job.

Of all the places I inquired concerning this problem, I received the best and quickest reply from you . . . .

GILBERT GAHLER
Janesville, Minn.

Rightfully Appalled

I was appalled to see *Hertz* used for *cycle* in "You and Your Oscilloscope" — May issue. This is like using *knots* (nautical miles per hour) to measure or specify distance.

One cycle of a waveform is properly referred to as "one cycle" where there is no reference to time. This is true even if that one cycle under consideration happens to belong to a signal having a frequency of one Hertz.

Hertz is a unit of *frequency* (number of events per second), the proper unit for *number of events* is still the cycle.

Otherwise, the article was an excellent one. It is gratifying to see that ET is not shying away from the introduction of these new units. But please; there's enough confusion even when they are used properly!

HOMER B. TILTON
Tucson, Ariz.

The red glow has already disappeared from our editors' faces. They believe that editors who shy away from leadership responsibilities toward their readers and avoid striving for excellence are the only editors who make no mistakes. — Ed.

Speaker Replacement Parts

In reference to a readers inquiry concerning source of speaker cones, spiders and voice coils, we can provide direct replacement parts for speaker reconing. In addition to speaker parts and our own reconing service we specialize in tape recorder replacement parts and service providing belts, heads, motors, drives, etc. We wish to express our interest and thanks to an excellent technical journal and specifically for the opportunity of readers and suppliers to exchange information and give assistance.

A. G. SYDNOR, Servicing Engineering
A. G. SYDNOR
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Altron Electronics Co.
Woodlyn, Pa. 19094
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How full is a "full line" of semiconductors?

It's a rare distributor that stocks a "complete" line of semiconductors. Your Sylvania man comes closest. He can make quick delivery from our extensive lines of integrated circuits, rectifiers, diodes, microwave diodes, and transistors.

Take a full look.

Microwave semiconductors: Schottky barrier diodes • Point-contact mixer diodes • Point-contact video detector diodes • Germanium tunnel diodes • Germanium backward diodes • Microwave oscillator diodes (MOD) • PIN switching diodes • Gallium arsenide varactor diodes • Step recovery diodes • Silicon varactor diodes • Parametric amplifier varactors • Tuning varactors.

Integrated Circuits (TTL) • SUHL I family • SUHL II family • Digital Functional Array • Linear Circuits.

Diodes & rectifiers • Germanium point-contact diodes • Germanium gold bond diodes • Silicon epitaxial planar diodes • Silicon alloy diodes • UHF silicon point-contact diodes • Monolithic diode assemblies • Discrete diode assemblies • Silicon epoxy rectifiers • Silicon glass rectifiers.

Transistors • Germanium mesa transistors • Germanium PNP power transistors • Germanium NPN power transistors • Silicon small signal transistors • Silicon large signal transistors • High frequency silicon transistors.

Sylvania Semiconductor Division, Electronic Components Group, Woburn, Massachusetts 01801.

SYLVANIA

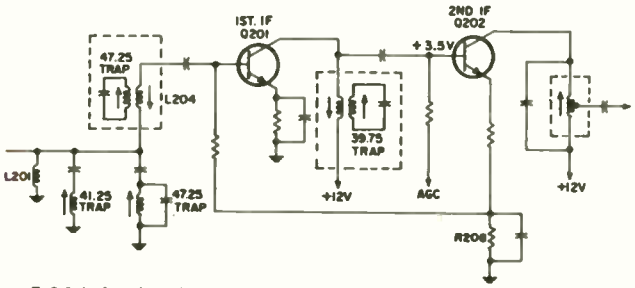
SUBSIDIARY OF GENERAL TELEPHONE & ELECTRONICS GT&E

MAGNAVOX

TV Chassis T908 and T915, Video IF and Output—Circuit Description

IF Circuits

The low impedance link coupling from the VHF tuner is terminated by L201 on the IF board. Three trap circuits are located in the base circuit of Q201. Two of them provide trappage for adjacent channel sound and the third provides 28db reduction of the desired sound carrier.



L204 is the input coil for Q201 and helps to shape the over-all IF response curve. Base bias voltage for Q201 is taken from R208. Emitter current flow through Q202 develops a positive voltage across R208 which is used to forward bias Q201. The IF transformer in the collector circuit is broadly tuned. An absorption trap tuned to the adjacent channel picture carrier frequency is wound on the same coil form.

The IF signal is next capacitively coupled to the base of the second IF stage. Q202 also has a broadly tuned transformer in its collector circuit. This stage is particularly important since its base is directly controlled by the AGC voltage. A nominal +3.5v is presented on the base to provide forward bias. At this voltage, the stage operates at maximum gain. Also, as stated earlier, the voltage drop across R208 supplies forward bias to the first IF stage.

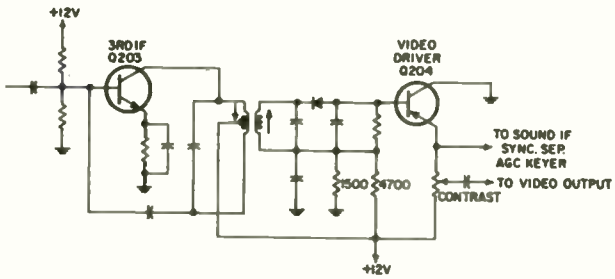
When AGC voltage is developed, the base of Q202 becomes more positive and increases collector current. The voltage drop across the emitter resistor becomes more positive and increases the collector current of the first IF stage. With these particular transistors, as collector current increases, gain decreases. This method of reducing gain is referred to as forward AGC.

The third IF stage is forward biased in the conventional manner with the voltage dividing resistors in the base circuit. The IF transformer in the collector circuit is sharply tuned to shape the IF response curve. The transformer is tapped so that an out-of-phase voltage can be coupled back to the base to neutralize this stage.

The IF signal is coupled through the transformer to the detector diode. The diode rectifies the IF signal and the remaining IF frequency components are filtered to ground. The polarity of the diode produces a video signal with negative-going sync pulses. This signal is then dc coupled to the base of the video driver stage.

Video Circuits

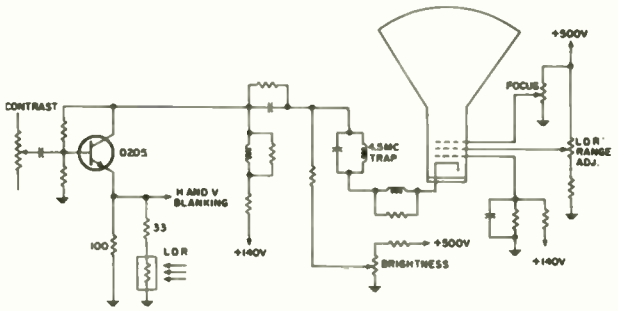
The video driver uses a PNP silicon transistor in an emitter-follower circuit. With this arrangement, all of the signal voltage is developed across the emitter resistance which, in this case, is the contrast control. The signal at the emitter has the same polarity and approximately the same amplitude as the signal on the base. The video signal at this point is of special importance since it is coupled to four different circuits: the video output stage (through the contrast control), the sound IF amplifier, the AGC circuits and the sync separator.



The video output stage is biased for class "A," linear operation. The base biasing resistors are connected directly to the collector. This is a negative feedback circuit for both ac and dc which stabilizes the amplifier and improves frequency response. The emitter resistor is unbypassed which results in some loss of gain. However, this is done to accommodate the LDR used in the automatic brightness and contrast circuit.

The transistor used in this stage is a silicon type NPN which is capable of handling relatively high collector voltages; the collector returns to a +140v supply. The picture tube requires a nominal P-P video signal of 50v at normal contrast. Because of variations from one picture tube to another the output stage must be able to supply ample drive beyond what is normally needed. At maximum contrast, the video signal has a P-P value of around 100v. A heat sink is attached to the transistor case to provide heat dissipation.

The video signal is amplified and inverted in the collector circuit so that sync tips are positive. This is the correct polarity for blanking the picture tube when the cathode is the driven element. Peaking networks are also included to optimize high frequency response. A 4.5MHz trap is inserted in series with the cathode to attenuate any sound carrier that may be present.



The brightness control affects the brightness of the picture tube by varying the CRT cathode voltage. Increasing the positive voltage on the cathode has the same effect as increasing the negative voltage on the control grid; that is, brightness will be reduced. In this case, the control grid is supplied with a fixed positive voltage

FINCO ALL-BAND UHF-VHF-FM ANTENNA
75 OHM Model CX-UVF-24 $72.10 List

FINCO ALL-BAND UHF-VHF-FM ANTENNA
300 OHM Model UVF-24 $59.95 List

The one antenna that does the work of three! Pulls in beautiful color and crystal clear black and white pictures on both UHF and VHF channels...plus the finest stereophonic and monophonic FM sound reproduction.

300-ohm models for normal reception areas from $18.50 to $59.95

75-ohm models for poor reception areas from $42.65 to $72.10

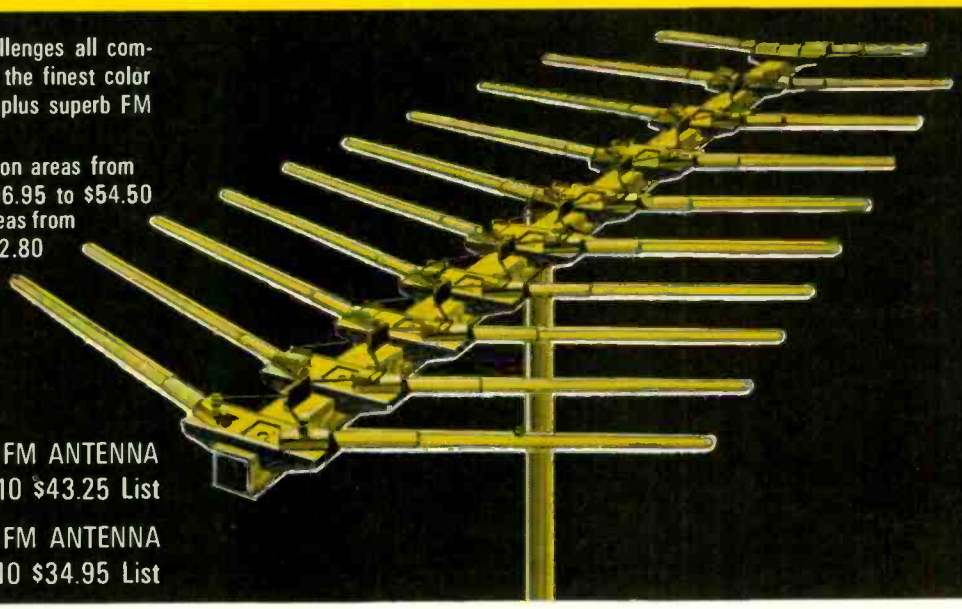
FINCO

introduces / 75-ohm COLOR VE-LOG ANTENNAS FOR UHF-VHF-FM RECEPTION

Finco's Swept-Element Antenna challenges all competition. Its unique design assures the finest color and black and white TV reception—plus superb FM and FM Stereo tone quality.

300-ohm models for normal reception areas from $16.95 to $54.50

75-ohm models for poor reception areas from $18.55 to $62.80



FINCO SWEPT-ELEMENT VHF-FM ANTENNA
75 OHM Model CXVL-10 $43.25 List

FINCO SWEPT-ELEMENT VHF-FM ANTENNA
300 OHM Model VL-10 $34.95 List

FREE! ALL FINCO CX-VL, CX-UVF AND UVF ANTENNAS COME WITH A FREE INDOOR SET-MOUNTED TRANSFORMER, VHF-UHF TRANSFORMER SPLITTER OR VHF-UHF SPLITTER.

MAKER OF THE WORLD FAMOUS COLOR FINCO BLACK / WHITE ANTENNA COMPONENTS AND ACCESSORIES

THE FINNEY COMPANY

34 WEST INTERSTATE STREET, DEPT. BEDFORD, OHIO

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through a voltage divider network. A more positive voltage is applied to the cathode so that the control grid is effectively negative with respect to the cathode.

Focusing of the beam spot is accomplished by adjusting the grid 3 voltage on the CRT from zero to 500v. This grid acts as a lens to converge the electrons making up the beam into a small spot at the time the beam strikes the faceplate.

Blanking of the picture tube is also provided in the video output stage. Horizontal and vertical blanking pulses are coupled from the sweep circuits to the emitter of Q205. These pulses are positive-going and, therefore, reduce the forward bias voltage on the base-emitter junction. The sync and blanking pulses contained in the composite video signal on the base are negative and also reduce forward bias. The combination of negative sync on the base and positive blanking on the emitter results in amplified, positive-going blanking pulses in the collector circuit which cut off the CRT during retrace time.

The LDR circuit provides an automatic means for adjusting brightness and contrast under varying room lighting conditions. The circuit accomplishes this control by varying the emitter resistance in the video output stage with a light dependent resistor. The LDR forms a part of the unbypassed emitter resistance of the video output stage. As room lighting increases, the LDR resistance becomes less which results in less total emitter resistance. The stage produces more gain, since there is less degeneration, and drives the CRT with a higher amplitude video signal to produce more contrast. As the stage conducts harder under these conditions, the average dc collector voltage decreases. Since the collector is dc coupled to the CRT cathode, this results in a decrease in cathode voltage and a higher brightness level on the picture tube.

As room lighting decreases, the LDR increases in resistance, produces more degeneration and less gain to reduce contrast. The output stage conducts less which allows the collector dc voltage to become more positive and reduce picture tube brightness. A 33Ω resistor is inserted in series with the LDR to limit the variations of resistance in the circuit so that over-correction of brightness and contrast does not occur.

RCA VICTOR

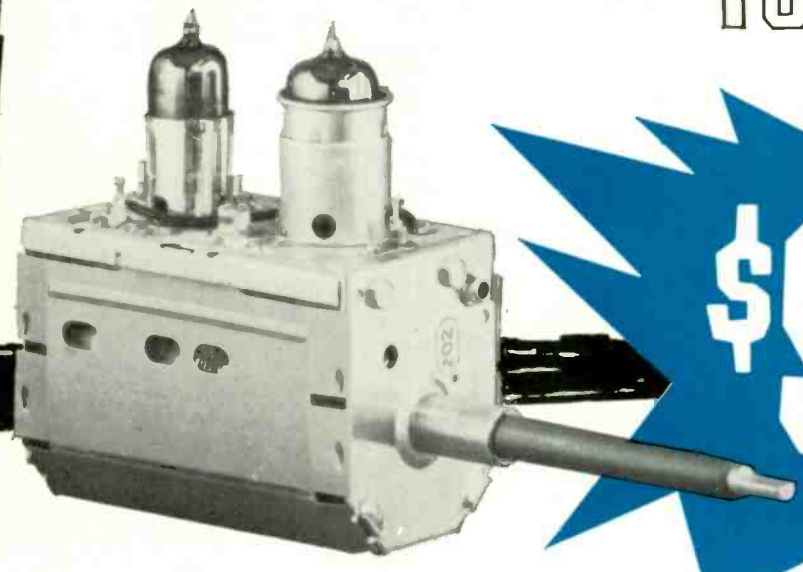
TV Chassis KCS153 Power Supply—Circuit Description

The KCS153 chassis is designed for 120v, 60Hz ac operation. A power transformer is used with provisions for high line voltage operation through an alternate 128v tap on the primary. The voltages furnished are; +30v for most of the circuit requirements, +140v for powering the audio output, video output, and biasing the vertical drivers and 6.3vac for the picture tube filament.

A circuit breaker is used which protects both the +140v and the +30v supplies. A power filter is used to produce an extremely smooth dc in the +30v source. This assures that hum will be minimized in all circuits which may be susceptible to amplifying ripple voltage.

The power filter circuit enables a very low level of

Complete TUNER REPAIR for only



$9.50

Sarkes Tarzian, Inc., largest manufacturer of TV and FM tuners, offers unexcelled tuner overhaul and factory-supervised repair service. Completely-equipped and conveniently-located Service Centers offer fast, dependable and factory-supervised repair service on all makes and models. Centers are staffed by well-trained technicians, assisted by engineering personnel.

Tarzian-made tuners received one day will be repaired and shipped out the next. More time may be required on other makes. Every channel—not just the channels existing in any given area—is checked and re-aligned per original specifications. Exclusive cleaning method makes the tuner look—as well as operate—like new.

Cost, including ALL labor and parts (except tubes) is only $9.50 and $15 for UV combinations. No additional charge. No hidden costs. Too, you get a full, 12-month warranty against defective workmanship and parts failure due to normal usage.

Always send TV make, chassis and Model number with faulty tuner. Check with your local distributor for Sarkes Tarzian replacement tuners, parts or repair service. Or, use the address nearest you for fast, factory-supervised repair service.

TSC

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(Factory-supervised tuner service authorized by Sarkes Tarzian)

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Tel: 317-632-3493

EAST — 547-49 Tonnele Ave., Jersey City, N. J.
Tel: 201-792-3730

SOUTH-EAST—938 Gordon St., S. W.
Atlanta, Georgia
Tel: 404-758-2232

WEST—
SARKES TARZIAN, Inc.
Tuner Service Division

10654 Magnolia Blvd.,
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Tel: 213-769-2720

Now RCA Victor most automatic

Surest to satisfy! The *new* RCA Victor Mark I Deluxe for 1967 is the most automatic Color TV ever made. With great new advances like these—

Automatic Frequency Control. Precisely tunes and locks the signal in place automatically.

has the Color TV!

Automatic Chroma Control. Keeps color level constant, regardless of channel switching. Customer merely sets color tint.

Remote Control for VHF *and* UHF—only from RCA Victor. Lets viewer change stations, switch between all VHF and UHF channels, turn TV off and on, adjust volume, tune "tint" and "color," even turn all power off. In remote control models of new Mark I Deluxe Color TV.

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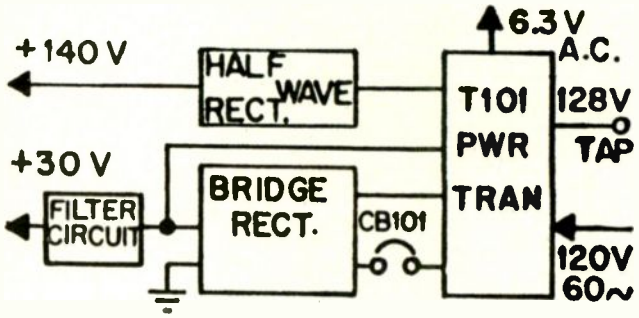
TECHNICAL DIGEST

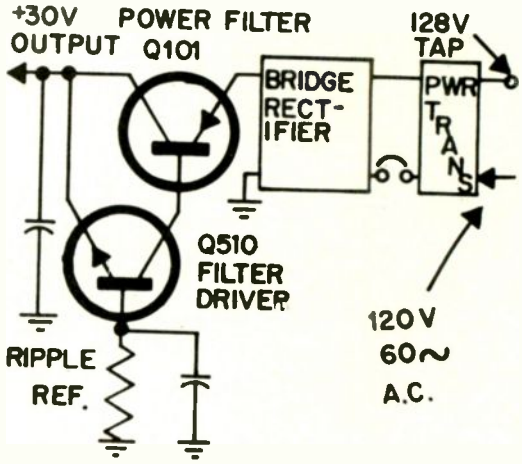
ripple to be obtained with a minimum of large (even prohibitive) size components. The "filter driver" senses any ripple voltage present and amplifies, inverts and feeds the



ripple to the "power filter" which cancels the effect of such ripple in the output.

Since the base current of the power filter is the same as the collector current of the filter driver, the effect of the ripple cancellation can be seen. A ripple level of only 50mv results from this circuit. This filtering is effective at 120Hz (the ripple frequency) as well as at 15Hz (the frequency of the variations originating in the horizontal circuits). A current of approximately 900ma is drawn from the +30v supply.

The +140v supply is a conventional half-wave rectifier



fed by a separate power transformer winding. The output is "stacked" on the +30v supply and smoothed by an RC filter. This circuit arrangement permits one circuit breaker to be common to both supplies. A circuit breaker, CB101, is in the common return of the power supply. This breaker will normally carry about 1.8a and will trip at 2.7a. Although the circuit breaker is similar in appearance to the type used in tube type instruments, it has a different current carrying capacity and tripping current rating than the usual circuit breaker. Replacement should be made only with the exact type specified in the parts list. Current of approximately 50ma is drawn from the +140v supply. If the circuit breaker should trip, a quick check would be to read both the +140v and +30v outputs while resetting the circuit breaker; this will indicate which circuit may have caused the tripping.

If service is performed with the deflection yoke removed, a load of 20Ω @ 25w should be inserted from the

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You already know how good Philco Star Bright 20/20 Picture tubes and Star Light Receiving tubes are. If you didn't, you wouldn't depend on them as you do. And enjoy such outstanding customer satisfaction.

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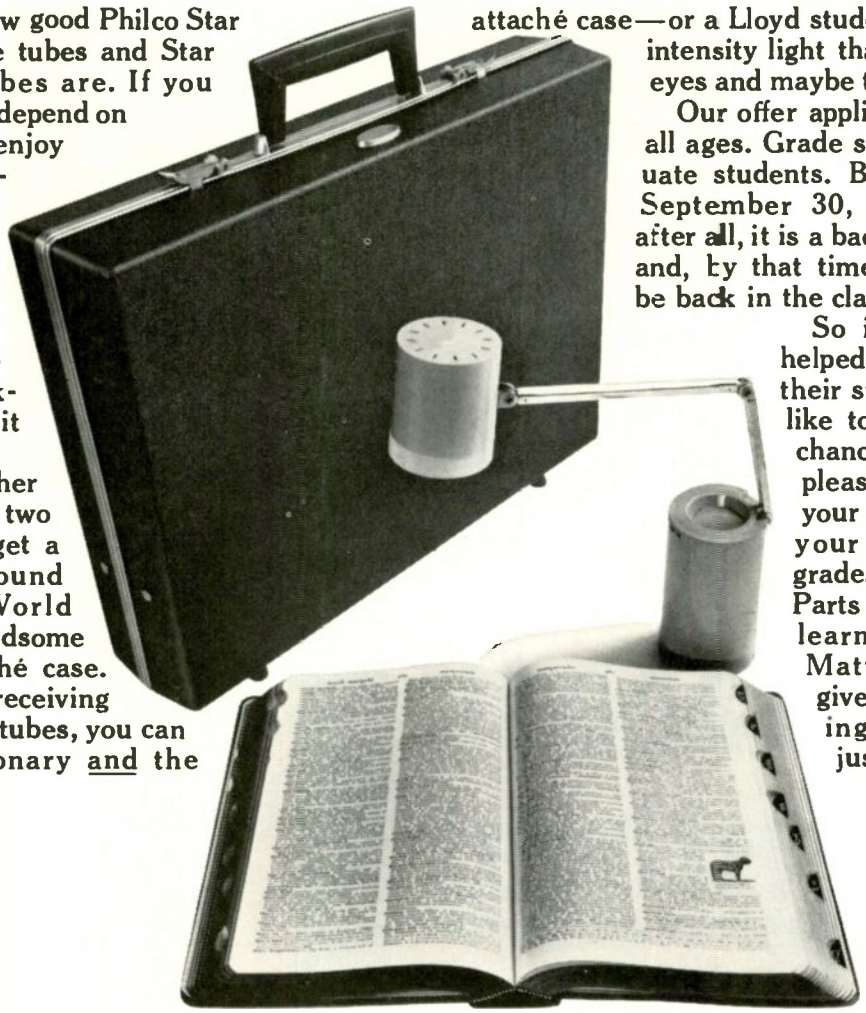
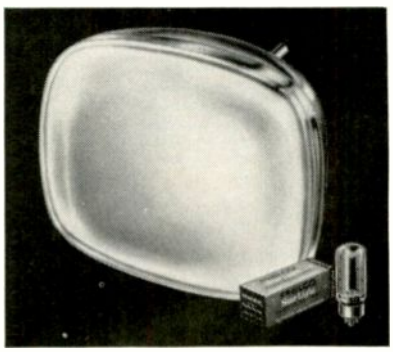
When you buy either 55 receiving tubes or two picture tubes, you get a free, beautifully bound Webster's New World Dictionary. Or a handsome executive-type attaché case.

If you buy 110 receiving tubes or four picture tubes, you can get both the dictionary and the attaché case—or a Lloyd student lamp, a high-intensity light that's good for the eyes and maybe the grades.



Our offer applies to students of all ages. Grade schoolers or graduate students. But it expires on September 30, 1966, because, after all, it is a back-to-school deal and, by that time, everybody will be back in the classrooms.

So if you've never helped your kids with their studies, and you'd like to, now's your big chance. It'll give you pleasure to know that your business helped your kids make the grades. See your Philco Parts Distributor and learn all the details. Matter of fact, he'll give you a great-looking ball-point pen just for stopping by.



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Let's face it,
without
wouldn't
the Color
AMERICAN INSTITUTE FOR BETTER TELEVISION RECEPTION
MADE BY A
MEMBER
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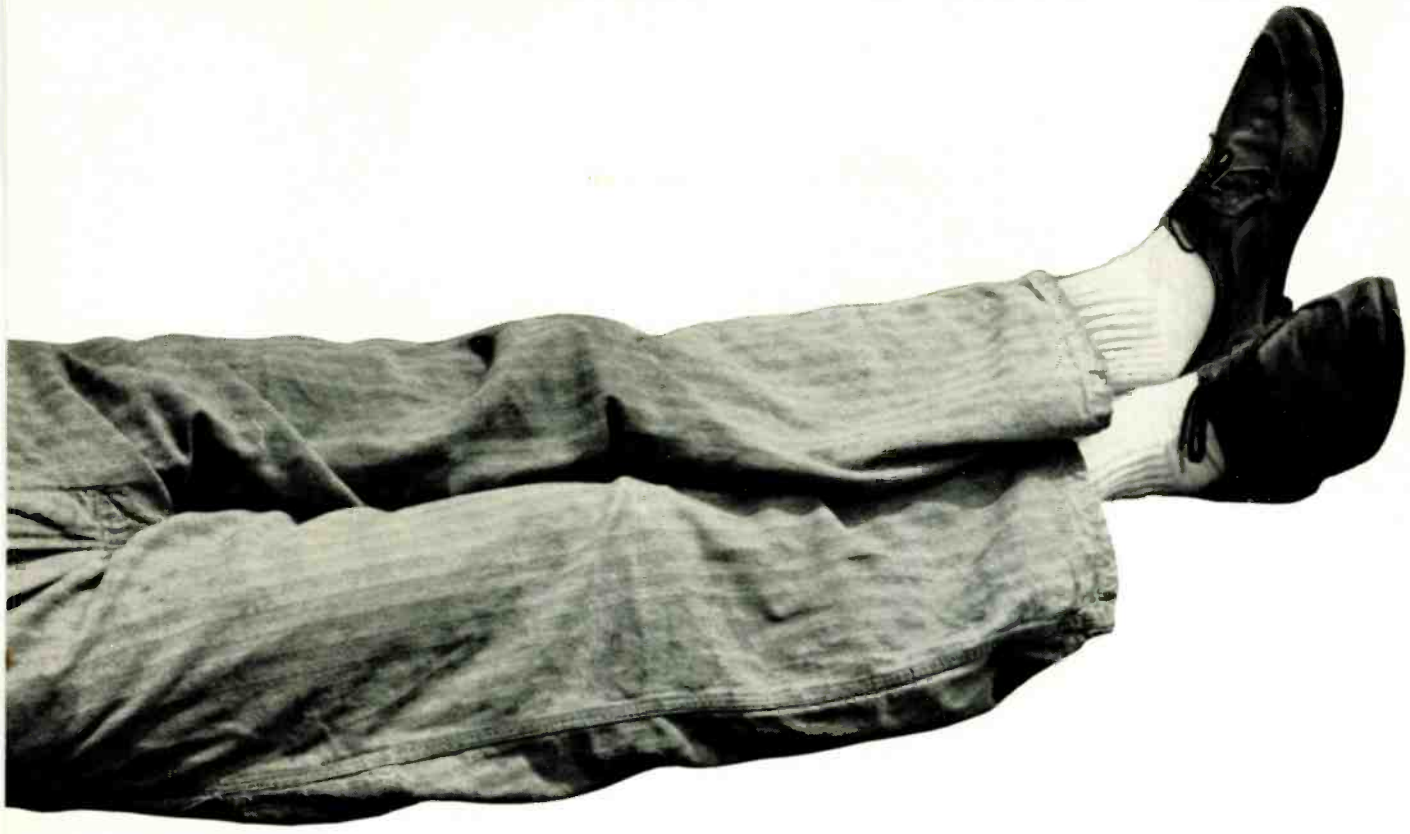

you look silly up there Breakthrough Antenna?

(Especially when it costs no more)

Channel Master didn't invent color. What we have done is to bring out the best in it. On both the VHF and UHF bands.

We're so much deeper than anybody else in top-calibre color antennas, you'd think we had a patent on the product. We do. 3 patents, in fact, and 2 patents pending.

What it adds up to is a grand total of 20 topline antennas with design so advanced—that they're better than anything anyone has ever made before. Anyone else has to be No. 2 at best—in quality (and sales). And hardly likely to become No. 1—even if they do try harder.

It's our principles that keep us on top. (Our proven Crossfire VHF Proportional Energy Absorption Principle — our proven Coloray Power Equalizer Principle—and our equally proven Ultradyne UHF Principle. To name three.)

What's your area—what's your need? Channel Master meets it with a model from one of three series:

Color Crossfire Series.* The best selling VHF/FM color antennas in history. Top gain and highest possible front-to-back ratio from metropolis to suburbs to deep fringe. Need we say more!

Coloray Series.* The antennas that don't believe in ghosts. They combine the high gain characteristics of the Crossfire with up to 30 to 1 front-to-back ratios.

Ultradyne Series.* Includes Ultradyne Crossfires — the most powerful 82-channel/FM antennas yet developed . . . with 15:1 front-to-back ratio across the entire UHF band. Ultradyne "UHF only" antennas require no coupler when used with any 300 ohm VHF antenna (such as the Crossfire).

All twenty "Color Breakthrough" antennas are built extra-rugged and protected against corrosion by our famous EPC Golden Overcoat.

So while you're up there, mister, make sure you don't let your customer (and yourself) down. Install a Channel Master—and it's 20 to 1 you've picked the right antenna. And when, like us, you get to sell more antennas than anybody else, you can bet it won't be by accident. It has to be by design.

CHANNEL MASTER The Color Breakthrough Antennas

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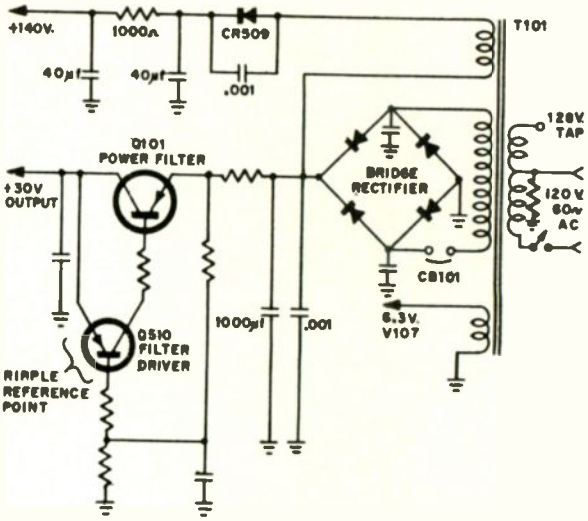
TECHNICAL DIGEST



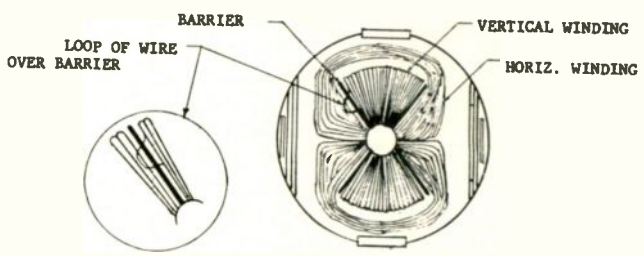
+30v supply. This will substitute for the current drain normally consumed in the deflection output circuits.

A wire fuse is used to protect the 6.3vac filament circuit of the picture tube. Power consumption from the ac line is approximately 60w in the KCS153.

GENERAL ELECTRIC

TV Chassis SB—Yoke Failure

Evaluation of several yokes returned from the field indicate that most SB yoke failures occur because of a turn of the vertical winding looped over the barrier and touching a horizontal winding. This may show up as a loss of high voltage or a trapezoidal raster. A visual



inspection of the inside of the yoke may reveal a loop of wire from a vertical winding looped over the barrier and touching the horizontal winding. Redressing the wire to the correct side of the barrier will restore normal operation. Any SB yokes which appear to be defective, should be inspected and redressed rather than replaced.

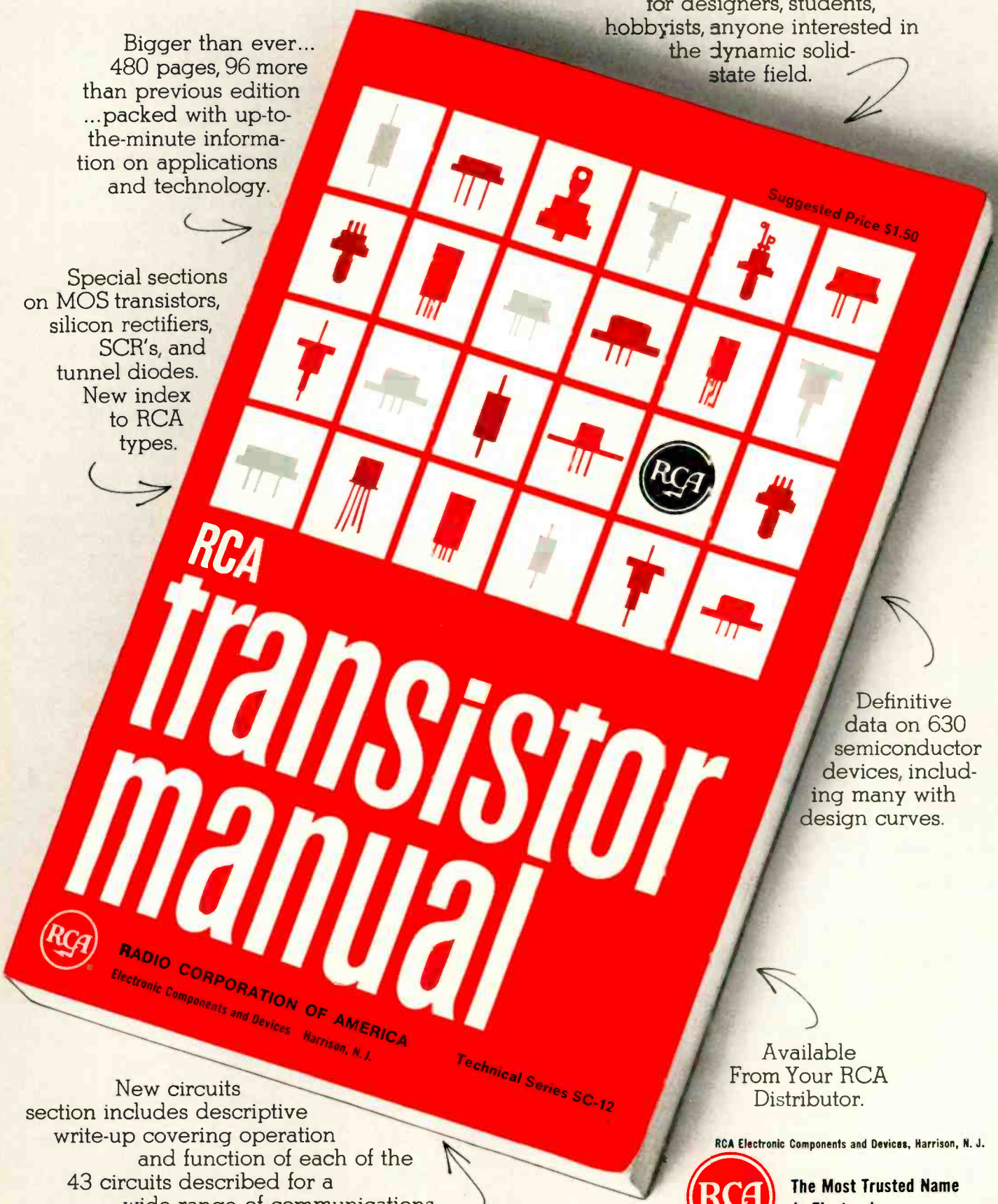
MOVING?

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

Better than ever... includes descriptive text up-dated for designers, students, hobbyists, anyone interested in the dynamic solid-state field.

Bigger than ever... 480 pages, 96 more than previous edition ...packed with up-to-the-minute information on applications and technology.

Special sections on MOS transistors, silicon rectifiers, SCR's, and tunnel diodes. New index to RCA types.



Definitive data on 630 semiconductor devices, including many with design curves.

Available From Your RCA Distributor.

New circuits section includes descriptive write-up covering operation and function of each of the 43 circuits described for a wide range of communications, industrial, and entertainment applications.

RCA Electronic Components and Devices, Harrison, N. J.

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CLOSED CIRCUIT TV CAMERA

■ A low cost CCTV camera has been introduced recently. It works with its own monitors or with existing TV sets.

William Shane, president of Video-Eye, Inc. announced that the VEC3's retail price will be $495 putting closed circuit television within the budget allowances of small industrial firms, commercial establishments, educational institutions and even private homes.

The VEC3 is a compact camera weighing only 6.3 lb and measuring 8½ x 3.6 x 5.4 in. It is a fully automated camera with electric eye lens control to adjust automatically to varying light conditions.

The camera features the extra-sensitive #7735-A Hitachi Vidicon pick-up tube and a modularized "Thixotropic" coated circuit assembly, said to be virtually maintenance-free. It has 24 transistors, 15 diodes and an exclusive patented "Minichron" time-totalizer. The camera gives a sharp, 400-line-resolution picture with a 2ASA sensitivity and covers channels 2, 3 or 4 in existing TV set monitors. Standard lens is the precision Cannon 25mm f1.4.

The camera works on standard electrical current (100 to 120vac, 50 to 60Hz) and consumes a maximum of 13w. Its output is 1.5v, P-P (composite into 75Ω load, sync neg.) Scanning is random interlace, vertical — 60Hz lock, and horizontal — 15.75KHz and s/n ratio is said to be 32db. Illumination at 30ft is "C" minimum.

Its standard closed circuit range is ⅛ mile which can be raised to 1¼ miles with 1800ft of cable and booster.

The VEC3's versatility is said to be backed by a complete line of special lenses — wide angle, close-up, telephoto, zoom and others — plus a wide range of supplementary equipment such as outdoor covers, motorized and manual pan tables.

Selected electronics manufacturer representatives in every region are now in the process of setting up authorized distributors and dealers, according to Mr. Shane. ■

Getting a hernia and not getting paid for it?

Let Arcolytic® capacitors lift the load off your mind. Or anywhere else it happens to be.

These aluminum electrolytics are built to last: wound with computer-grade 99.99% pure aluminum foil so they'll keep operating in your customers' sets even at continuous temperatures of 85°C.

You'll find they take the worry right out of premature failure, lost customer confidence and costly call-backs.

There's no premium cost, either. Arcolytics are priced along with other home entertainment capacitors.

Ask your Authorized Arco Distributor for Arcolytic electrolytic capacitors in single-section tubular, multiple-section tubular, or twist-mount designs. It may be the best break you get this year.

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SYNC ON BUSINESS

A special promotion package includes five IR No. 61-8969 TV focus rectifiers and five No. 5A6D one-amp power supply rectifiers. In the package is a gift-boxed DuJean-designed pendant in Florentine gold finish. Nestled in the pendant are a diamond and cultured pearl. Dealer net is $15.95. Retail value of the pendant alone is said to be $12.95. At your International Rectifier distributor.

• • •

Complete service information on G-E radios, "Show 'N Tell," portable phonographs, portable tape recorders, intercoms and CB transceivers is available on subscription from G-E's Radio Receiver Dept. Plan A, priced at $5.50 for all 1966 manuals, provides current service information, schematics, wiring diagrams, alignment procedures, electrical specifications and parts lists with prices. Plan B, at $11.50, includes all material in Plan A, plus three radio service guides covering all G-E radios made between 1964 and 1965. The three radio service guides also are available separately as follows: 1946-1951, $1.95; 1961-1963, $1.45; 1963-1965, $2.95. Send check or money order to General Electric, Radio Receiver Dept., P. O. Box 831, Utica, N.Y. Add state and local taxes where required.

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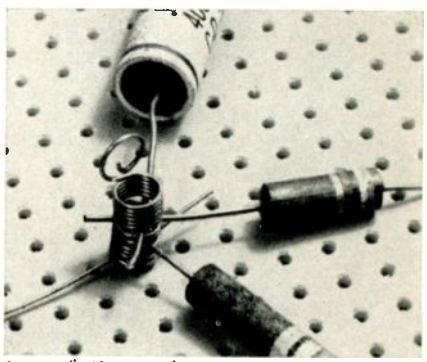

Understanding solid-state diode and transistor circuits is very easy if you use one or more of the Aladin Kits. A phenolic board, full of holes, is used to mount tightly coiled plated springs. A finger loop at the top of the spring enables the coils to be extended and wires passed through. Potentiometers, switches and transistors which generally are not wired point to point have brackets designed to speed up circuitry development. You can throw all kinds of solid-state circuits together very quickly, use your VOM, VTVM and scope to check bias voltages, current, direction of current flow and then take the whole thing apart in a few seconds and put the components back on the shelf. This breadboarding technique has been used by design engineers for years. For further information write to Aladin Kits Co., 21011 Dequinder Rd., Hazel Park, Mich.

Sencore has done it again—introduced the right instrument at the right time at the right price. FM-Stereo Multiplex is here, now, and growing as fast as Color TV. This new field is just waiting for qualified men. All you need to start "channelizing" profits your way is the new Sencore Econoline MX11 Channelizer Multiplex Generator. So light and compact you take it with you on your TV service calls, and when in the home suggest an alignment on that FM-Stereo hi-fi in the corner.

So simple to operate, you need no other instrument. Just hook up the RF output cable to the receiver antenna terminals; connect the two speaker leads in place of the speakers; then read the channel separation directly on the meters. Two meters with built-in loads substitute directly in place of speakers. When you flick on the left channel switch you have left channel output; now flip on the right channel switch and you have both. That's all there is to it.

All solid state circuitry—battery operated. Feature for feature, dollar for dollar, the Sencore MX11 Channelizer is your No. 1 buy in multiplex generators. Sencore has paved the way—so take the quickest road to your distributor. In stock now for only .....

$99.50
(Less than the price of a kit.)

CHANNELIZER

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With Simplified FM-Multiplex Servicing

SENCORE MX129 FM STEREO MULTIPLEX GENERATOR AND ANALYZER

A Complete FM Stereo Service Center

The ultimate in multiplex generators for this field that's growing as fast as color TV. Like having your own FM stereo transmitter on your bench or service truck.

The MX129 produces all signals needed for trouble-shooting and aligning the stereo portion of the FM multiplex receiver. It is a complete trouble-shooting analyzer with a sensitive transistorized AC voltmeter calibrated in peak to peak volts and decibels. It can be used as a stereo demonstrator even when no stereo program is being broadcast. With the MX129 you can use external sources to modulate the carrier, re-balance the system at any time, and adjust the crystal controlled pilot signal to any level. Instantaneous warm-up—all solid state, A.C. powered.

The Sencore MX129 gives you features comparable to equipment costing up to $350.00, yet its priced at only **$169.50**

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NO. 1 MANUFACTURER OF ELECTRONIC MAINTENANCE EQUIPMENT

426 SOUTH WESTGATE DRIVE, ADDISON, ILLINOIS 60101

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SYNC ON BUSINESS

A kit of 12 Twist-Prong electrolytic capacitors is said to provide 441 exact replacement types. A 4-page brochure, titled "The Magnificent 12," describes the kit. See your Cornell-Dubilier distributor or write to: Marketing Services Dept., Cornell-Dubilier Electronics, 50 Paris St., Newark, N.J. 07101.

• • •

Solid-state portable radio sales potential is getting another shot-in-the-arm from a four-month's country-wide promotional tour by two college students who represent Mallory Battery Co. When the tour is completed at the end of August the students will have visited 32 major cities in the United States — including Boston, Cleveland, Detroit, Chicago, St. Louis, Denver, Seattle, San Francisco, Los Angeles, New Orleans, Jacksonville, San Antonio, Pittsburgh, Washington and others. The students are meeting with leading city and community officials. Mallory is also sponsoring a "radio rally sweepstakes" in cooperation with leading radio stations in many of the cities. Several hundred transistor radios are offered as prizes along with a free trip to any place in the United States for two persons. The idea of having a transistor radio available as stand-by equipment has been strongly endorsed by Civil Defense, the FCC and other government and community agencies. Solid-state radios and batteries should always be in stock. And August is a good time to promote transistor radio sales — using "Hurricane Season" as a theme. Wherever hurricanes, "twisters" and floods are prevalent, is a good place to promote sales.

• • •

Your career in electronics is a 64-page catalog that briefly outlines a number of home study programs. Various career opportunities in electronics — including FCC license preparation, electronic automation, industrial electronics, automatic controls, digital techniques, nuclear instrumentation, solid-state electronics, electronics drafting, computer programing, TV servicing, color TV, electronic communications and a variety of other courses — are presented. Write RCA Institutes, Inc., 350 West Fourth St., New York, N.Y. 10014.

• • •

A cross reference of coil and transformer part numbers used by all manufacturers using Workman parts is available at most electronic parts distributors. It has been compiled by Workman Electronic Products, Box 3828, Sarasota, Fla. The company manufactures over 3000 different coils which include RF chokes, balun coils, antenna coils, oscillator coils, peaking coils, sound discriminators, horizontal, width and linearity coils and IF transformers in 44, 21, 10.7 and 4.5MHz types, plus 455 and 262kHz types. The coil cross reference catalog, #103, is free to qualified TV-radio technicians upon request.

• • •

If you handle two-way radio equipment, see your Motorola jobber and pick up a brochure on the PT Series "Handie-Talkie," a fully transistorized unit. The brochure is not available direct from Motorola.

CG138

CG10

It's time you too switched to Sencore and saved $100 in the bargain. The new LO-BOY is a solid Sencore value — already selling at the rate of one every 8 minutes.

Small wonder. The LO-BOY outperforms the highest priced unit on the market . . . and gives you all this: • Ten standard RCA licensed color bars; NTSC phased colors. • All the patterns found on more expensive generators—crosshatch, individual vertical and horizontal lines, and adjustable white dots . . . all at the flick of a switch. No lines missing on crosshatch—14 horizontal and 10 vertical, same as our more expensive models. • Interlace control—a Sencore "first." Stops dot bounce that varies from set to set. • Rugged all steel construction with tough scuff-resistant vinyl finish. • LO in silhouette—not much bigger than a cigar box. • LO in warm-up time. All solid state design. • LO in troubles. All new **patent pending** counting circuits using new silicon transistors. Crystal controlled timers for the utmost in stability.

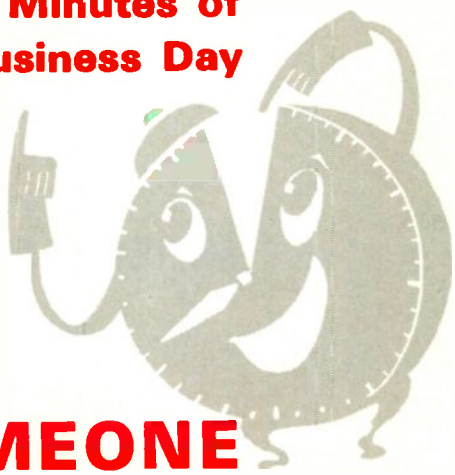
Timer controls brought right out on the front panel as simple operators controls. Adjusted as easily as the horizontal and vertical hold controls on a TV set, if they should ever jump. Absolutely eliminates timer instability.

Compare these features and you'll decide in less than 8 minutes that you need a new Sencore Lo-Boy.

SENCORE CG10. All solid state. New zener regulated battery power supply with long life "C" cells. The 12 volt battery supply can wear down to nearly 9 volts before the circuits are affected. New leakproof battery holders permit easy battery replacement without dismantling the unit. You don't have to hunt for a place to plug it in. Priced at less than the cost of a kit. .....Only **$89.50**

SENCORE CG138. A performance giant just like the CG10 except AC operated with a zener regulated power supply for added stability even with line voltage variations. Has 4.5 mc crystal controlled signal for fine tuning as recommended by color set manufacturers. .....Only **$109.50**

Every 8 Minutes of Every Business Day



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STANDARD COLOR BAR GENERATOR

See America's most complete line of professional test instruments — at your Distributor's now.

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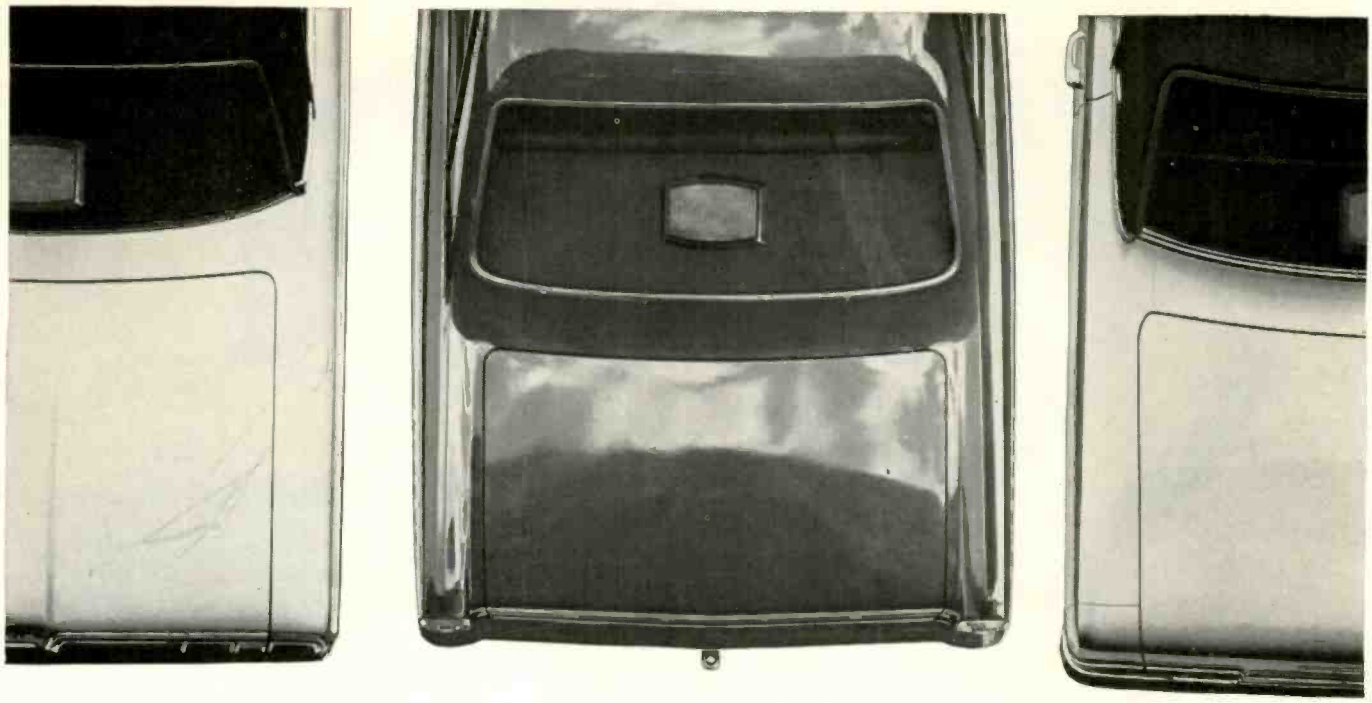

Listen!

Jensen rear-seat/deck speaker kits sound great—sell easy!

Jensen rear-seat and rear-deck speaker kits will let you grab a bigger share of the 10 million car market.

Jensen performance extras like whizzer cones, heavy duty magnets and oversize air-gap clearances, plus solid domes and dust drain holes help reduce call backs.

Installation—it's a cinch! New *solderless* universal connectors install faster and easier than any other kit, fit all car makes, too. Each kit includes speaker, grille, cable, fader control with anodized aluminum escutcheon mounting bracket, mounting hardware and simple instructions.

Kits are available in display packs, shown here, or individually boxed. Deluxe grille and harness kits also come in see-through display packs.

Nine models in Deluxe and Standard kits are attractively displayed on rugged plastic see-through packs to help you earn more profits. Ask your Jensen representative about them. Or write Jensen Manufacturing Division, The Muter Company, 6601 S. Laramie Ave., Chicago, Illinois 60638

Jensen

ELECTRONIC TECHNICIAN

AUGUST 1966

Servicing Solid-State Portable TVs

Learn what the old symptoms mean when modern semiconductor circuits fail

■ Semicondutor circuits have now become commonplace throughout the electronics industry. And most major TV manufacturers have added a solid-state portable or table model to their TV line.

It is necessary, then, for every up-and-coming TV technician to become acquainted with solid-state circuits and their peculiarities. Although solid-state equipment may not break down as often, it will require service the same as tube sets do.

Most solid-state equipment, unlike tube sets, will have to be brought to the shop for repairs. There are no tubes to be pulled and checked on tube testers. In fact, most semiconductor components are soldered directly to the circuit board.

Test Instruments Required

Test instruments required for servicing solid-state TVs will include:

1. VTVM or proper VOM
2. Scope
3. Transistor tester
4. Printed circuit diagrams and schematics
5. Noise or modulated signal generator

The VTVM must have a low ohmage, low voltage scale. An ordinary type 20,000 ohm/v multimeter will load a transistor circuit and give false readings. A good scope can be used to check the IF, video, sync, horizontal and vertical output

waveforms. A transistor tester will check the quality of a transistor. Correct component placement diagrams and schematics can help locate defective stages and components.

Preliminary Considerations and Precautions

You still use the TV screen as an aid in locating a defective section in a solid-state receiver — the same as in tube sets. If the TV screen shows insufficient vertical height, for example, the trouble is obviously in the vertical section and you would use the scope to check vertical waveforms. Compare waveforms with those on the TV schematic. When the defective stage is located, use the VTVM to pinpoint the defective component. The procedure is the same as in tube sets but new dimensions have been added — especially in the area of precise symptom meanings and diagnosis.

You will use your scope more than ever on solid-state circuits. Most manufacturers' solid-state diagrams show the location of component parts. This resembles the electron tube circuit but several transistors may be required to do the same job as one tube. Solid-state parts are usually very close together. See Fig. 1 for component location in a typical solid-state portable TV.

Use extreme care when applying test instrument probes around transistor leads or other components. You can accidentally touch two or more connections and damage one or two transistors at the same time. Know exactly where you are applying that test probe and why. A solid-state component will not take a high voltage surge like an electron tube will.

The solid-state TV receiver has fewer components than tube sets: mostly low-voltage capacitors, low-value resistors, a lot of transistors and many semiconductor diodes. A leaky transistor will show low voltages on the collector and base. Likewise, a transistor that's shorted between emitter and collector, will show very low or no voltage. A 1Ω short between emitter and collector may not allow a voltage reading on the collector terminal. The transistor will have to be replaced before the voltage returns to normal.

Servicing Solid-State...

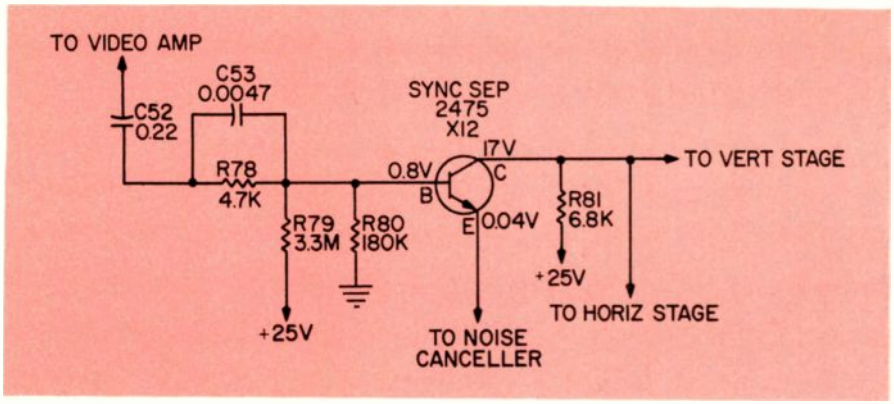

Fig. 1 — Transistorized sync stage in RCA KCS153 chassis.

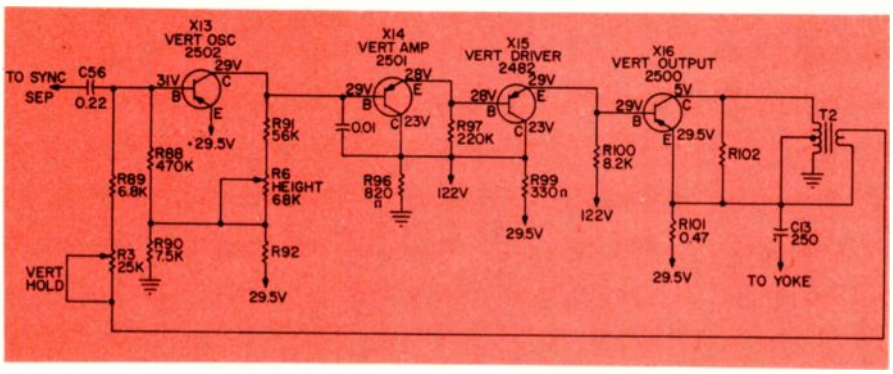

Fig. 2 — Vertical stages of RCA KCS153.

Use a small pair of long-nose pliers clamped to a transistor lead when unsoldering or when soldering into a circuit. Do not attempt to replace a power transistor when the set is turned on. Check the insulated spacer of a power transistor, if one is used, before the new transistor is bolted in place. Apply silicone grease to the insulated washer and the transistor surface that makes contact with the insulated washer.

Checking the Front End

VHF and UHF tuners in solid-state portables are small in size. Most VHF tuners have a separate transistor for RF amplifier, VHF oscillator and mixer circuits. The UHF tuner has only one solid-state component. Try to replace these transistors with original factory types or with those having the same characteristics as the original.

A weak or leaky RF transistor will cause a snowy picture. In a Sylvania GT12 model, for example, the RF transistor was discovered to be intermittent, creating snow one moment and then almost immediately thereafter, normal reception. Be extremely careful when replacing these front-end transistors and keep the leads the same length as the original ones when making replacements. When channel 70, for example, drops out on the UHF band and a lower UHF channel still performs normally, change the UHF oscillator transistor. Most solid-state VHF tuners have the transistors mounted on top of the tuner for easy replacement.

The typical solid-state TV has three to four transistors in the IF stages, with one and two transistors employed in the video output stage. These stages can be checked with a scope and demodulaor probe.

Sound and Audio Stages

The sound section consists of two or three IF stages, diode ratio detector and at least two audio stages. Some solid-state receivers use two transistors push-pull in the audio output circuit. A weak transistor will cause low and distorted sound. Generally, the cause of distortion will be located in one of the last two audio stages.

A leaky or shorted transistor in the push-pull power output stage will cause distortion. The one with the lower collector voltage will be defective. But, in push pull stages, replace both with a matched pair. Before replacing either, however, make a visual inspection and check for burned or charred resistors. Check for a change of resistance in the bias or emitter resistors. A receiver with weak sound or with no sound or audio can also be caused by open electrolytic coupling capacitors.

Sync Stage Considerations

In the RCA KCS153 chassis, horizontal and vertical sync pulses are taken from the collector terminal of the first video amplifier. Only one stage of vertical sync is used in this set. Some portable TV receivers employ up to three transistors to accomplish the same thing. Notice that both vertical and horizontal sync pulses are taken from the collector terminal of the sync separator and go to their respective stages.

Check the input and output waveforms with a scope. Compare these waveforms with the manufacturer's schematic for shape and correct voltage amplitude.

As shown in Fig. 1, a 100Ω leakage between X12's base and emitter will prevent both the vertical and horizontal sync from locking. For instance, only a 2.2K leakage at this point will start the vertical sync rolling. But the picture will lock horizontally.

If a short exists between the base and emitter terminals of the sync separator, the picture will roll vertically and slip horizontally and the collector voltage will rise 5 or 6v. Look for a small change in voltage at the collector terminal.

Vertical Troubles

The vertical section may have from one to four transistors. As shown in Fig. 2, one transistor is used in each of the following stages: vertical oscillator, vertical amplifier, vertical driver and vertical output. Again, use the scope to locate the defective stages and pinpoint voltage discrepancies with a VTVM.

Most troubles in the vertical stages can be tied directly to transistors, vertical controls, vertical output transformers and electrolytic capacitors.

A small leakage betwen emitter and base of the vertical oscillator will stop the stage oscillating. Likewise, a small leakage between emitter and base of the vertical amplifier transistor will cause a horizontal white line across the screen. Heavy leakage between emitter and base in the vertical driver will decrease the vertical sweep about two or three inches top and bottom.

The vertical output transistor is generally a power type with a heat sink. Leakage between base and emitter of the vertical output transistor will cause poor height. This leakage will also cause poor linearity with wide spaced scanning lines at the top of the screen. A short between emitter and base will show a thin white horizontal line across the screen.

A 100Ω short between base and collector of transistor 2501 vertical driver (see Fig. 2) caused bad vertical foldover (Fig. 3).

If the electrolytic capacitor, C13 (250μf at 50v), shown in Fig 3, has internal leakage, the vertical sweep lines at the top of the screen will spread out with poor vertical linearity. Also, if C13 opens, only a horizontal white line appears on the screen.

Checking Horizontal Stages

About 90 percent of all portable transistor troubles will be caused by the horizontal and hi-voltage stages. These stages have from three to five transistors and several diodes. The block diagram in Fig. 4 shows a typical horizontal layout.

Some TV manufacturers use a tube as high voltage rectifier. But many models use a series of hi-

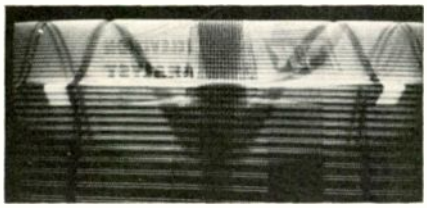

Fig. 3—Bad vertical foldover caused by 100Ω leakage between base and collector of transistor 2501 (Fig. 2)

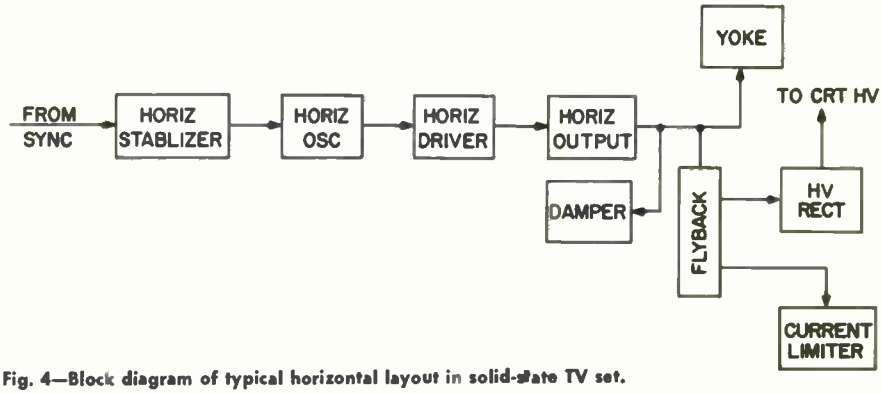

Fig. 4—Block diagram of typical horizontal layout in solid-state TV set.

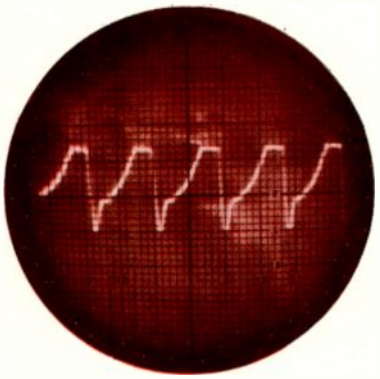

Fig. 5—Correct waveform taken at the base of the horizontal oscillator as seen on the scope.

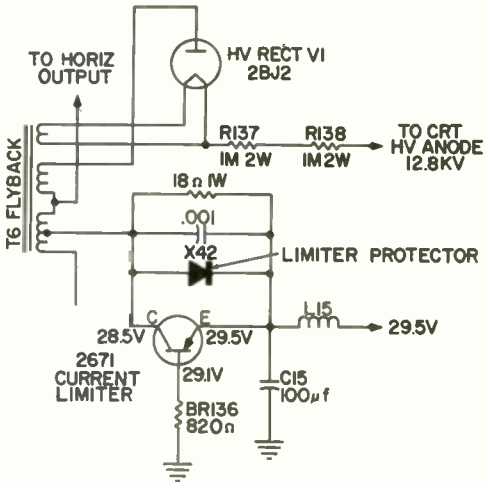

Fig. 6—HV, current limiter and limiter protector circuits in KCS153A.

Servicing Solid-State...

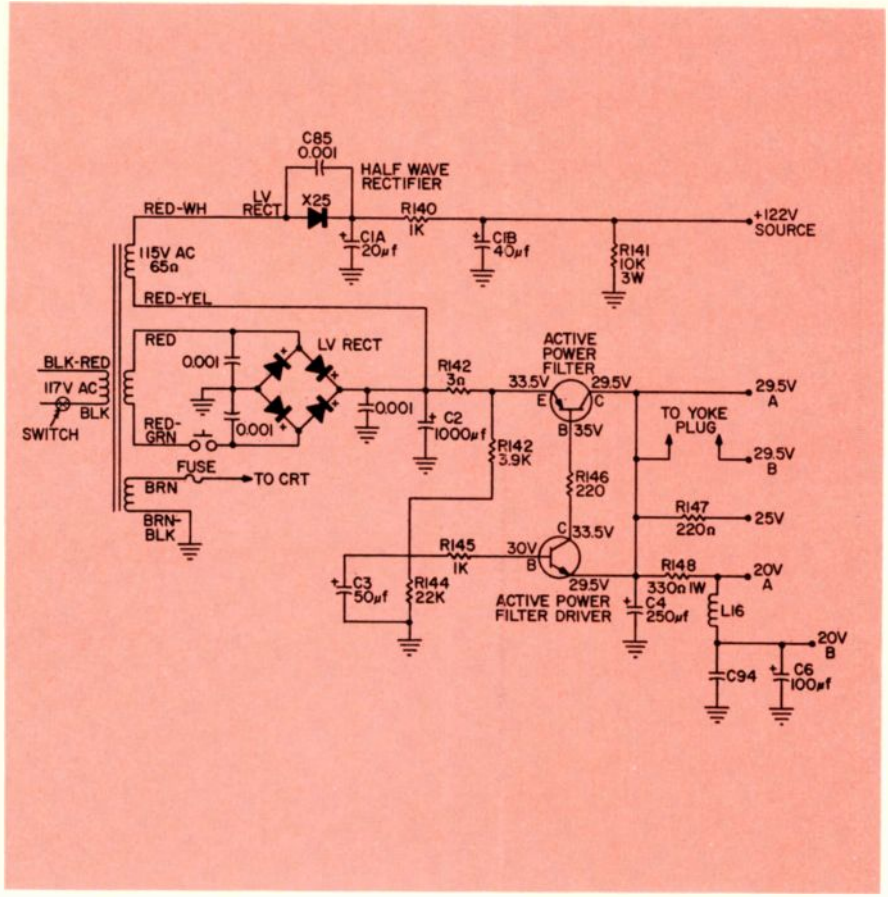

Fig. 7—Power supply in KCS153A solid-state TV.

voltage diodes. Others use multiple, doubler, tripler and quadrupler circuits to obtain the required high voltage.

Be careful when working around transistors in the horizontal circuits. In many cases, if the drive voltage is removed from the horizontal output transistor base, the transistor will be ruined. This happened in an RCA KCS153 chassis we investigated.

This transistor portable came to the shop with no brightness, no picture but good sound came in just a second after the set was switched on. The interlock would kick out, indicating excessive current drain. To determine if the trouble is in the high voltage stages, unplug the deflection yoke from the circuit. If there is no plug, unsolder the B+ lead going to the high voltage output stage. Now push in the interlock and see if the sound stays on. If it does, the trouble is in the high voltage stage.

Touch the scope probe to the base of the horizontal driver for a sawtooth pulse. If none, go to the collector terminal of the horizontal oscillator transistor and see if this stage is oscillating (See Fig. 5). If no pulse or waveform is present, check the horizontal oscillator transistor.

In this chassis, the horizontal oscillator transistor was shorted between base and emitter. A new horizontal oscillator transistor was installed but still no high voltage came on. Waveforms were checked with a scope down to the base of the horizontal output transistor. This transistor, an RCA 2494 type, was removed from its socket and checked. A leakage of 15Ω showed from emitter to collector and from collector to emitter. If a new hori-

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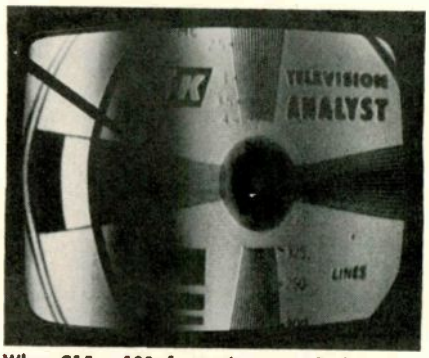
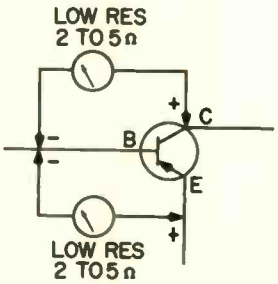
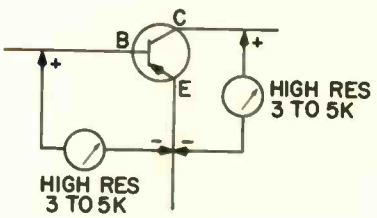
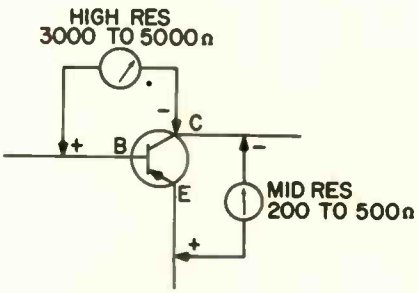


When C15, a 100μf capacitor went bad in the current limiter stage, (Fig. 6), a dark vertical line appeared on the left side of the screen.







Proper method of making transistor resistance measurements with proper VOM or VTVM.

Open Hand Policy Doubles Income

The more money this small but enterprising service-dealer spends, the more he makes

■ "I spend money with an open hand for advertising and sales promotion," Sam Gambacorta admits. And my volume is approaching the point where I will soon be using both hands to rake it in! By the end of June, 1966, my business had more than doubled over the previous fiscal year."

Sam (few of his customers and none of his associates ever bother to try pronouncing his last name) owns Village TV & Hi Fi in Wilmette, Illinois. A year ago, June 30th, showed an $85,000 gross for the year. During the year that ended this June, he racked up $197,000.

"The only reason is because I am a convert to the theory that you have to spend money to make money," he says. "I read someplace how many of the biggest companies in the country spend 5 and 10 percent of their gross on advertising. If this made economic good sense for them, why not for me? I decided to try the same system myself."

In The Beginning

Sam had been plugging along pretty well and making a better-than-average living, just taking whatever business came his way until a couple of years ago. With a background as a good salaried technician for other electronics firms, he started out for himself in 1961 in a small 600 sq ft shop in the northern suburb of Chicago.

He got most of his business by word-of-mouth advertising and through referrals because of his slowly but steadily growing reputation for dependability. Along with service work, he started to build up merchandise sales almost from the start, but he was pretty badly cramped for space. He soon got the itch to expand — but he didn't want to risk making a wrong move, either.

Organized, Aggressive Advertising

"I had long talks with my auditor and then my banker," he says. "They both thought my proposed plan for using a percentage of the gross for promotion was sound. Finally, I settled on allocating 5 percent as an advertising budget — and then I was off and running."

He started by placing quarter-page ads in a local magazine called WILMETTE LIFE, a fat publication running up to 142 pages a week which covers the town like a blan-

Next phase in remodeling: putting on a new store front.

Open Hand Policy . . .

ket. Wilmette, with a population of 32,000, has an average income of almost $14,000 a year, and although the magazine's starting rate of $2.50 per column inch is high for a circulation of only 9000, the results are impressive when an advertiser has something to say.

And Sam had plenty to say. He plugged TV sets in the fall when the new shows came on, record players in the winter when Hi Fi buffs have long winter evenings, tape recorders in the spring for everything from weddings to graduations and radios in the summer for the beach. He missed few holidays for tied-in advertising to get the most out of his lineage. And always with service.

As revenues increased, so did Village TV's advertising. Sam's 5 percent was soon buying half pages, and to take up the summer slack, he added air conditioners. After he sold 60 of these for a $25,000 gross during the summer of 1965, his sales were at a point where he started to run full page ads for special sales, which in turn generated enough additional volume so that he was soon running full page ads every week. Contract rates cut the column-inch display rate appreciably, but Sam's advertising became a steady $133 per week in WILMETTE LIFE.

Expanding

By this time, Village TV had virtually no elbow room at all in the 600 sq ft shop. Sam acquired a new place, and even while he was moving, he ran a well-advertised clearance sale which grossed over $6000 in a couple of memorable week-ends at the little place.

The new quarters, where Village TV moved toward the end of 1965, are in a 5000 sq ft building which the company, now incorporated, bought outright on Ridge Avenue, the town's main thoroughfare where the street traffic is excellent. Half the building is rented out to help make the investment self-liquidating. Village TV devotes over two-thirds of its own 2500 sq ft to display areas, where sales alone are averaging better than $12,000 a month.

Sam spent over $15,000 on improvements to the building after acquisition, including interior remodeling as well as a new roof, wiring, floors, and, naturally, new air-conditioning and heating systems. Current estimated value of the property is $60,000.

Sam handles the floor sales personally and this keeps him so busy, along with general administration, that he seldom has time to touch a soldering iron. He still recognizes the back of the shop as the heart of the business, though.

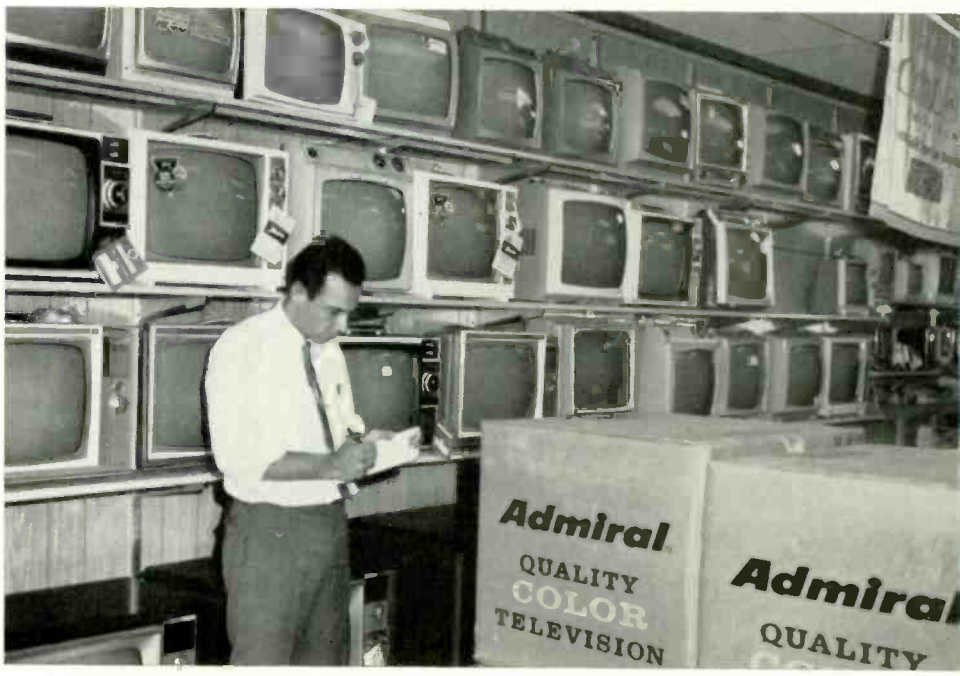
"People can buy a TV set from the discounters for maybe $10 less than it would cost them here," he says. "But we can furnish service that they know is dependable. A few weeks ago, a crack-down took place on a few gyp TV service outfits and the newspapers gave it a lot of space when the States Attorney's office sent out special investigators.

"Some of those crooks charged for non-existent service. TV technicians all over the city got 'dark looks' from their customers for quite awhile after those newspaper stories came out, but I'm happy to say that our own business actually increased. We got invaluable word-of-mouth advertising during that time, when so many people were thinking and talking about it that they all began comparing notes."

Service

At times, Village TV has more service work than can be handled

Sam has replaced the soldering iron with an adding machine as his basic work tool.



Inventory is so heavy that shipments are sometimes stored in packing crates right on the display floor.

comfortably by the two inside men and two outside men. Air-conditioning service work is now farmed out. The two service trucks owned by the firm are kept busy on TV and related work, augmented by a completely equipped antenna truck fitted out for this work exclusively.

Bench work averages a $10 per hour gross, and a $29.95 package repair job for color TV is featured when the "peacocks" have to be pulled to the shop. This flat fee covers all circuit work, with parts billed extra. Village TV's profit margin on all parts runs in the 40 to 50 percent range.

Outside calls average 20 to 25 a day, with healthy service charges high enough so that Village TV's technicians can afford to do a good job. Minimum charge for color TV is $7.95; for B/W, the tab for a house call is $6.95.

"We used to make the standard $5 minimum charge for fixing a set at the house, but our situation here in Wilmette is somewhat unique," Sam avers. "While answering the call, so many of our customers would bring out additional equipment on the blink that we charged an extra couple of dollars to service the second set. But we got a lot of complaints on this policy.

"Now we make the minimum $6.95, with no extras except for parts. The people who bring up the set from the basement, after we're finished with the one in the living room, are now happy with the deal, and we have fixed everything to the kids' transistor radios under that one minimum charge. Even the people with only one piece of 'on-the-bum' equipment know our prices when they call, and all complaints on this score have stopped."

Customer Relations

Sam even *asks* for trouble. After every service call, he mails customers a double postcard thanking them for the opportunity of doing their work and asking if the service has been satisfactory. Boxes on the postage-paid return card are provided for the customer to check off courtesy, efficiency, promptness and any other items that might be questionable. Most cards returned by customers express satisfaction, but Sam welcomes the few complaints that do come in, which he feels keep his organization on its "corporate toes." The complaints are followed up by phone and if Sam feels a second call is justified to rectify anything wrong, it is made "on the house" without delay.

"These postcards are a valuable part of advertising, too," says Sam. "There is no point in spending the kind of money we do for a general advertising to build a public image, if we ignore the opportunity to crystallize that image with another nickel for a postcard."

He is a great believer in postcards in other areas, too. For example, when his technicians are out in the trucks and they happen to see a defective antenna, they make a note of the address. Sam checks out the name from a criss-cross directory (which lists all residents street by street, in numerical order), and mails out an offer to do the needed work. Winds are heavy along the western shore of Lake Michigan, and the antenna truck has paid for itself many times over.

These customers, too, are followed up witn the "asking for trouble" postcard. Even customers who buy floor stock are followed up in 90 days, to make sure that the set is performing up to expectations.

"This 90-day follow-up probably does as much as anything to build our reputation in the community,"

continued on page 89

*Dear*_____

This is to thank you for the opportunity of servicing your set.

We take pride in our service here at VILLAGE TV. It is our policy to be sure that you are completely satisfied with our service.

If for any reason, you are dissatisfied with the work that was done, PLEASE CALL NOW.

Hoping to be of future service, I remain

VILLAGE TV & HI-FI

_____ *Phone: AL 1-0250*

Dear Sir:

You may not know it but your TV Antenna is badly in need of repair.

One of our technicians noticed the condition of your antenna recently while working elsewhere in your neighborhood.

We suggest that you have it repaired promptly by a qualified technician such as we employ here at VILLAGE TV.

Feel free to discuss your antenna problems with us.

Hoping to be of future service, I remain,

Village TV & Hi-Fi
Phone ALpine 1-0250

VILLAGE TELEVISION & HI-FI
809 RIDGE RD WILMETTE,ILL

Preferred Customer Invitation

Customer Name_____

Address_____
(For Attendance Prize)

This sale is for our store customers only.
It will not be advertised in the Newspapers or on the air.

GOOD ONLY ON DATES OF SALE

PRIVATE SALE
SUNDAY, MAY 1st 1966

ADMIT ONE

No. 457

Upper left: Part of Sam's customer-relations policy is to "look for trouble." This is the card he mails to every customer after servicing a set.

Left: Business is where you find it. If a defective antenna is observed, this card goes out to the prospective customer.

Above: Two "closed-door" private sales are held twice each year. Here's the invitation Sam mails. Admission is allowed through the back door only.

Selecting Replacement Transistors

■ Modern developments in solid-state technology have been exploding at a rapid rate. But most of us have been too busy trying to make a living in this business to appreciate the constantly accelerating developments that were taking place under our very noses. Now, however, we can no longer ignore these events — we must sit up and observe.

Why Do We Have So Many Transistor Types?

An article in the December 1965 issue of ELECTRONIC TECHNICIAN, page 43, touched briefly on some advanced scientific thought which was directed toward a solution to major problems involved in selecting replacement transistors for the many thousands of types now being used in electronic equipment — including the wide area of home-entertainment products, two-way radio communications equipment and a multitude of specialized components and instruments employed in business, industry, research and education.

One reason why we have so many different transistor types today is because the present state-of-the-art does not allow highly refined manufacturing techniques and high-order quality control processes to be instituted in the extremely competitive home-entertainment products area. There's a great spread existing between the cost of manufacturing a Hi Fi push-pull output transistor, for example, and a transistor designed to perform a certain function in an astronautic computer used to land a Surveyor package gently on the moon. The difference in cost is unbelievable. But, for practical purposes, the differences between the two transistors — so far as preciseness of parameters and reliability are concerned — are very small, percentage-wise. This is only part of the story but it will suffice as a beginning.

To understand why we now have so many transistor types, we must take a brief look at the basic method used to manufacture transistors. We do not have sufficient space here to cover this subject thoroughly. It would serve no useful purpose anyway. So we'll touch only on those few details which contribute to an understanding of the over-all problem of selecting adequate transistor replacements.

We have not yet learned to control and refine the transistor manufacturing process in every precise detail (except at exhorbitant cost) so we can produce one transistor after another having the exact same parameters. We normally begin the manufacturing process by setting the "dials" so a certain transistor design can be produced that fits a specified circuit. Because of variations that take place in this manufacturing process (the whole works "hunts" around a group of set-points) we end up with *one* transistor that fits our needs, together with many others whose characteristics vary in degree outward from both sides of the fixed design-norm.

The total transistor output, from each specified design run, is called a "family" of transistors — and a new prolific family is produced each time *one* specific transistor type is made. Each individual transistor in the family, having similar characteristics, is then sorted into family "groups." It can easily be seen that this state-of-affairs not only gives birth to hundreds of families — but thousands of specific individuals in the various families.

To some of you this may appear somewhat paradoxical and even humorous. Perhaps it is. On the one hand we design a few transistors to fit specified circuits and end up having to design a lot of circuits to fit transistors! This will probably remind you of the French philosopher Voltaire's satirical remarks regarding certain French views prevailing in his time. "Obviously," Voltaire said, "feet were made to fit sox—not sox to fit feet!" (Our translation—Ed.)

But the mess is not quite as bad as it looks. It might be even worse. A number of original equipment and transistor manufacturers have been working over-time trying to find a solution to the problem.

Almost everyone agrees that: 1) No such thing exists as a "universal" replacement transistor (but this is a semantic term that means little or nothing); 2) you can't match parameters in selecting a replacement — you would need an expensive digital computer to arrive at reasonable answers to your questions; 3) the practical solution is in the direction of manufacturing special transistor numbers that match the over-all requirements of a relatively few basic circuits.

A transistor, for example, can be produced to function as mixer oscillator converter. Another can be made to function as a HF RF amplifier. Another as an IF amplifier. And still another functions as an AF amplifier. Of course, a few additional types are required to cover intermediate and special situations to fit high and low voltage require-

Learn how you can replace thousands of transistor types with a couple of dozen or less

ments, high and low power requirements and possibly a few others to meet specialized needs. But the number of regular transistor replacements that you'll have to stock can be cut down to about two dozen or less. Later you'll have to stock a few field effect transistors (FETs). These are now being used in an increasingly larger number of Hi Fi components and other areas. You may possibly soon require a few tunnel diodes, too.

Replacement Transistor Lines

RCA's "Sk series" includes 13 transistors and two solid-state rectifiers. This group is shown in Table I. The manufacturer assures us the group will replace 2700 existing transistor numbers.

Tung-Sol's replacement line includes 12 transistors which are listed in Table II.

GC Electronics provides seven replacement numbers said to substitute for over 4000 transistors. The manufacturer provides a cross-reference guide.

International Rectifier has a line of 23 replacement transistors which it says will substitute for 5000 JEDEC (Joint Electronic Devices

continued on page 90

Table II

	MIXER OSCILLATOR CONVERTER	IF AMPLIFIER	AF AMPLIFIER
AM RECEIVERS	PNP — ET 1 NPN — ET 8	PNP — ET 2 NPN — ET 9	PNP NPN 6V ET 3 12V ET 4* ET 11* 9V ET 5* ET 9*
AUTO RADIOS			ET 6 Power Amp ET 7 High Power Amp
FM RECEIVERS	RF AMP MIXER OSCILLATOR CONVERTER IF AMP		SAME AS AM SETS
	ET 12		

Table I

SK-3003. PNP type, AF Driver and Output Stages (9 volt supply).

SK-3004. PNP type, AF Driver and Output Stages (15 volt supply).

SK-3005. PNP type, RF, IF, and Converter Stages of Broadcast Receivers.

SK-3006. PNP type, RF, IF, and Converter Stages of FM and AM/FM Receivers.

SK-3007. PNP type, RF, IF, and Converter Stages of All-Wave Receivers.

SK-3008. PNP type, RF, IF, and Converter Stages of Auto Radios.

SK-3009. PNP type, Audio Output Stages of Auto Radios.

SK-3010. NPN type, AF Driver and Output Stages of Broadcast Receivers.

SK-3011. NPN type, RF, IF, and Converter Stages of Broadcast Receivers.

SK-3012. PNP type, Audio Output Stages of Auto Radios.

SK-3013. Matched pair of SK-3009 for push-pull stages.

SK-3014. Drift-Field type for Output and Driver Stages of Hi-Fi equipment.

SK-3015. Matched pair of SK-3014 for push-pull stages.

SK-3016. Silicon Rectifier for color, black-and-white TV, Radios, Phonographs.

SK-3017. Silicon Rectifier for color, black-and-white TV, Radios, Phonographs.

Troubleshooting Solid-

Beef up your Indian-summer business

■Most manufacturers in the home-entertainment equipment business are catering as never before to the "younger generation." This is generally considered the "teen" group so far as portable and table-top record players are concerned. But, you ask, "what's a 'portable?' " This is a good question. Actually, almost everything having a handle is called a portable. Many record players with a handle are not actually portable. The true portable is a solid-state job that works on batteries or equivalent and can be operated anywhere —at picnics, on outings, at the beach, etc. These are generally monophonic single channel record players.

Many so-called portable stereo record players are stereo table model jobs that are seldom removed from the home. These units are generally in the medium-to-higher priced category and since they can be closed up, complete with one or more speakers, they can be and frequently are, brought to the shop by the owner. Some are combination radios and phonos.

The initial purchase price of some combination AM/FM/phono table-top sets can run well beyond $200. The amplifiers in some of the more expensive units are frequently similar to those used in the manufacturers' console line—with the console switching arrangements left off. Some even contain component-quality equipment.

Shop Facilities and Stock

You should have a section of your work bench set aside to service these solid-state units. Proper tools and test instruments should be at hand, including a good pair of tweezers that can be helpful when removing and replacing styli.

The first important servicing item is manufacturers' service data and instructions. Although most automatic record changers are basically similar, important differences do exist and in most cases it is helpful to have individual service instructions for each changer type.

Another reason for having this service data on hand concerns component disassembly and removal. A wide variety of component mounting methods are used. Step-by-step instructions can save you time.

Let's see how these instructions vary from one equipment type to another. Airline model 937A portable phono instructions for changer removal says: 1) Remove screws securing motorboard; 2) lift changer and board out of cabinet; 3) disconnect leads at changer; 4) flip changer retaining brackets and remove changer from motorboard. But Model 947A, same manufacturer, has a different removal procedure: 1) Remove hole plug button from the right side of changer base; 2) reach through hole and flip changer retaining brackets; 3) lift right side of changer and slide changer to right and lift up; 4) disconnect leads at changer. Other removal and disassembly instructions vary widely from unit to unit, from component to component. This is especially important when working on table-top AM/FM/phono combinations.

A modest number of universal replacement cartridges and a supply of needles should be kept in stock. Idler wheels, motor-step pulleys, belts, etc., are other items that require replacement and should also be in stock. Solder-in line cords, proper cleaners, lubricants and "non-slip" compound are other necessary items. You'll need a gram scale for checking stylus pressure and a standard turntable holder which is necessary for properly mounting the turntable when making underside repairs and adjustments and a few test records. Cross referenced needle and cartridge replacement guides will also come in handy and help speed your work.

Common Service Problems and Solutions

You will be confronted with problems in two major areas: mechanical and electronic. Most problems will no doubt fall into the mechanical area. In many cases, however, the solid-state electronic components will develop a variety of faults. And in this area, you will be dealing with basic problems common to most other types of solid-state preamplifiers and amplifiers.

Two frequent problems will be: worn styli and defective cartridges. Manufacturers' service data, especially cartridge removal and stylus replacement instructions, are helpful here in most cases. For example, the proper steps employed in replacing a stylus used in a changer furnished in some G-E portable stereos, are shown in Fig. 1. The instructions are clear:

Grasp the cartridge in front as shown and press it in the direction of the arrow to release it from the front mounting clip. The cartridge will drop easily from the mounting clip. Do not disconnect wires from the cartridge pins. Release both ends of the stylus captivator clip as shown in the second step and remove. Place stylus selector lever to an upright position with respect to the cartridge as shown in the third step and slide stylus assembly out of cartridge spring and replace it with a new one in the following manner:

Insert the rear of the stylus assembly under the cartridge spring until it snaps into place. Flip the stylus selector lever back and forth a few times to insure proper seating

State Portable Phonographs

repairing 'carry-around' and table-top record players

of the stylus support rod in the coupler. Replace the stylus captivator clip with the arrow pointing in the direction as shown in step two.

Insert the front of the cartridge into the mounting clip as shown in step four and press the cartridge into the clip as shown in step five. Move the rear of the cartridge from side to side until you feel it snap into place.

You will run into three or four different coupling methods in the drive systems of automatic record changers. Common defects in drive systems include: 1) Turntable stalls or stops during cycle; 2) turntable does not start; 3) slow or varying turntable speed.

The first defect can be caused by a weak or otherwise defective motor, "frozen" motor bearings, slipping idler wheel, idler spring disengaged at one end, broken or stretched gear teeth or turntable hub is badly worn or the lubricant on the idler wheel shaft is gummed up with lint, dust or is otherwise hardened. Clean the idler wheel with alcohol or replace it. Clean the old lubricant from the idler shaft and apply a drop or two of light (sewing machine) oil. Replace the turntable hub. Re-attach or replace idler spring.

The second defect can also be caused by a slipping idler wheel or disengaged, broken or stretched idler spring. The motor can also be defective. Solutions are obvious.

The third defect can be caused by gummed-up motor bearings, defective turntable bearings, slipping idler wheel, improper lubrication of turntable bearings or the spindle. Under certain conditions, a low line voltage (105vac or less) can cause or contribute to causing some of these symptoms. Don't forget to check the ON/OFF switch when the motor won't start.

Although not a common problem, motors do develop troubles in addition to faults that are corrected by cleaning and lubricating. One or more shorted turns in the windings can cause the motor torque to be reduced and open windings can prevent the motor from running. If the motor is noisy or makes a thumping noise, check its suspension or the condition of its mounting grommets. These can be frayed, twisted or improperly seated.

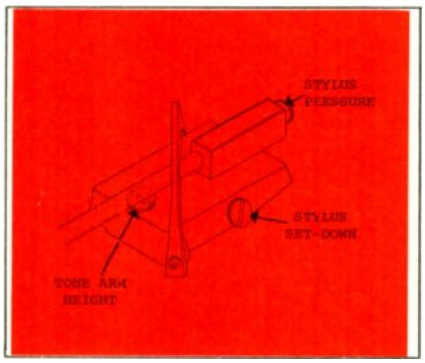


Fig. 2—Adjustment points in G-E record changer, RD225.

Some Adjustments Frequently Required

Other problems will arise which can be solved only by making proper adjustments. Here again, since the exact location of these adjustment screws varies from machine to machine, manufacturers' service data is very important. For example, tone arm height, stylus set-down and stylus pressure screw locations for G-E's RD225 record changer are shown in Fig. 2. Here again the instructions are simple and clear:

The tone arm height adjustment is correct when the stylus will clear the top record of a stack of six 33rpm records on the turntable during change cycle and will not touch the changer base when the tone arm is off the rest post. The tone arm is raised by turning the height adjustment screw counterclockwise and lowered by turning the screw clockwise.

The stylus set-down adjustment is correct when the stylus sets down in the first groove of the record. If

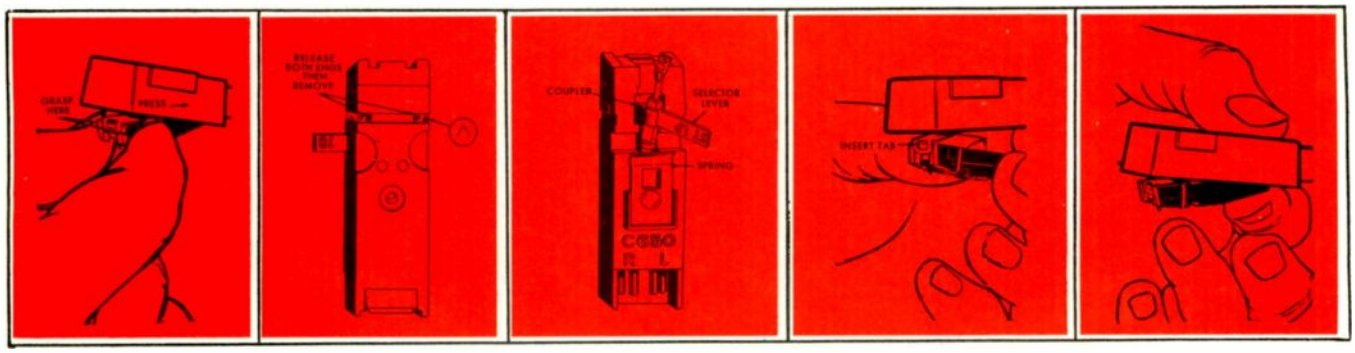


Fig. 1—Five steps in replacing stylus in G-E record changer used in portable solid-state phono.

Troubleshooting . . .

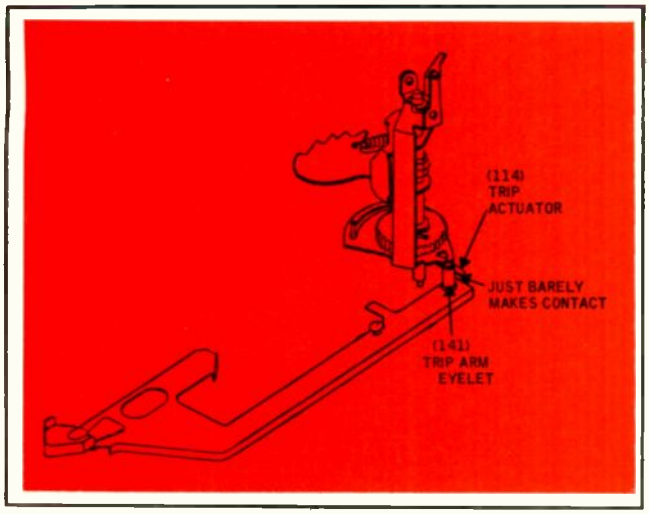


Fig. 3—Trip actuator adjustment details for G-E RD200, 210 and 225 group of record changer models.

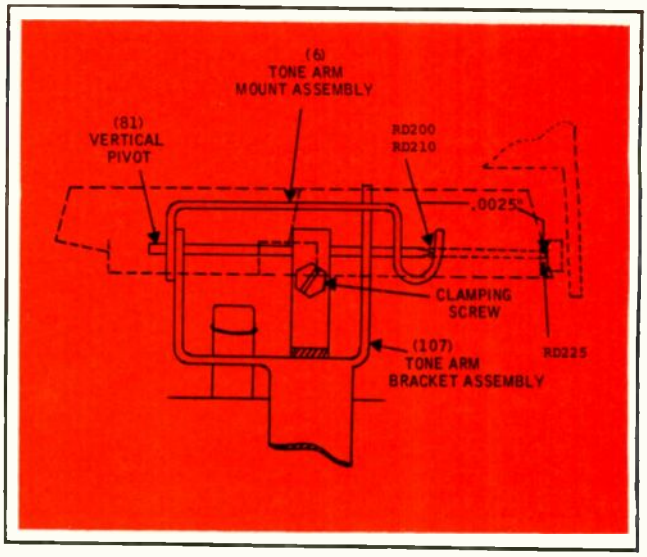


Fig. 5—Details of vertical pivot adjustment. (Dashed lines indicate vertical pivot adjustment for RD225).

adjustment is needed, turn the stylus set-down screw counterclockwise to move the tone arm toward the outer edge of the record and clockwise to move the tone arm toward the changer spindle.

In the event stylus pressure adjustment is needed, turn the stylus pressure screw counterclockwise to lighten the pressure and clockwise to increase the pressure. Stylus pressure varies on different machines — ranging between approximately 2 to 6g.

This same changer has three other important adjustments that may need to be made under certain circumstances. These are: trip actuator, idler height, and vertical pivot adjustments. The first adjustment is made as follows:

Cycle the changer by hand into the 7in. record position. The cycling mechanism should be stopped just before the tone arm contacts the record. At this moment the trip actuator (114) as shown in Fig. 3, should just barely contact the velocity trip arm eyelet (141) when holding the velocity trip arm to its rear-most position. The trip actuator may be adjusted to the front or rear by inserting and turning a flat screwdriver in the trip actuator slot from the bottom of the main mechanism. The trip actuator controls the engaging point of the trip mechanism as the tone arm enters the lead-out groove.

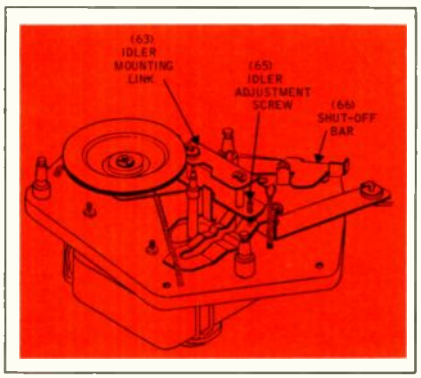


Fig. 4—Details of idler height adjustment in the same group of G-E record changers.

The second adjusment, idler height, is made by a screw (65) as shown in Fig. 4 on the idler mounting link (63). The turntable must be removed to gain access to this screw. Turn the screw clockwise to raise the idler wheel and counterclockwise to lower the wheel. Before reinstalling the turntable, engage the shut-off lever with shut-off bar (66) to prevent possible damage to the idler wheel. The idler wheel adjustment should always place the idler wheel contact surface in the center of the step on the step pulley. The speed control should be moved through the four positions to check for correct setting.

The tone arm vertical pivot adjustment is made as follows: As shown in Fig. 5, the pointed end of the vertical pivot (81) must be positioned 0.0025in. from the lip of the tone arm mount assembly (6). This adjustment can be made by loosening the clamping screw on the tone arm bracket assembly (107) allowing the vertical pivot to be adjusted horizontally. While making this adjustment the tone arm mount assembly must be held in firm contact with the tone arm bracket assembly. The adjustment can be accurately performed by using a hard feeler-gage of the type used to adjust automobile ignition points. When the vertical pivot is adjusted to the correct position the clamping screws should be tightened until snug. Do not overtighten the clamping screws.

The next article in this series will cover various other mechanical problems connected with portable and table-top phono troubleshooting and repair. After this we will go into the problems of solid-state circuitry and repair. (Also refer to "The ABC's of Automatic Record Changers" in the July 1966 issue of ELECTRONIC TECHNICIAN.) ■

Apply your basic knowledge of electronics to understanding how solid-state diodes and transistors function in practical circuits

Semiconductors from A to Z

■ If you are thoroughly familiar with semiconductors and semiconductor circuits you'll find this particular article elementary. If you do not know all about semiconductors and semiconductor circuits, then read on.

Early experiments indicated that current in electrical circuits flowed from positive to negative. This was proven false when electron tubes were developed. Current was observed to actually flow from the tube's negatively polarized cathode to its positively polarized plate. By this time, however, people were so entrenched in the "conventional" current-flow concept, they continued to speak and think in those terms.

With the development of semiconductor materials, scientists felt it was necessary to speak more exactly regarding the direction in which current flowed in p-n junctions of solid-state circuits. Hence, many technicians have been thoroughly confused in attempting to reconcile "hole" flow, "electron" flow and "current" flow in semiconductor components and circuits. But these matters actually concern only chemists, physicists and other scientists.

It is not necessary to understand the precise atomic principles of semiconductors to successfully troubleshoot and repair solid-state equipment. We intend, therefore, to circumvent this man-made confusion by sticking to the accepted electron theory — as we already know it in electron tube circuitry.

Although we believe no useful purpose can be served by attempting a full, and necessarily artificial, comparison between electron tubes and transistors, we will call attention to an occasional similarity or difference between the two components if an understanding of the similarity or difference seems helpful.

Current Flow

When current flows through an electron tube diode (Fig. 1), the plate must be more positive than the cathode. Similarly, if current is to flow through a semiconductor diode (Fig. 2), its anode must be more positive than its cathode. Note the semiconductor diode schematic shows the anode as an arrow point and the cathode as a bar. The arrow points toward the negative polarity. Before this diode can conduct significant current, it must be forward biased — the cathode must be negatively polarized and the anode positively polarized. Note, also, that current flows through the diode from negative to positive — according to the accepted electron theory — opposite the direction of the arrow (originally pointed to indicate the direction of "convential" current flow). If an ac voltage is applied to this diode it will conduct current only when the anode is positive — on the positive half-cycles of a sinewave, for example. But it will conduct on the negative half-cycles if its position in the circuit is reversed (Fig. 3).

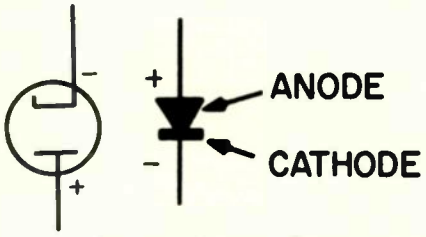


Fig. 1—Forward biased diode electron tube.

Fig. 2—Forward biased semiconductor diode.

Transistor Types and Functions

Two junction-transistor types, NPN and PNP, are in general use today (Fig. 4). An NPN transistor's P and N material arrangement requires the collector (Fig. 4A) to be more positive than the emitter before the transistor can conduct current. Note the transistor symbol shows the emitter having an arrow. The arrow points toward the negative polarity, the same as the arrow in a diode symbol.

Because the PNP transistor's P and N material is arranged in a different manner, it is biased differently. Its collector is biased more negative than its emitter (Fig. 4B). The arrow shown on the emitter symbol points away from the positive polarity.

The emitter of an NPN transistor should be negative while the emitter

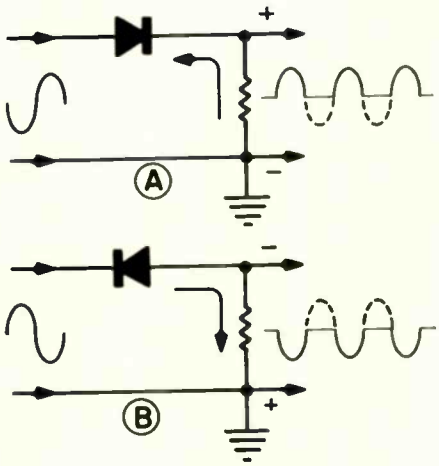


Fig. 3 (A)—Positive peaks passing through diode. (B)—Negative peaks passing through diode.

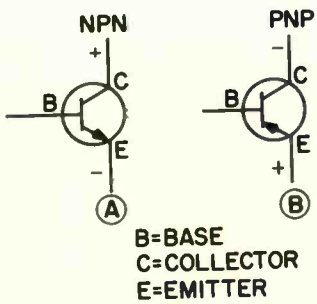


Fig. 4 (A)—The NPN transistor collector is the most positive element. (B)—The PNP transistor collector is the most negative element.

of a PNP transistor should be positive.

When the cathode and plate of an electron tube (Fig. 1) are properly biased, it will conduct. By making the tube's grid more negative than its cathode (Fig. 5) current flow can be decreased and even stopped. Electron tube current flow is controlled by varying the negative bias between the grid and cathode.

Since transistors are made of semiconductor material, their chemical composition does not allow them to be good electrical conductors under normal conditions. Transistors must be "encouraged" to conduct electricity. Biasing the transistor base to encourage current flow is called forward biasing. As previously stated, the collector of an NPN transistor should be more positive than the emitter. To encourage current flow, the base should also be more positive than the emitter (which results in forward biasing) as shown in Fig. 6.

The collector of a PNP transistor should be more negative than the emitter. To encourage current flow the base should also be more negative than the emitter (forward biased) as shown in Fig. 7. A forward biased PNP transistor has emitter-to-collector and emitter-to-base polarities, opposite those of forward biased NPN transistors.

If the base lead of a transistor is broken, the transistor will no longer be forward biased and will virtually cease to conduct current. But an electron tube will conduct current when its grid lead is broken.

Transistor Circuits and Signal Characteristics

Three basic transistor circuits are in general use today. The most widely used circuit is the common-emitter. When a positive signal is applied to the base of an NPN transistor in a common-emitter circuit (Fig. 8), the transistor becomes more forward biased and conducts more current. As more current flows through the collector and the collector resistor, a larger voltage drop appears across the collector resistor. This results in a voltage drop at the transistor collector and the input signal in this circuit is inverted at the output.

When a positive signal is applied to the base of an NPN transistor in a grounded-collector circuit (Fig. 9), the transistor becomes more forward biased and more current flows through the emitter and the emitter resistor. A greater voltage drop takes place across the emitter resistor and the emitter becomes more positive. But the input signal in the grounded-collector circuit is not inverted.

When a negative signal is applied to the emitter in a common-base circuit (Fig.10), the base is made more positive than the emitter. The transistor is then forward biased and conducts more current. As

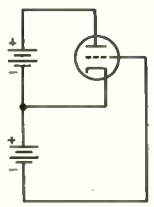


Fig. 5—Biasing circuit for triode electron tube.

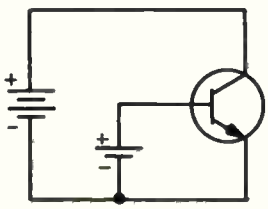


Fig. 6—Biasing circuit for NPN transistor.

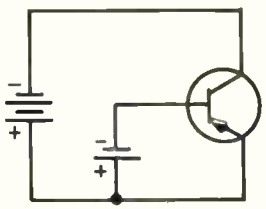


Fig. 7—Biasing circuit for PNP transistor.

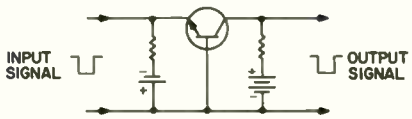


Fig. 10—Basic common base circuit.

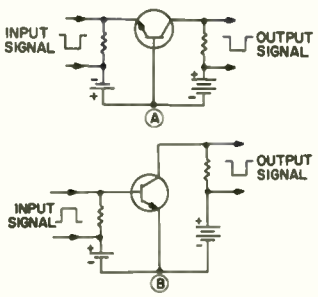


Fig. 11 (A)—Bias sources removed from signals in common base circuit. (B)—Bias sources removed from signals in common emitter circuit.

more current flows through the collector and the collector resistor, a larger voltage drop appears across the collector resistor, causing the collector to become less positive. When the emitter receives a negative signal the collector becomes less positive and the input signal in the grounded-base circuit is not inverted.

By reversing the polarity of all bias batteries and signals, the descriptions and diagrams for the three basic circuits will apply to PNP transistors.

Compound Circuit

Common-base and common-emitter circuits are frequently combined to form a single circuit with dual function.

We assume the bias supplies for these circuits are from constant voltage sources. An input signal applied directly to a base or emitter resistor will affect the transistor's forward bias in a common-emitter or common-base circuit. An output signal results from the voltage drop across the collector resistor and can be obtained directly from it. The inputs and outputs of these two circuits can be changed (Fig. 11) without affecting their functions.

The revised common-base circuit (Fig. 11A) can be rearranged without making any additional changes in the circuit (Fig. 12). This circuit can be modified (Fig. 13) by regrouping the two bias supplies. The amount of emitter-to-base and emitter-to-collector bias, however, remains unchanged. The base-to-collector voltage must, therefore, also remain the same. A negative signal applied to the emitter resistor in the revised common-base circuit will still produce a negative output across the collector resistor.

The biasing network for the revised circuit is similar to that in the revised common-collector circuit (Fig. 11B). In that circuit a positive signal applied to the emitter resistor produces a negative signal across the collector resistor.

The two circuits (Fig. 13 and 11B) can be combined (Fig. 14). A positive signal applied to the base resistor will forward bias the transistor and cause it to conduct more current. A negative signal applied to the emitter resistor will also forward bias the transistor and cause it to conduct more current. In either case, the resulting current will cause a greater voltage drop across the collector resistor, resulting in a negative output signal.

Two independent input signals can be applied to this compound circuit where they will be amplified, and mixed at the output.

A series of forthcoming articles will go more fully into biasing, stabilizing circuits and circuit functions. And we will quickly go into practical solid-state circuits now being used in all types of home-entertainment equipment. ■

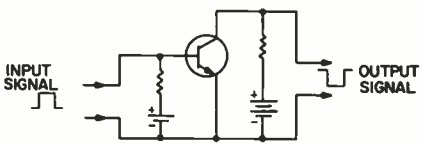


Fig. 8—Basic common emitter circuit.

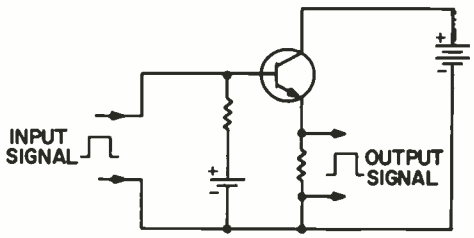


Fig. 9—Basic common collector circuit.

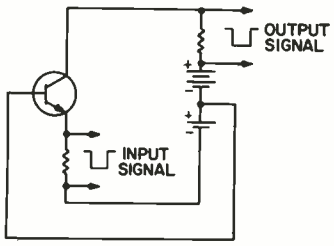


Fig. 12—Another version of common base circuit with bias sources removed from signals.

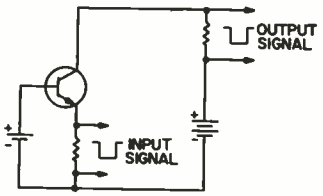


Fig. 13—Bias sources regrouped in common base circuit.

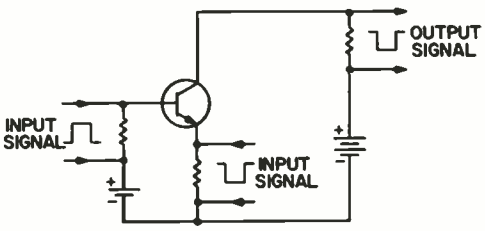


Fig. 14—Common base and common emitter circuits combined as compound circuit.

What About Antennas?

Get ready for a substantial antenna boom this Autumn

■ Some knowledgeable service-dealers and technicians are beginning to "stock-pile" antennas for the coming autumn season. They foresee a heavier-than-normal demand for antennas in coming months. (And 1966 has already been a good antenna year up to now.) In fact, there's some indication that dollar-volume in 1966 antenna sales may soar to a new record — pushed quickly forward by a roaring demand from booming color TV sales, more new FM/stereo broadcasting and more UHF telecasting stations.

Public demand for antennas reaches two normal peaks every year: In spring or early summer, after the winter snow, ice and March winds have put the finishing touches to already depreciated antennas (most people won't have their antennas fixed or replaced until they fall apart altogether). And again in the autumn months when TV owners have returned from summer vacations or after a few hurricanes and "twisters" have laid old antennas low across roof tops (especially along the Gulf Coast and Eastern Seaboard) or after the new shows and programs hit the networks. Of course, some alert technicians sell antennas almost all the year round—but they get out and push them during spring, summer and autumn because they don't like to put up antennas in the winter—especially if the antennas are already on the verge of falling apart in spring, summer or autumn.

Today's Confusing 'Antenna Crop'

Research and development in VHF, UHF TV and FM antennas has produced phenomenal results during the past 15 years. This has been a slow evolutionary process. Old, already-known principles have been combined into multi-elemented types through different mathematical approaches. Overall results have been little short of astounding. An entire family of broadbanded antenna types have been developed having frequency-independent, gain and other characteristics that no one except the "mad geniuses" and science-fictionists of 20 years ago could have visualized. There's one designed to meet every need.

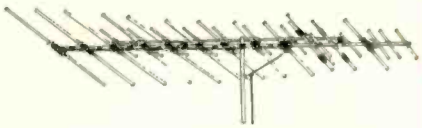
Despite this progress, however, many TV-radio and Hi Fi technicians have been subjected to considerable confusion by the various claims of antenna manufacturers. This has created problems in selecting the "best" antenna for a particular job. It has been almost impossible for some technicians to cut through this confusion and come up with an answer to the question of "which *is* best?" Hence, many have learned in recent times to be guided by the "rule-of-thumb" approach that the "best" is what gives satisfactory or optimum results in each situation.

But this approach requires technicians to expend extra effort, time and money experimenting with antennas. And it requires specialized equipment: specially constructed mobile telescoping masts, a large supply of different types of antennas, field strength meters, etc. The aforementioned situation has prompted some antenna manufacturers to engage in area-research in an effort to develop and design "customized" antennas for various specific local areas. We do not know what results have come out of these efforts. We do know, based on our own researches, that no one single antenna type will give consistent results under all conditions and for all specific localities.

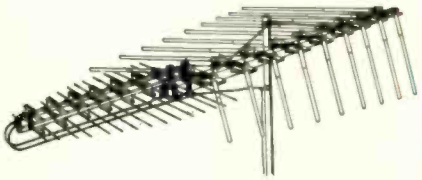
Then again, one manufacturer may have a temporary advantage over one or more other manufacturers but this advantage frequently disappears quickly because of upcoming improvements made by other manufacturers. In fact, although basic patents have been issued on some antenna designs, plus one or more "amendments," it is not always easy to specifically define "basic principles" since many so-called basic principles overlap and merge imperceptibly into each other. This has not only added to the confusion but it has caused law-suits to arise between antenna patent owners. Part of this confusion arises because of inadequate and unrefined information-and-retrieval systems in the patent office and elsewhere. And we must not forget — the pirate Morgan's ghost still stalks the world of commerce.

It is interesting to note that approximately $2-billion was spent in the nation's total research and development program in a recent year, including government and industry, to "invent," or re-invent items that had already been invented. Furthermore, similar solutions to old problems are frequently found through entirely different, or "new," approaches. And when two or more "different," or new, approaches give similar results, conflict of interest among patent-holders sometimes arises — especially when it is not easy to draw clear lines between one "fundamental" and another.

Be this as it may, VHF TV/FM and UHF TV antennas have higher gains, better front-to-back ratios and lower over-all VSWRs than they ever had before. Moreover, single antenna arrays are now designed to give reasonably good results across the entire VHF TV/FM through



Kay Townes



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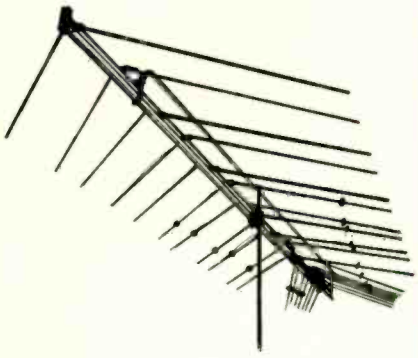

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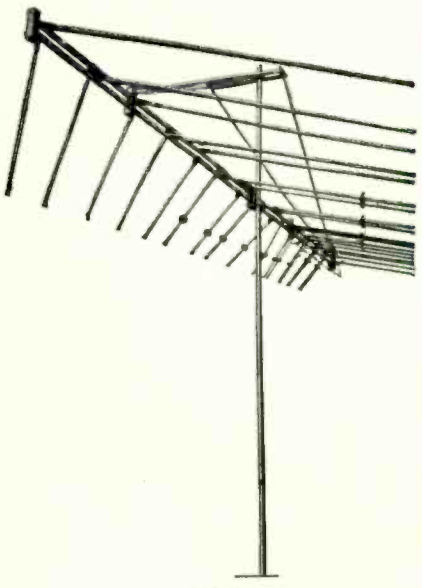

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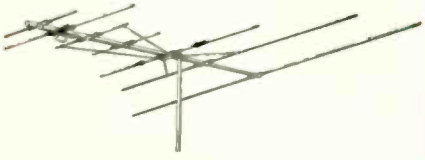

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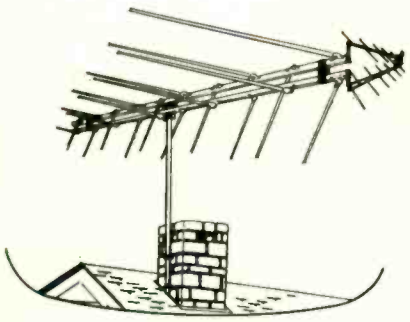
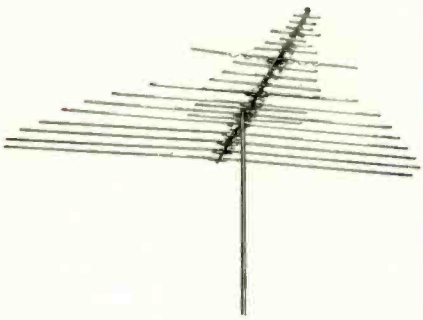


Blonder Tongue



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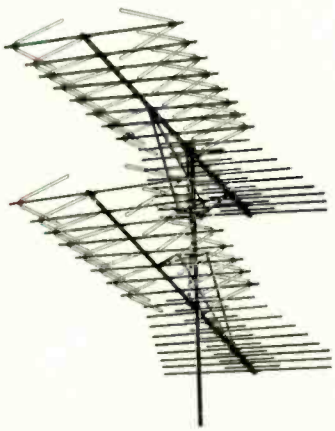

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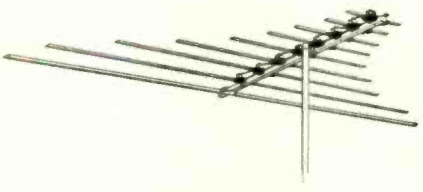

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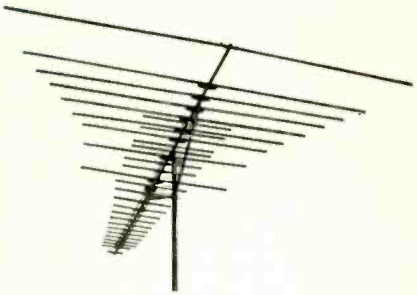

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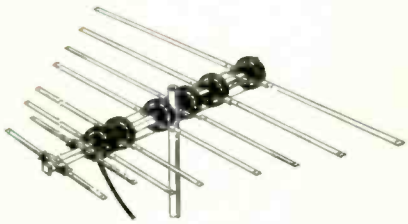

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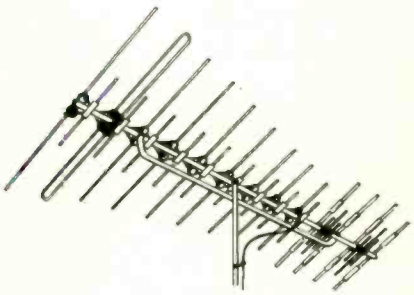

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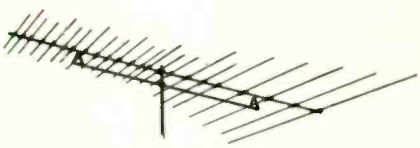

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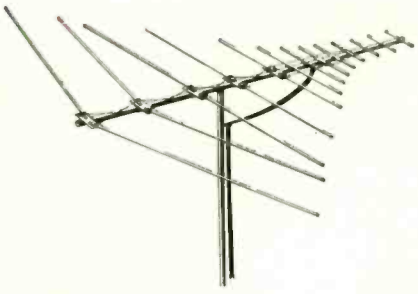

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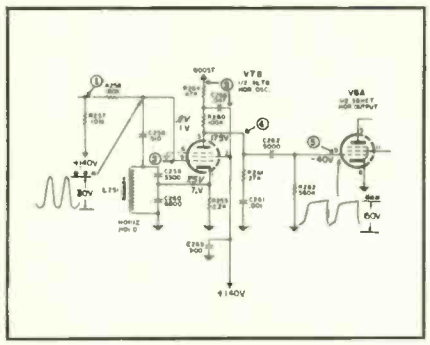

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the UHF TV bands. Only in extreme fringe or low-signal areas is it necessary to install separate, elaborate high gain antennas for single-channel UHF or VHF reception.

New indoor UHF/VHF and FM antennas have also been designed in recent times. Many work satisfactorily when the receiver is near the telecasting or transmitting station. But this is not always true. Where tall buildings, hills, etc., cause multipath signals to be radiated into the antenna or where steel-walled building absorption is high, a moderate-gain, sharp frontal-lobed roof antenna may be better than an indoor antenna — especially for good color or FM/stereo reception. Where signal strengths of a number of stations from the same direction vary widely, under multipath conditions, it may even be necessary to use a higher gain antenna and provide a variable attenuator (pad) in the antenna leads to the set if the set's AGC cannot be adjusted to give satisfactory overall results.

Accessory Aids

As we have pointed out here before, when you find — after experimenting with a number of different antenna designs — you cannot come up with satisfactory reception because of ghosts (multipath reflections), insufficient gain, etc., you may have to turn to one or another or even to a combination of antenna accessories, including splitters (for antenna combinations), preamplifiers or rotators. Rotators are especially needed when one broad-banded antenna, providing good gain from a number of stations whose signals arrive from two or more different directions, must be oriented in those directions. It is then simple to rotate the single antenna in the direction of the station or stations desired. Otherwise, two or more antennas would have to be mounted on the mast in different fixed directions.

Technicians must be able to determine when a preamplifier, or "booster," is needed. It seems obvious that, except under very unusual conditions, a preamplifier would not be needed except in a situation where the highest gain antenna available is in use but does not produce enough signal to operate the TV satisfactorily on the channels desired. Solid-state type preamplifiers are now made which give good results and offer less trouble than some preamplifiers made a few years ago.

Some Problems You'll Encounter

We've repeatedly called attention to some of the problems you will encounter and find it necessary to solve when selecting the best antenna for a given job. (See page 43 and 53 in September 1964 issue of ELECTRONIC TECHNICIAN, page 56 in the February 1965 issue and page 62, April 1966 issue). But

continued on page 91

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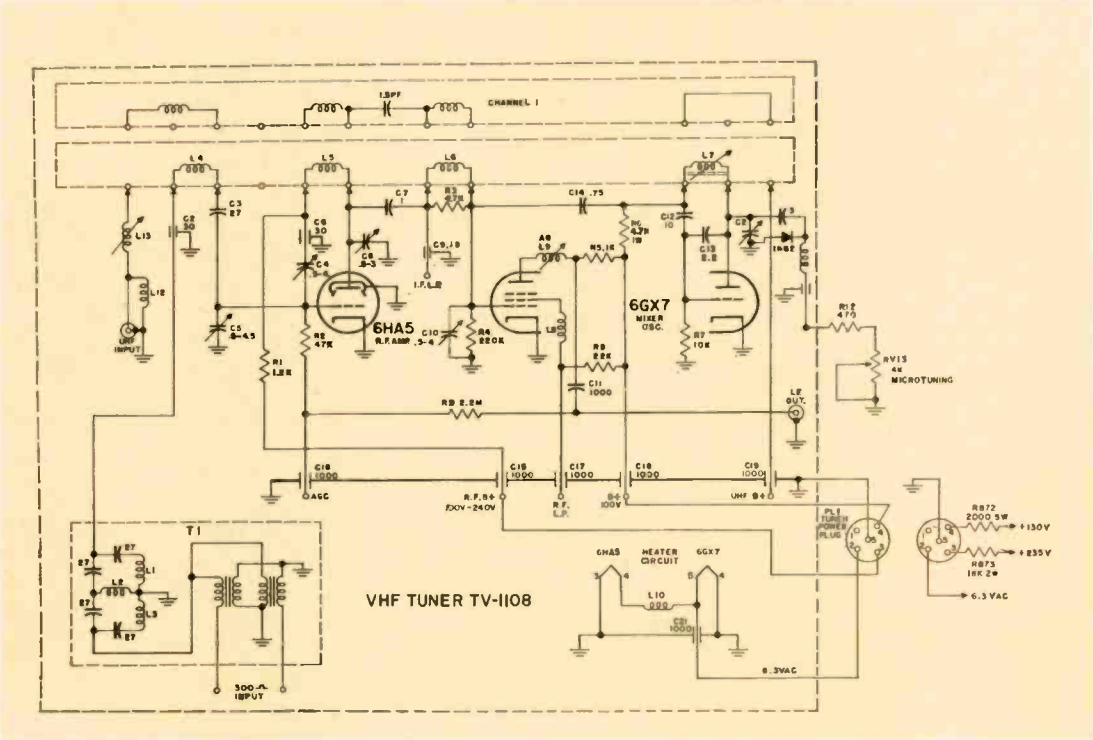


Fig. 1—Schematic of VHF tuner used in Setchell-Carlson U802 chassis.

■ The U802 chassis employed in the current Setchell-Carlson color line is of unitized construction and contains 29 tubes. Either a 23 or 25 in. CRT is used. The set consists of a basic chassis with six removable units attached. A seventh unit, the tuner, is fastened to the cabinet wall. This remote location enables tuning knob location near the top of the set.

Each of the units can be removed for troubleshooting and repair. Test cables for connecting individual units for bench checking are available from the manufacturer. The basic chassis contains only interconnecting wires and few parts so complete chassis removal is seldom necessary while servicing. All setup controls including the convergence board are accessible through a service panel located on the front of the set, below the picture tube.

The RF amplifier employs a neutralized triode circuit with a 6HA5 tube and the oscillator-mixer stage uses a 6GX7. In addition to fine tuning control L7, RV113 (Fig. 1) labeled microtuning is used to more precisely tune in the picture.

The video IF section has three stages: two 6EH7s and a 6EJ7 are used. After detection, the video signal is fed to the first video amplifier, V6, 6AU6 (Fig. 2). The output of this tube is applied to the

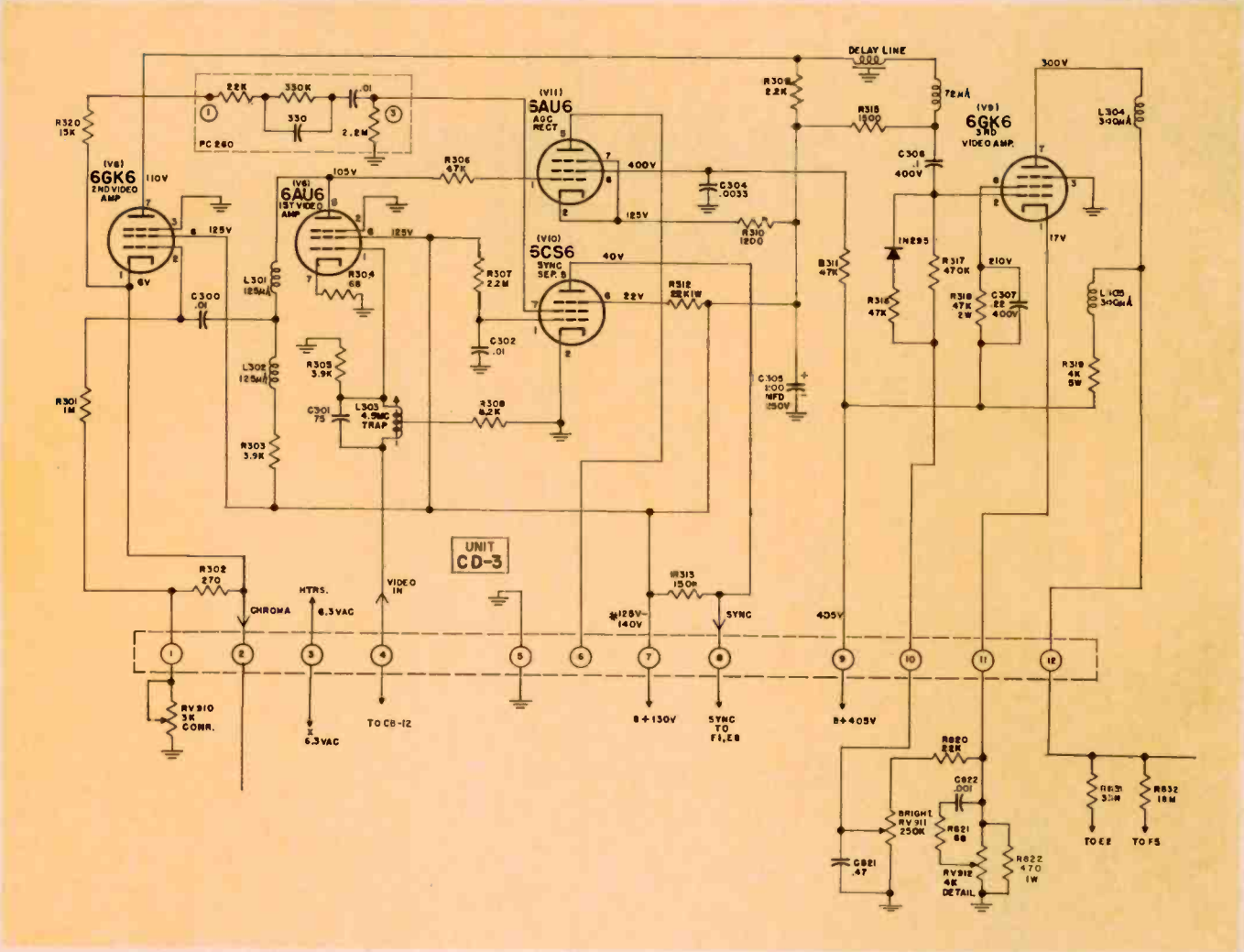


Fig. 2—The video amplifier, sync and AGC circuitry is contained in this unit.

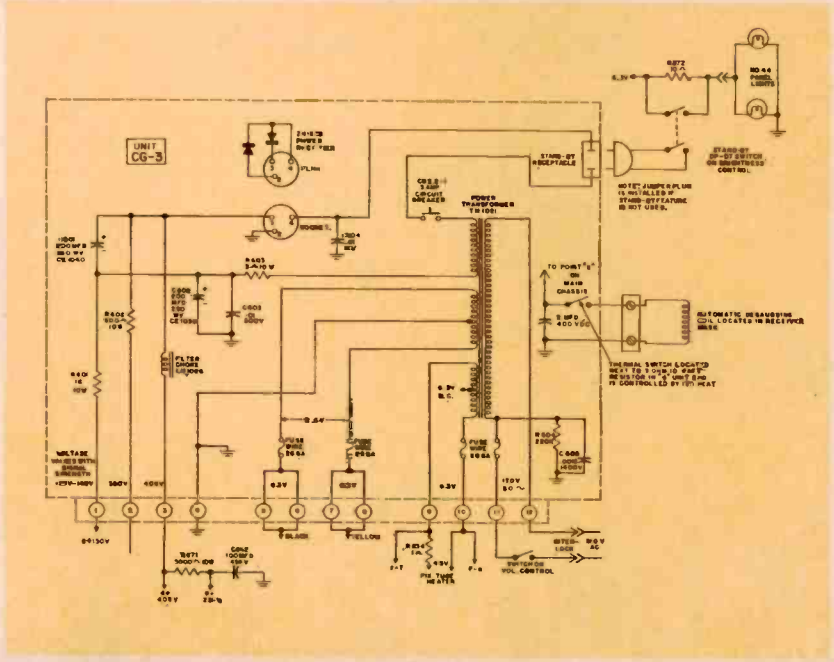


Fig. 3—Power supply unit used in U802 color chassis.

second video amplifier 6GK6 (V8). Chroma information is taken from the cathode of this amplifier and the luminance component is forwarded from the plate through a delay line to the third video amplifier tube. This stage drives the CRT cathodes.

The chroma section employs fairly conventional RCA circuitry using a pair of 6AL5 tubes instead of the familiar 6JU8 as AFC detector and killer detector. All color circuits are contained on one unit and this unit may be removed for servicing without disrupting monochrome reception. This feature enables technicians to make color repairs without taking the entire set to the shop.

Power Supply

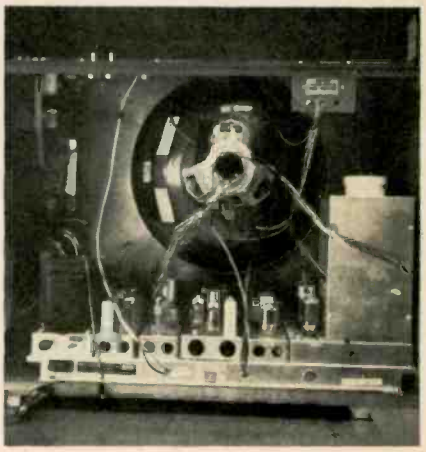
An 8.3v power transformer secondary winding (Fig. 3) furnishes heater power for the 6BK4 HV regulator, and the CRT. This circuit is held at about 260v above ground to minimize cathode leakage in associated tubes. The 8.3v is dropped to the normal 6.3v for the 6BK4 by an 11Ω resistor in series with the filaments. A 1Ω dropping resistor for the CRT heaters is mounted under the main chassis at the rear. This resistor not only protects the CRT heaters from warm-up surge, but can be shunted to act as a built-in booster for a weak CRT. A wire can easily be soldered across the resistor, thereby increasing the CRT filament voltage.

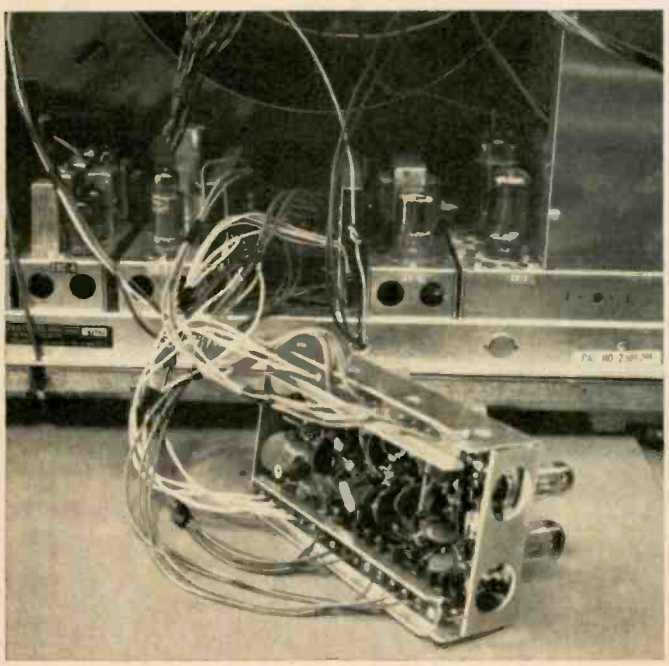
The heater supply of all tubes, except the CRT and 6BK4, is divided so a portion of the load is carried by each side of a grounded center tapped 12.6v winding. Loads for each side are almost completely balanced to eliminate ac current loops through the chassis, thus eliminating ripple.

Some models contain the standby provision shown in Fig. 3. A DPDT switch on these models switches off B+ but leaves the filaments supplied, thereby keeping heaters warm and offering instant picture and sound when switched on. The dial lights remain dimly lit when the receiver is in the standby position.

Plug in power rectifiers are mounted at the rear of the power supply unit. ■

Rear view of Cetchell-Carlson Model 3C66





Front view of set showing location of convergence board and access to setup controls.

Color unit removed and connected to main chassis by test cables.

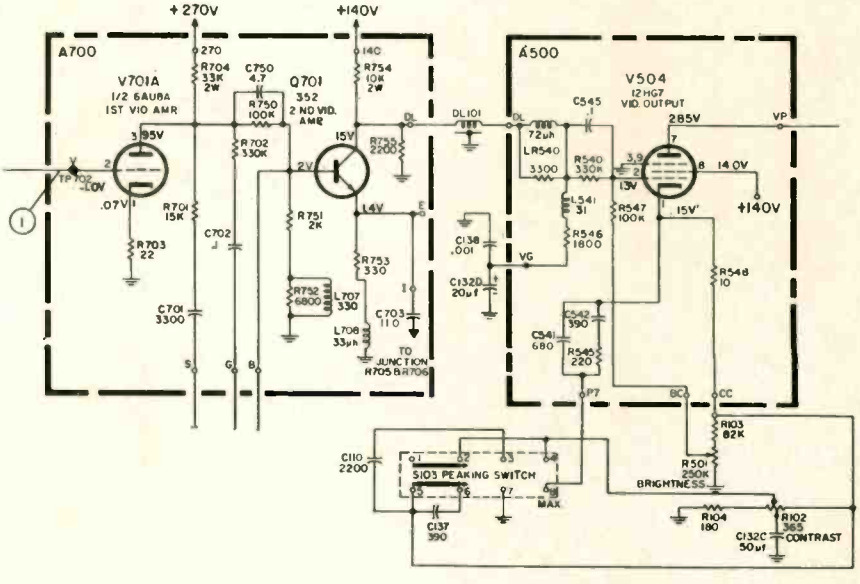
COLORFAX

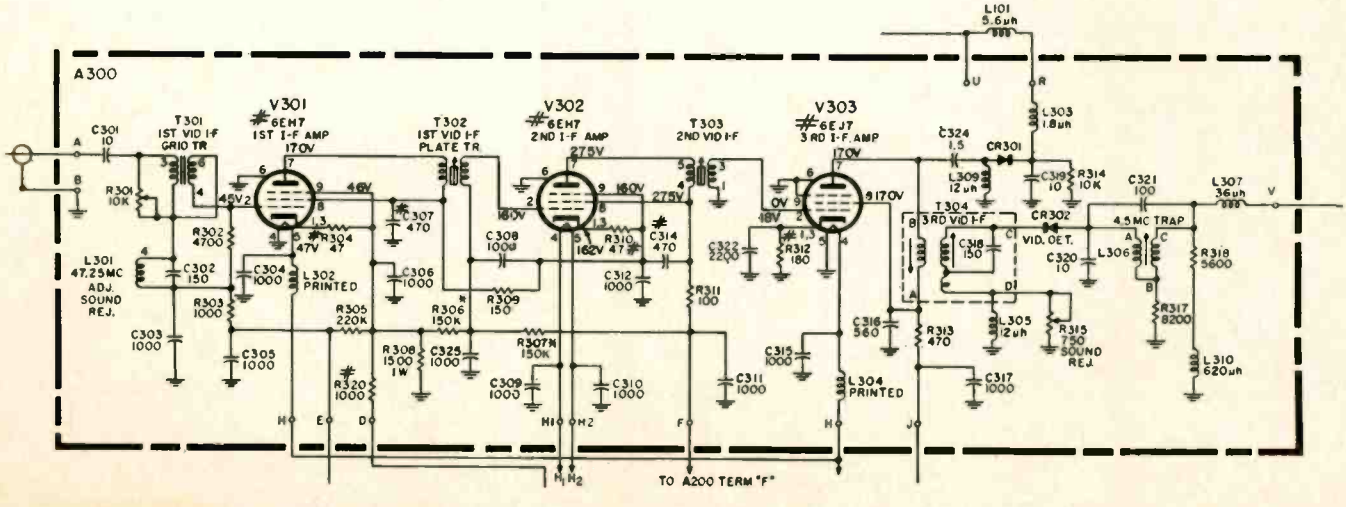
Video IF and Video Amplifiers—G-E CB Chassis

The output from the VHF tuner at 45MHz is coupled to the grid of the 1st IF tube, V301, through T301. C301 blocks dc from the tuner. The impedances of the primary and secondary bifilar windings to T301 are correctly matched by the adjustment of R301 across the primary. With the impedances correctly matched, maximum attenuation is attained with the 47.25MHz trap, L301. A small misadjustment of R301 would greatly decrease the attenuation of the trap. V301's grid is biased by the voltage developed at the AGC keyer, V501A. This voltage is proportional to the signal strength and is variable from about −4v (measured to ground) at maximum signal to approximately 20v at minimum signal. The voltage at the cathode is about 2v more than the grid on weak signals and about 8v more positive than the grid on strong signals. Therefore the net bias on the grid, as measured from grid to cathode, is variable from −2v on a weak signal to −8v on a strong signal. This is shown in the typical curve. The AGC voltage is connected to V301's grid through R303 and R302.

The plate of V301 is coupled to the grid of V302 through T302. The 1st and 2nd video IF amplifiers, V301 and V302, are stacked (in series) for B+ with R309. The plate of V301 is therefore at approximately the same voltage as the cathode of V302. The grid voltage of V302 is stabilized at about 10v less than the cathode and is derived from a matched pair of resistors, R306 and R307. These resistors are in series with B+ and R308. Because V301 and V302 are in series with B+, a change in V301 plate current caused by the AGC voltage will also cause a change in V302 plate current. Therefore, the gain of V302 is indirectly controlled by the AGC voltage on the grid of V301. T303 couples V302 to the grid of the 3rd IF amplifier, V303.

The 3rd IF amplifier, V303, is conventional with the primary of T304 in its plate circuit. The secondary of T304 is connected in series with L305. R315, in parallel with L305, produces a correct impedance match between the primary and secondary of T304. With impedance matching, 60db attenuation is attained at 41.25MHz by adjusting the 41.25-MHz trap on T304. This prevents harsh 920kc beats from appearing in the picture because of the mixing of 41.25MHz audio and 42.17MHz chroma information in the video detector diode, CR302. Because of the high order of 41.25MHz attenuation at the video detector, it is necessary to take off the 4.5MHz sound signal ahead of the video detector and 41.25MHz trap. The sound detector diode, CR301, accomplishes this. Although it would normally not make any difference, CR301 is connected in a polarity to produce positive audio





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information. This is done so the dc component of the audio can be used to provide a low positive dc voltage at the AGC keyer grid (V5011A).

L306, the 4.5MHz trap, is a bifilar wound coil which couples the video detector output (CR302) to the 1st video amplifier grid (701A). R317 terminates the coil with the correct impedance at point B and R318 terminates point C. R317 and R318 are in parallel for dc so their total resistance performs the diode load and V701A grid return functions. L102 suppresses tweets.

Video Amplifiers

Negative composite video information is dc coupled from the video detector circuit to the 1st video amplifier grid (V701A) by the tweet choke, L307. The positive composite video information which appears in the plate circuit of V701A is dc coupled to the base circuit of the 2nd video amplifier, Q701, by R750 and ac coupled through C750. R750, R751 and the parallel combination of R752 and L707 form a voltage divider circuit. The proper base voltage for Q701 is taken from the junction of R750 and R751.

The negative composite video information which appears in the collector circuit of Q701 is dc coupled to the grid circuit of V504 by the delay line DL101, the parallel combination of a resistor and peaking coil, L540 and R540, a 320K resistor. The collector end of DL101 is terminated by approximately 1800Ω which is made up of the parallel combination of R755 and the shunt resistance of Q701. The grid end of DL101 is terminated by R546 and the series capacitor, C132D. C545 provides the ac signal path from LR540 to the grid of V504, the 3rd video amplifier.

The positive composite video signal for the chroma bandpass amplifier is coupled from the emitter circuit of Q701 to the junction of R705 and R706 by C703.

The three-position video peaking switch, S103, is mounted vertically on the rear apron of the chassis. The switch allows three different video amplifier responses to be selected. The circuits and responses of the three positions are described here.

When the receiver is installed, the technician may demonstrate reception in each of three positions and select the position which produces a picture most pleasing to the customer.

Top Position: Accentuated overshoot. The RC network, C541, C542 and R545 is connected from the cathode of V504 to chassis by S103. S103 also connects C110 from the fixed tap on the contrast control to the junction of the contrast control and R548. *Middle Position:* Medium overshoot. The RC network, C541, C542 and R545 are not connected to chassis. C110 is connected the same as in the top position. S103 connects C137 from the chassis to the junction of the contrast control and R548. *Bottom Position:* No overshoot. S103 switches C137, C110, C541, C542 and R545 out of the circuit.

The negative composite video signal applied to the grid of V504, the 3rd video amplifier, will be amplified by the tube and appear in its plate circuit as positive-going video information. T201, in the plate circuit of V504, functions as a video peaking transformer. The brightness control is located in the cathode circuit of V504. Its function is to adjust the grid bias of this stage. The contrast control, R102, is also located in the cathode circuit of V504. A 50μf capacitor, C132, is connected from the arm of the contrast post to chassis. The volt-

Zenith is proud to receive the NATESA "Friends of Service" award... for the 4th year in a row!

Zenith is pleased and proud to be the first TV set manufacturer to be honored with NATESA's national "Friends of Service" award for four consecutive years.

NATESA has helped to build and support expert electronic service facilities for many years. These strong facilities have helped the independent serviceman reach a prominent and respected place in the industry.

The high regard which independent servicemen have for Zenith service policies and products has been a major factor in establishing Zenith's leadership in the TV field. We are determined to continue to merit this confidence and approval.

We pledge to continue Zenith's full cooperation in service policies and training programs for the independent serviceman.

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The quality goes in before the name goes on

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COLORFAX

age gain of the stage is varied by changing the amount of cathode degeneration. The gain of the stage will increase as the arm of the contrast control is moved closer to the cathode of V504, providing the least amount of cathode degeneration. The stage gain is lowered as the arm of the contrast control is moved closer to R104, providing increased cathode degeneration.

RCA 22-in. Color CRT

The Radio Corp. of America will introduce a 22in., 90deg rectangular color television picture tube during the last quarter of 1966.

Harry R. Seelen, division vice president, RCA television picture division, said. "Although bulbs for the 22in. rectangular color tube were not available from the glass supplier, RCA completed the preliminary design work on the tube.

"Development samples of the 22in. tube were expected to be available in limited quantities during June at a price of $150 per unit," he said.

The tube will be produced in a laminated-etched version with a safety window treated to reduce reflections and a non-laminated type, according to the executive. Very limited commercial production of these two versions of the tube is planned for the fourth quarter of 1966.

Introductory prices of the commercial tubes will be $118 for the laminated etched version and $110.50 for the non-laminated version.

The tube will incorporate the three-gun shadowmask principle. The overall length of the tube is 19.2 in. and it measures 21.707 in. diagonally.

G-E CB Chassis — Fleshtone Color Reproduction

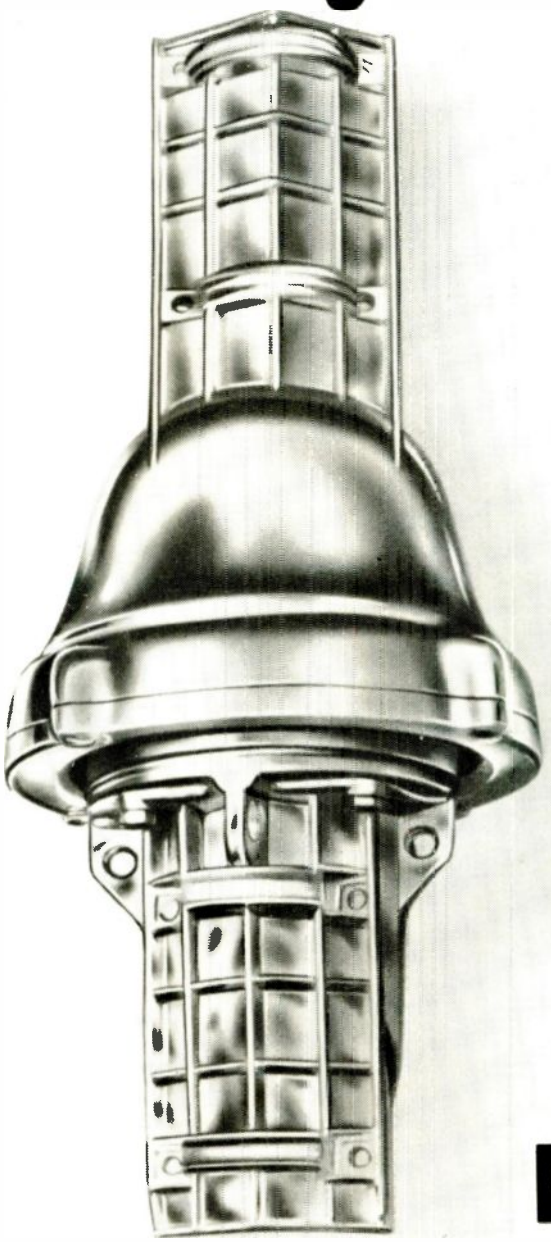
Some flesh tone problems have been experienced in the CB chassis with certain color transmissions. During these transmissions, flesh tone areas appear greenish in low light portions. This may also be described as greenish "blotches," or spots, in shadowed areas which will vary with program material.

This problem can be solved and more pleasing flesh tones obtained by opening the demodulation angle between R-Y and B-Y from 90 to 107 deg (± 3 deg). Starting with February 1966 production, the factory alignment incorporated this change.

It is recommended that whenever receivers built prior to Feb. '66 (Chassis Code 605 CB or earlier) require sub-carrier adjustment or have a complaint concerning flesh tones, the following procedure be followed: (1) Peak sub-carrier. (2) After completing sub-carrier peaking, remove the meter from the test point and readjust the B-Y tuning core of 1/6 of a turn *counter-clockwise*. This is the direction which moves the core up and away from the board. The R-Y, B-Y angle will then be 105-110-deg and within the new limits. (The angle must not be increased beyond this point.) (3) Carefully check for ac and dc balance. Unbalance on any of the three color-difference-amplifier grids must not exceed 0.05v (50 mv). Because of the adjustment accuracy required, you should set the VTVM either to center scale or to some arbitrary calibration above 0 before connecting to the test points. Using the lowest scale, this will permit an accurate reading for balance. As a final check, remove the meter probe from the test point, then reconnect it. There should not be any movement of the meter pointer if adjustments are correct. (4) As a final check on sub-carrier and balance adjustments, a color bar signal should be used to determine the following conditions: (a) All primary colors, red, blue and green, should be accurately reproduced. (b) The yellow bar or yellow-orange bar will be shifted very slightly toward orange. (c) The cyan bar will be shifted very slightly in the blueish direction. If the cyan bar is too blue the (R-Y)—(B-Y) angle has been increased a little too far. Close up (B-Y) adjustment slightly toward original setting.

This fully transistorized color television camera manufactured by Marconi uses four plumbicon pickup tubes. The camera can be switched to either the 525 line or 625 line standards and will provide signals suitable for coding to any of the systems that have been proposed—NTSC, PAL or SECAM.

Never ask a lightweight rotor to do a heavyweight's job.



Selling your customer a lightweight rotor when he has a large antenna array just doesn't make sense. Especially since you can offer him an alternative: the heavy-duty "Bell Series" rotor, from CDE.

Available in both automatic and manual forms, this rotor is designed specifically for large, heavy antenna arrays... designed specifically for unmatched fringe-area reception... designed to give your customers the finest color TV reception possible. In fact, this is the *only* heavy-duty rotor available.

We call it the Bell Series because of its completely weatherproof, die-cast aluminum housing. You'll call it rugged because it has 4 to 5 times the stalling and braking torque of any other rotor! This means *any* antenna will turn, even under the most adverse weather conditions... and that your customers will get terrific color or black and white reception despite high winds or heavy icing. Great FM reception too!

The Bell Series rotor: one-of-a-kind built for one-of-a-kind performance!

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Don't Forget To Ask Them: WHAT ELSE NEEDS FIXING?

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NEW PRODUCTS

FOR MORE INFORMATION CIRCLE NEW PRODUCT NUMBERS ON POSTCARD INSIDE LAST COVER.

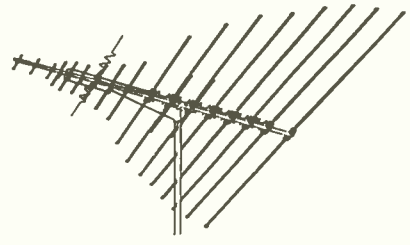
Field-Strength Meter 700

A completely solid-state, light weight, battery operated field-strength meter, designed for all around use, covers the VHF TV and FM bands

and the UHF TV band. The unit employs "C" type cells but an optional battery charging system is available for rechargeable batteries. The unit can also be operated directly from the ac line for various shop applications. Either 75 or 300Ω inputs are available and the most popular type 75Ω connectors are supplied for making direct connection into antenna and distribution systems. A built-in matching transformer, attenuators, separate UHF and VHF tuners are other features. The unit has a three-stage IF system which is controlled by amplified AGC. A 4in. meter is calibrated in both μv and db. An extended logrithmic μv scale indicates from 30 to 30,000μv. Audio signals can be monitored on a built-in 3½in. speaker. Sencore.

All Band Antennas 701

A line of combination VHF TV, FM and UHF TV antennas is announced. Each of the four all-band antennas are supplied with VHF/UHF splitters which are attached behind the TV set. The announcement said that the line has been compacted



to about one-half the size of previous designs by a system called Chromalens for which a patent application has been made, plus "impedance correlators" designed to boost the impedance of the antennas' driven elements. Gain is said to be flat within ±¼db over any VHF/FM/UHF channel. Winegard.

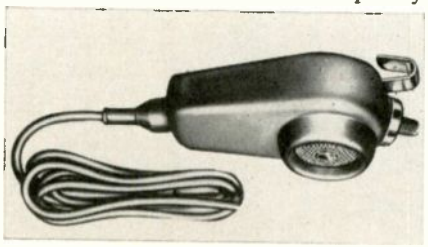
Solid-State Portable Phono 702

Announced is the model 369 portable component system stereo phonograph having a 4-speed record

changer. It is said that the speakers may be separated up to 16ft. Each enclosure contains a 9in. oval and one 3½in. speaker. Comes in metallic olive or walnut grain vinyl. V-M.

Dynamic Microphone 703

Announced is a push-to-talk microphone for use with two-way mobile, ship-to-shore, ham radio and similar applications. Sensitivity is said to be 1.2mv/microbar with a frequency



response of 80Hz to 12kHz. A positive lock action switch holds the circuit closed. Has high impact rubber case to assure protection against shock and damage. Size is 2in. Two impedance models are available: 250 and 45K. American Geloso.

Aerosol Cleaner 704

Said to be an improved formulation of a previous product, this cleaner is available in 6, 8 and 16oz. spray cans having a stainless steel injector needle. The announcement said that the formulation has antistatic qual-

ities and is designed primarily for treating color and B/W TV tuners. It was also stated to have low surface tension, to be non-flammable, nontoxic and safe to use on plastics. Injectorall.

Transistor Tester 705

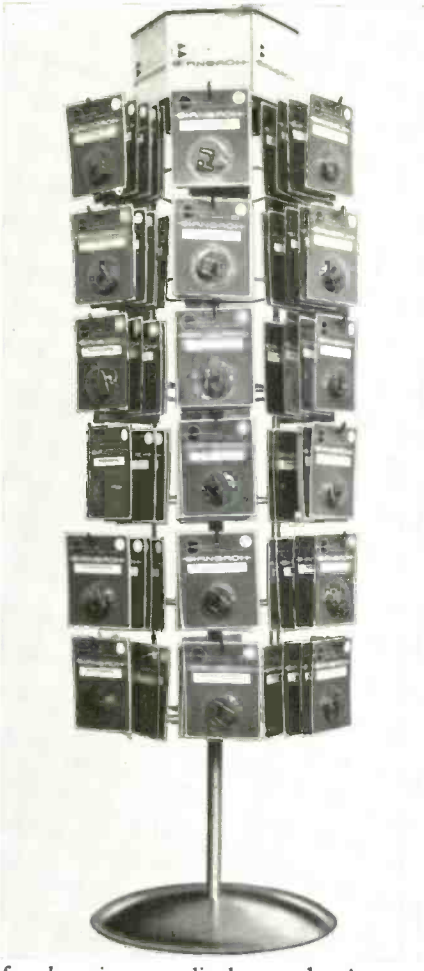
An in-circuit, true ac beta-reading transistor tester is said to measure the base collector ratio of an ac signal.

The tester has been designed to meet increased demands in servicing solid-state circuitry now being used in TV, Hi Fi, radio, phono and tape recorder equipment. According to the manufacturers specifications, true ac beta of an in-circuit transistor is read direct on the tester's meter. A calibration knob is set and a button is pushed — the announcement said. ICBO (collector cutoff current) is also read directly on a meter in μa. No set-up book is needed. Price $89. Sencore.

NEW PRODUCTS

Hardware 706

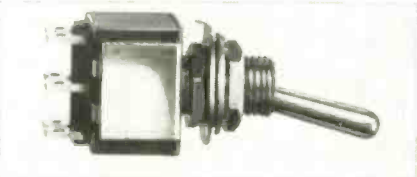
Electronic hardware packaged in transparent "blister packs" is available. The card contains an easy-to-read description and is punched to allow



for hanging on display rack. Among the 36 items packaged are solderless phone tips, test and alligator clips, microphone and chassis connectors, telephone plugs and packs, and insulated plugs. Birnbach.

Toggle Switch 707

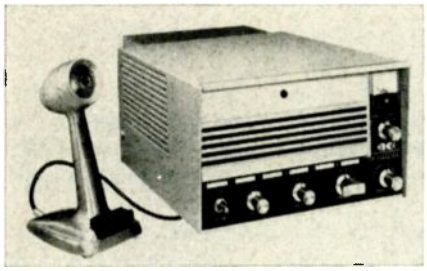
An ON-OFF-ON DPDT subminiature toggle switch is announced for which a 100,000 cycle minimum life is



claimed. The switch contains solid coin silver contacts and terminals which are mounted in a general purpose phenolic base. Specifications are: Contact rating @ 115vac, 5a. Insulating resistance, 1GΩ. Weight, 5.5g. C & K Components.

SSB/AM Radiotelephone **708**

A 100w transistoried communications unit, designed for both SSB and AM transmissions is announced. Plug-in tuning coils are provided for the six channels and a matching antenna tuner may be either installed



on the back of the set or remotely controlled up to 100ft away to permit a variety of antennas without excessive signal loss. The unit is said to draw only .16a while monitoring. Plug-in power modules are provided for 12, 24, 32vdc or 115/230vac operation. The unit measures 10¾ x 7 x 13¾ in. and weighs 22 lb. Kaar Electronics Corp.

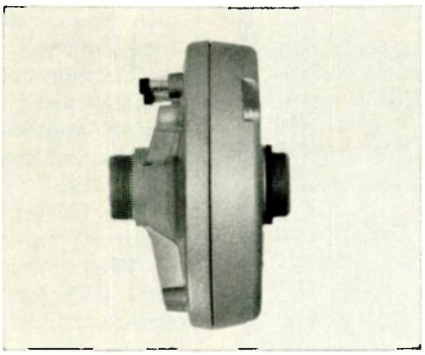
Mobile Antenna **709**

A mobile antenna designed for CB operation as well as AM and FM broadcast reception is announced. The matcher pairs 60in. of 52Ω coax and 60in. of high impedance auto antenna

lead thus performing as a diplexer. Reportedly the matcher also performs as a line flattener and its series-tuned circuit permits matching to a wider impedance range to produce a low SWR. The unit has an adjustable stainless steel tip rod for tuning and a sealed waterproof resonator. Price $13.95. New-Tronics Corp.

Convertible Driver **710**

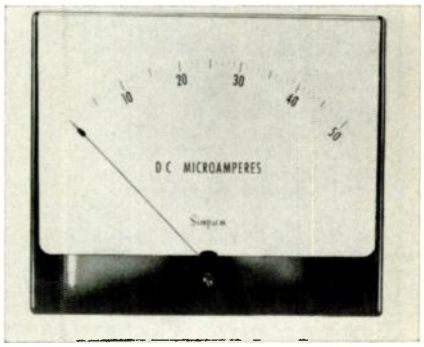
A series of 60w convertible drivers for high-fidelity reproduction in public address installations is announced.



These drivers are sealed structures designed for any reentrant or compound horn. They have a baked enamel finish and are 5-5/16in. in diameter. Specifications are: Series 1829. Length, 4-1/16in. Weight, 7lb. Impedance, 16Ω. Series 1829T. Length, 5-15/16in. Weight, 9lb. 11oz. Multiple impedance. Electro-Voice.

Panel Meter **711**

A new panel meter with a scale eight in. long is now being offered. Ranges available on the meter extend



from 25μa to 50a and 10mv to 500v. The standard ranges have taut band construction but pivot-and-jewel construction is available as an option. The features reportedly include excellent repeatability, low power consumption, low hysteresis, shelf-shielding characteristics and ±2% full-scale accuracy. Simpson.

NEWS OF THE INDUSTRY

Urges Technicians To Keep Up

The nation's TV service technicians were urged to "retread yourself as often as necessary just like the physician or engineer," to keep pace with new developments in consumer electronics.

The advice came from Paul B. Garver, general manager, RCA Parts and Accessories, in the keynote address at the Tri-State Council of the Television Servicemen's Assn.'s Telerama 66 convention at the Traymore Hotel. Approximately 250 independent service technicians and their wives from New Jersey, Delaware and Pennsylvania were present.

The consumer appreciates the improved performance of products using new techniques," Mr. Garver said. "He is equally appreciative of the technician who understands, accepts and can repair the product using the newest developments."

Mr. Garver said he was referring to such new developments as circuit boards and integrated circuits.

"The introduction of new techniques into the manufacture of TV sets has not reduced the demand for qualified service technicians," he said. "The increase in use of TV sets has placed a demand on technicians. This demand has far overshadowed any reduction in service caused by the improved reliability.

"There is no need to fear progress. The only thing that progress requires of us is that our personal progress keep pace . . . . You can do more to create a distorted image in the mind of your customer by knocking progress than in any other way."

He pointed out that manufacturers such as RCA "spend a lot of time and money to make training session available to you so that you can be kept current on the new developments. It is extremely important that you avail yourself of every opportunity to learn."

He cited six characteristics of a successful service technician — dependability, quality consciousness, a professional appearance, flexibility and willingness to accept change, capability and honesty.

"Be honest with your customers and honest with yourself," Mr. Garver concluded. "Make sure you are making an honest and reasonable profit in your business and you will create the kind of image that will last."

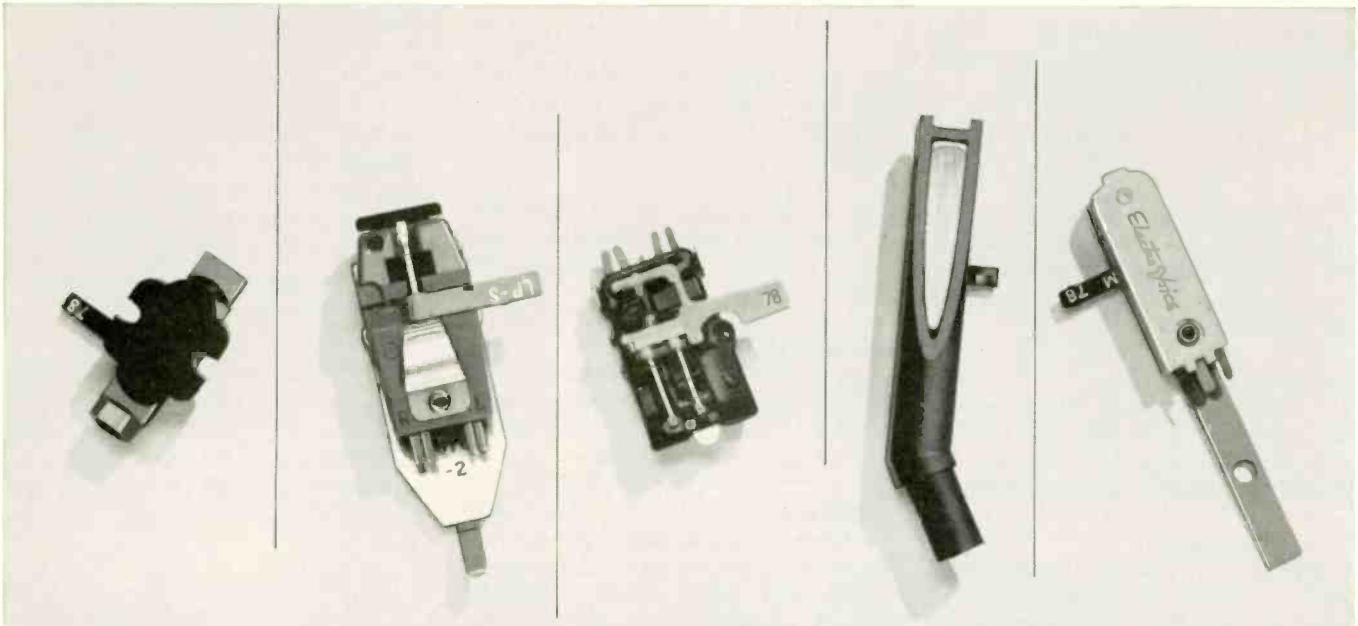
B-T Seminars

Closed-circuit TV camera care and servicing techniques will now be included in the curriculum of Blonder-Tongue's training sessions being held across the country for CCTV distributors and installers.

A three-day CCTV seminar, recently held in Youngstown, Ohio, was the testing ground for the new chapter in the electronics firm's continuing educational program, under the direction of Nick Young, national training program director.

According to Mr. Young, "the subject was so well received that we have decided to make it a regular part of our CCTV seminar presentations."

Other subjects covered during the session, included CCTV system designs, theory and applications, as well as cost analysis and equipment involved.



How long was your distributor out of stock after these new cartridges were introduced?

It isn't easy to keep up with the many new phono cartridges being introduced these days.

And if your distributor doesn't order until you ask for them — you're in trouble.

After all, a delay of more than 24 hours can cost you plenty in customer goodwill — perhaps even a sale.

But that problem is eliminated when you deal with an Electro-Voice distributor.

Here's how. He can place a standing order with us. We ship every new model to him *automatically*, as soon as it comes out. He doesn't wait for an order, and neither do we.

This way, the new models are waiting for you *before* you need them. It's good business to see your E-V distributor — he's first with everything in needles and cartridges.

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CATALOGS AND BULLETINS

Tools 400

A complete line of tools — solid joint pliers, alloy wrenches, slip-joint pliers, snips, wrench sets, punches and chisels—are described in this 20-page catalog. Kreuter.

Lubricant-Conditioner 401

A folder describes the chemical properties and applications of a bottled and Aerosol-canned product for all electrical contacts. Brobst-Whitfield.

Stereo Equipment 402

Stereo/monophonic turntables, AM/FM tuners and amplifiers—both tube and solid-state—are described in this 8-page brochure. Bogen.

Cartridges 403

A total of 5700 cartridge listings are cross-referenced in this manual. A phonograph cartridge specification guide is also included. Sonotone.

Power Tools 404

Over 130 power tools to handle a wide assortment of applications are listed in this 82-page catalog. It includes accessories to fit most makes of power tools and also lists 12 products that never appeared in this catalog before. Battery-powered tools are covered too. Skil.

Wire and Cable 405

A 38-page catalog covers wire and cable available for use in many categories. ITT.

Semiconductor Testers 406

A bulletin describes semiconductor testers designed for testing semiconductors in-circuit easily and safely. American Electronic Labs.

Receivers 407

Three transistorized receivers for alert and monitor use in the 30-50 MHz and 150-174MHz frequency ranges, are described in a 4-page bulletin. Each receiver contains an emergency power pack for use during power failures. Viking Instruments.

Solder Terminals 408

This bulletin describes self-clinching solder terminals for obtaining chassis grounding connections. They are designed for mounting in relatively brittle or hard panels without using screws or rivets. Penn Engineering.

PORTABLE TV'S . . .

continued from page 52

zontal output transistor had been placed in the socket *before* checking the drive, the replacement transistor would have been ruined. Always check for a proper drive pulse on the base of the horizontal output transistor. If no pulse here, don't replace the transistor.

When the picture tears or pulls horizontally, check the AFC dual diodes and horizontal stabilizer coils. Replace all horizontal transistors with original types or with replacements having similar parameters.

A single transistor or diode serves as a damper rectifier in this set. If the damper transistor has a leakage of 100Ω, the picture will pull way in on the sides and then the circuit-breaker will cut out. Do not remove a current limiter transistor from the circuit and then switch on the receiver. The diode protector can be ruined and the 18Ω resistor will go up in smoke (See Fig. 6).

Some Horizontal Troubles

In a Sylvania GT12 model the overload relay would sometimes kick out and then a little while later the set would be OK. The trouble was in the high voltage diode string. One or more diodes may short out and cause the overload relay to kick out. Replacing the entire diode assembly clears the trouble.

In the same model, if severe picture blooming occurs and the center of the screen becomes dark, the trouble is usually in the horizontal drive circuit. Change resistor R438, a 4.7Ω component connected in the base of the output transistor. Replace it with a 1.8Ω resistor.

Power Supply Troubles

The all-transistor power supply may be transformer or battery powered. Fullwave, halfwave and "budge" rectification can be found in the secondary of the power transformer circuit. Some receivers use one or two transistors in the power supply output for filtering and voltage regulation.

When one silicon diode shorts in a bridge rectifier, check all diodes. The silicon diode can be checked with an ohmmeter or diode checker. Measure the resistance both ways.

A good diode will measure from 6 to 20Ω forward resistance and very high reverse resistance. An open silicon diode will have no resistance in either direction while a shorted one will be under 6Ω in both directions.

A defective electrolytic capacitor or transistor power filter will cause 60Hz hum in the picture. As shown in Fig. 7, when C2, a 1000μf capacitor opens or dries out, the picture sides pull in with 60Hz vertical bars on the TV screen. The power supply output voltage will measure very low.

Solid-state equipment is here to stay and we have to learn about the new meanings of old electron tube symptoms. ■

OPEN HAND . . .

continued from page 55

Sam thinks. He does not need to add that it also gives him a pretty good lock on such customers' service business, not to mention that it is also good assurance that Village TV's accounts receivables are kept tight.

"As in any well-to-do community, we not only have a lot of genuinely wealthy people, but plenty of four-flushers who are just trying to act like millionaires, too. A good deal of our volume is on credit, service work as well as merchandise sales, but only a valid account gets a charge account. We check out each new application with our local credit bureau — which costs money — but is well worth it. We consider the ability to offer credit as part of our over-all sales promotion program."

Large Inventory

Sam even considers his bigger-than-average inventory as part of this sales promotion program. On June 20th, his floor stock offered a selection of 50 color TV sets, 75 portables, 200 radios of all shapes and sizes, 25 record players and a dozen stereos. This did not include 120 air conditioners and countless Hi Fi equipment components. At any given time, Village TV may have $40,000 or $50,000 worth of merchandise in stock, plus $10,000 to $12,000 in test instruments and parts inventory.

"Many dealers pride themselves on being able to turn over their inventory as often as ten times a year," Sam says. "Our turnover is only about three times a year — well, maybe four times this year — but I believe in giving the prospect as big and complete a selection as possible. Maintaining the kind of inventory we do costs a great amount of money, but it's worth it in terms of satisfied customers."

Rentals Pay Off Too

Almost everything Sam does costs money, but it usually comes back many-fold. One of his ventures is TV rentals, with 15 to 20 portables out at all times.

"The rental units represent a frozen investment of about $2000," he says. "But at current interest rates, that $2000 is only worth about $120 a year in the bank — and rentals bring in more than that each week."

Village TV gets $10 a week rental per set or $30 a month. No deposit

is charged, but in 800 rental tickets written in the last 14 months, there has never been a skip. Most of the rentals are for convalescents, out-of-town visitors, beach parties and special events like the World Series when many rentals are used by restaurants and bars in the area. Charges include delivery and pickup service, and customers are liable for "careless damages," but repairs are billed at cost.

Sam even carries a display ad in the phone book yellow pages for rental business, which also includes PA systems. This supplements his regular display ad in the yellow pages, where he spends a total of $1,800 a year.

'Closed-Door' Sales

One of Village TV's biggest advertising splurges is for a promotion Sam calls his "Closed Door Sale," staged in September and April. He has a mailing house send out promotional literature to a select list of 10,000 residents of Wilmette and nearby communities for the invitational sales event. In September of 1965 the one-day sale grossed $12,000 and in the following April the gross was $15,000.

"Sending out the 10,000 admission tickets costs about $1,000 per shot for a closed door sale," Sam muses. "We give away a lot of door prizes, too."

"In other words," ELECTRONIC TECHNICIAN's reporter said, "you promote the closed door sale with the open hand policy. Inasmuch as you work on an average profit margin of 20 percent on merchandise sales, that makes for nice additional week-end money for almost any service-dealer."

"It's all advertising and good service," Sam grinned and extended the open hand. "Shake on it." ■

. . . REPLACEMENT TRANSISTORS

continued from page 57

Engineering Council), domestic and foreign transistor types. This company also has a cross-reference guide available.

Semitronics provides approximately eight transistors in the TV, AM and FM radio replacement line but additional numbers are available which cover special areas. Reliable information from the field indicates that a number of other manufacturers may soon move into the service replacement area. A number of these manufacturers have been supplying only OEM (original equipment manufacturers') requirements. And most OEMs supply exact replacements for the equipment they manufacture. But the problem is, many times these exact replacements are not always instantly available.

A general guide to selecting the proper replacement transistor includes the following considerations:

1. Make sure the power dissipation rating of the replacement transistor equals or exceeds that of the original.
2. The gain of the replacement should be as close to the original as possible.
3. Circuit voltages must not exceed the replacement's emitter, collector and base break-down ratings.
4. Frequency response of the re-

placement should be the same as the original.

5. The replacement should be shaped to fit the space occupied by the original. ■

ANTENNAS . . .

continued from page 66

we will again go over some important points to be considered.

If you are serious about your antenna installations or plan to be, begin learning everything there is to know about reception conditions and peculiarities throughout the entire area you work in — if you don't already know the particular characteristics involved over every square block and mile of it.

If you want the best antenna for a given job or area, you'll approach the job intelligently by measuring the field strength at the exact spot you plan to install the antenna (or very near the spot, depending on particular conditions). This requires a good, solid-state, thoroughly portable field strength meter for efficient results — to save time running and retrieving power cable that has to be run for a straight ac operated field strength meter.

Know the receiver's gain (see page 63, April 1966 ELECTRONIC TECHNICIAN) and figure out what the antenna's gain should be after checking it directly or with a regular half-wave test dipole attached to your field strength meter.

Obtain full technical details from all antenna manufacturers and become familiar with gains, overall VSWR across the bandwidth and for all channels, front-to-back ratios and other pertinent and important details regarding their antennas so you can check these figures in actual practice. Try a number of different antenna designs from time to time until you learn what each will do under a given set of circumstances. Keep careful records of results and details on antenna type used in each case.

This may require some additional time experimenting but it will eventually make you the *top* antenna expert in your area, an enviable position to attain. ■

ADVERTISERS INDEX

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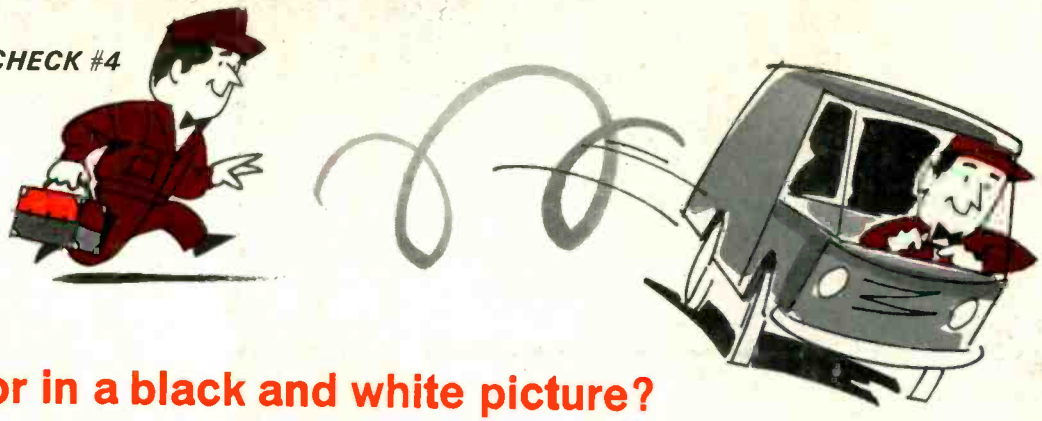
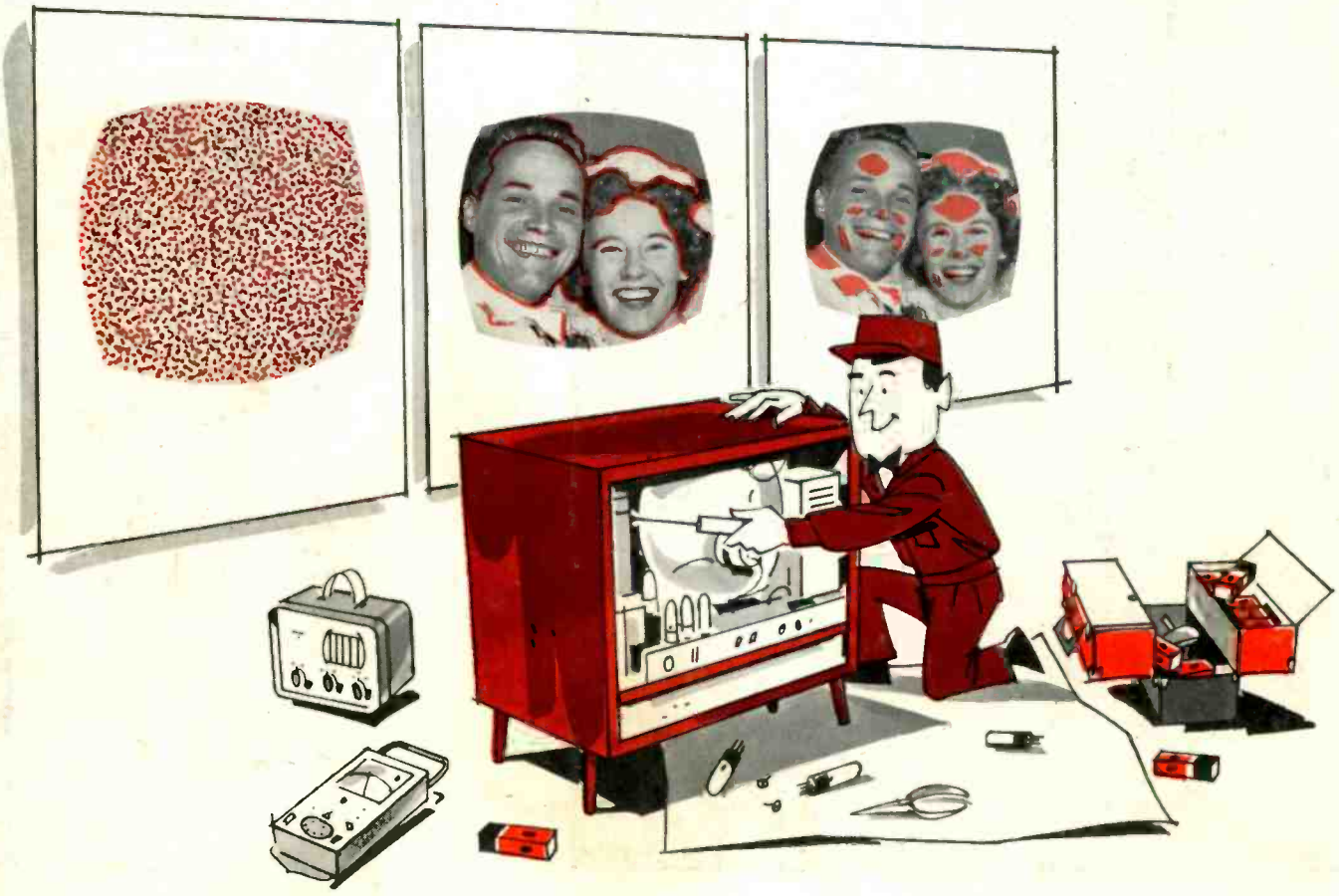
. . . for more details circle 102 on postcard

RCA's COLOR TV FASTCHECK #4



Color in a black and white picture?



First, determine the exact nature of the undesired color...

One of the best performance indicators of a color TV receiver is the quality of its black and white picture. It should be free of all color fringing and tinted areas. Because undesired color effects can be due to several causes, the exact nature of the unwanted color should be determined before adjustments are attempted.

Make sure that rf interference is not present. Then, follow these steps in order:

1. Tune in a black and white picture, adjusting fine-tuning correctly.
2. Check for color fringing (misconvergence) around picture elements, and for tinted patches. If fringing is evident, use an RCA WR-64B Color-Bar/Dot/Crosshatch Generator and readjust convergence. Eliminate tinted raster areas by degaussing the picture tube and resetting purity if required.
3. Tune to an unused channel and look for colored snow. If colored snow is present, adjust the color-killer threshold control to the point where color disappears from the snow.
4. Tune in a black and white picture. Set controls for normal brightness and contrast. The highlights should be white and the lowlights should be gray. If highlights and/or lowlights are tinted, adjust gray-scale tracking.
5. If proper gray-scale tracking cannot be achieved, check tubes and components in the chroma amplifier stages.
6. If these checks fail to correct the trouble, use an RCA WT-115A Color Picture Tube Tester to check emission of the three electron guns of the picture tube.

This is another in a series of color TV service hints from RCA. For more satisfied customers always replace with top quality RCA receiving tubes. Your local RCA tube distributor can supply all your tube needs for color TV, black and white TV, radio and hi-fi.

RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N.J.

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