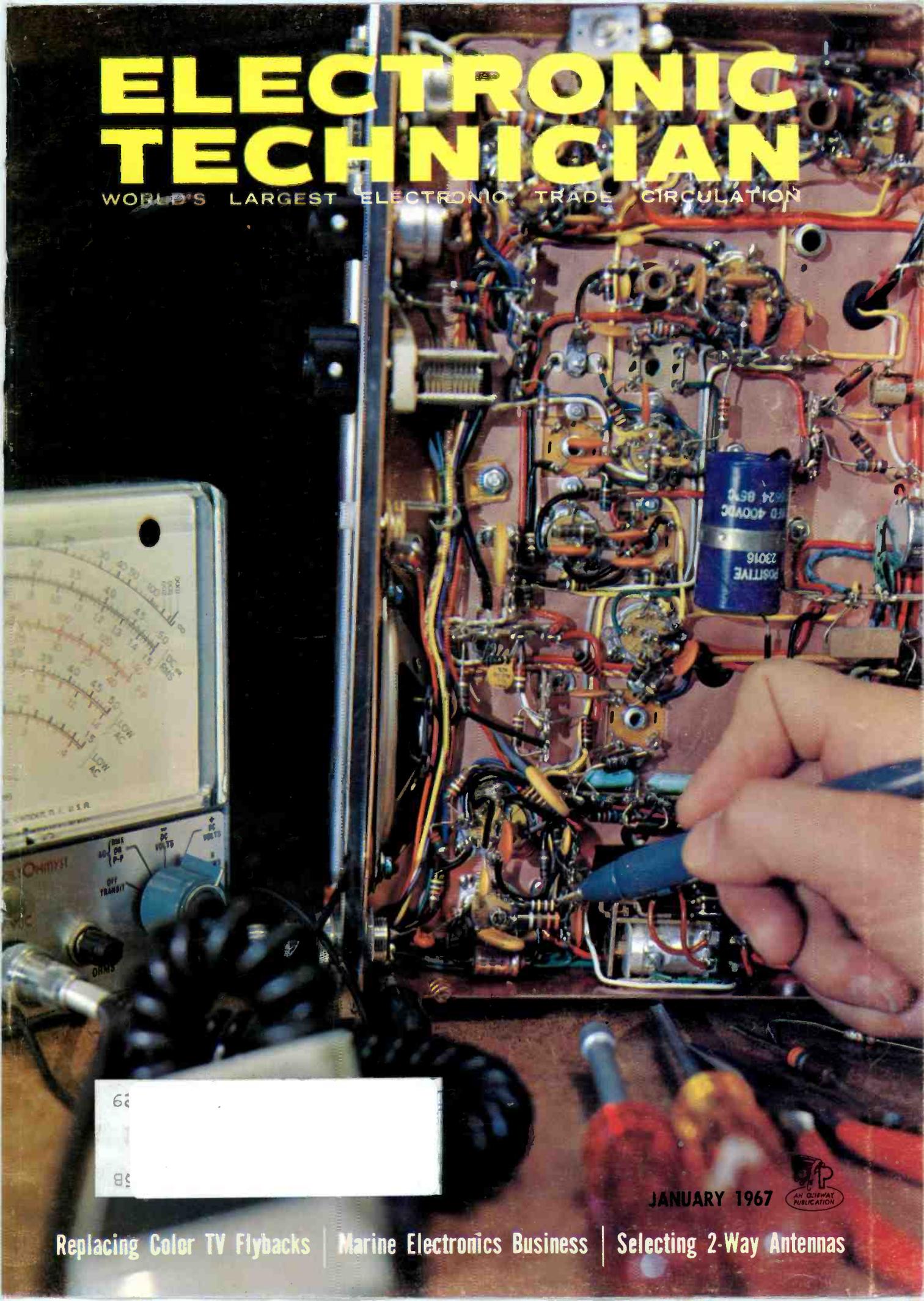


# ELECTRONIC TECHNICIAN

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION



62  
88

JANUARY 1967



Replacing Color TV Flybacks | Marine Electronics Business | Selecting 2-Way Antennas

# We set out to give you the industry's outstanding VOM value. We succeeded.



Leave it to B & K engineering know-how to create a Volt-Ohm-Milliammeter that puts you a jump ahead of your competition—helps make your job more rewarding and profitable. Only B & K Model 120 VOM offers a 2 ohm center scale, burnout-proof meter movement, a polished mirrored scale plus a total of 61 ranges! Model 120 VOM ranges start lower . . . and go higher than other instruments of similar size and type, making transistor servicing far easier. It's

true. B&K brings you the industry's outstanding VOM value—Model 120 VOM, and prices it right! Only \$51.95, net.



**Division of Dynascan Corporation**  
1801 W. Belle Plaine  
Chicago, Illinois 60613

Canada: Atlas Radio Corp., 50 Wingold, Toronto 19, Ont.  
Export: Empire Exporters, 123 Grand St., New York 13, U.S.A.

# And we succeeded with our VTVM, too.

Only the B & K Model 175 VTVM has a built-in battery eliminator—no ohmmeter battery required! B & K Model 175 features Transit-Carry—reducing possibility of a bent meter indicator. In addition, B&K built into this VTVM a totally reliable protection system. The meter movement cannot be damaged from application of a wrong in-

put voltage. Looking for the industry's outstanding value in VTVM application? Look to B&K Model 175, only \$59.95, net.



*Where Electronic Innovation  
Is A Way Of Life*



... for more details circle 103 on postcard

# FINCO

"has 'em both"



MODEL #65-1 \$29<sup>95</sup> list



MODEL #65-2 \$39<sup>95</sup> list

## BOOSTER COUPLERS IN 300 OR 75 OHM For Deluxe Home & Commercial Use

Finco's famous 2-tube, 4-set VHF-TV OR FM Distribution Amplifier is now available for 75 OHM CO-AX or 300 OHM operation.

Price? You can't beat it! Rugged quality? Finco's got it! Performance? Finco challenges 'em all!

Equip either model with Finco low-loss splitters (#3001 or #3003) and you can drive up to 16 sets in a master antenna system!

### FINCO MODEL #65-1 \$29.95 list

#### Outstanding Features:

- 350,000 microvolts maximum input with +8dB to each output • Maximum signal output of .85 volts in each of 4 outputs • Low noise 6HA5 premium tubes
- One 300 ohm input — 4 300 ohm outputs • Silicone diode rectifier for dependability • Flat response —  $\pm 1/4$  db per 6 mc channel • Ventilated perforated steel cabinet  $6\frac{1}{2} \times 3\frac{7}{16} \times 3\frac{3}{16}$ " • Metal enclosed to eliminate shock hazard — easy access for servicing
- Easy mounting and connecting • All fittings & brackets supplied • UL listed AC cord — 117 volts, 60 cycles • 100% test for all electrical characteristics

### FINCO MODEL #65-2 \$39.95 list

#### Outstanding Features:

- 400,000 microvolts maximum input with +8dB to each output • 200,000 microvolt input — 1 volt output per band • Low noise 6HA5 premium tubes • One 75 ohm input — 4 75 ohm outputs • Most compatible "F" type input and output fixtures • Ultra-flat frequency response and complete RF isolation • Ventilated perforated steel cabinet  $6\frac{1}{2} \times 3\frac{7}{16} \times 3\frac{3}{16}$ " • Metal enclosed to eliminate shock hazard — easy access for servicing • Easy mounting and connecting
- All fittings & brackets supplied • UL listed AC cord — 117 volts, 60 cycles • 100% test for all electrical characteristics

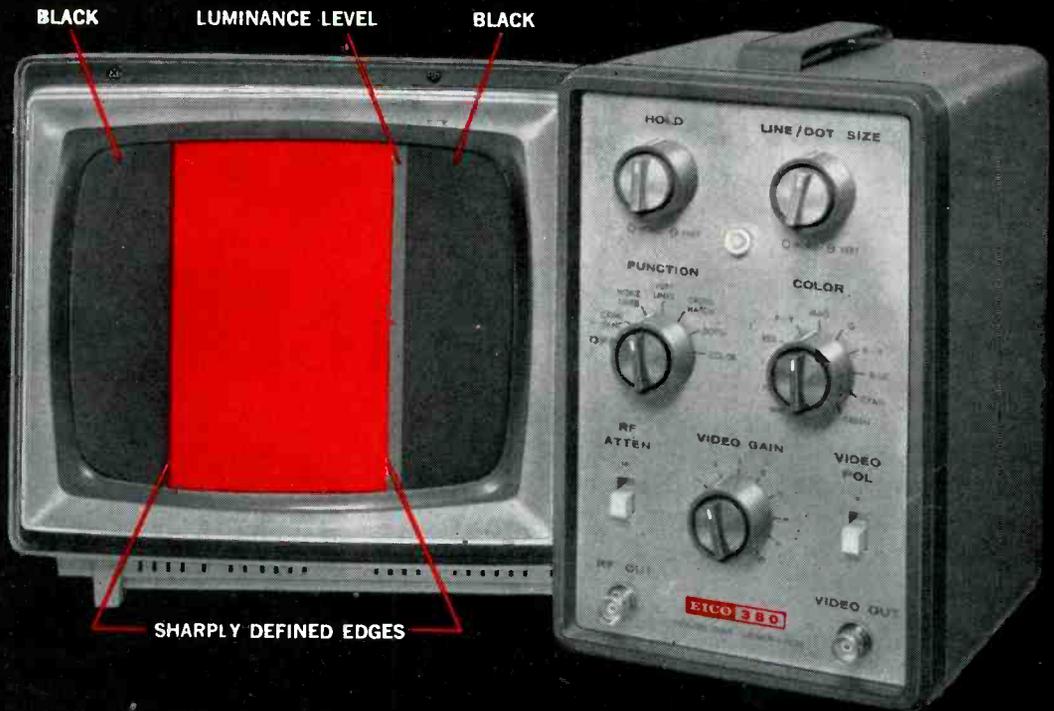


ALL FINCO PRODUCTS ARE ENGINEERED FOR COLOR!

## THE FINNEY COMPANY

34 West Interstate Street, Bedford, Ohio 44014  
Dept. 110

... for more details circle 117 on postcard



EICO 380's color signals (3 primaries, 3 complementaries) cover fully 60% of the screen: thus tell you MORE about the set's response — enable EXACT alignment.

# Now you can afford a True NTSC\* Color Generator

(NEW EICO ALL SOLID STATE 380 IS ONLY \$169.)

## Every pro knows

that the best generator to use to do the *best, fastest, most accurate* color servicing is the NTSC type. EICO is first to bring it to you at a serviceman price.

The 380 takes the risky guesswork out of color servicing — because it gives you all test signals *exactly* like the Color TV station. So now you can be *certain of exact* results — faster, easier, for more profits per day. You'll also quickly become known as the pro who makes sets "*come alive*" with brilliant *correct* color response!

Only EICO provides you with all these advanced engineering features at so low a cost: ■ **100% true NTSC\* full-field color signals**, including both chrominance and luminance exactly as specified for a Color TV station transmission. ■ **No "Gun Killers"** — Faster, easier use by feeding to the RF stage. You don't need to go inside the TV set to feed the color signal. ■ **Each true NTSC\* color signal covers fully 60% of the entire TV screen** (as compared to 1-inch from a rainbow generator) — this tells you a full, true picture of what's going on inside the set — all the way from the RF to the screen. ■ **100% solid state** (33 transistors). ■ **5 Individual switch-selected alignment patterns** for monochrome and color. ■ **Individual, switch-selected full-field color display.** ■ **Generates I, Q, R-Y, and B-Y signals** for demodulator adjustment, plus 7 standard color signals (3 primaries, 3 complementaries, plus black and white). ■ **Adjustable bar width and dot size** down to just visible for exact convergence. ■ **3 crystal-controlled oscillators** for true 3.58 MC color signal generation, pattern timing, and RF output. ■ **Drift-free RF output** (crystal-controlled Channel 3) and video output. ■ Conveniently compact: 8" high x 5" wide x 6" long. ■ Portable and light weight (only 4 lbs.) for easier field use. ■ Instant-on operation: time-saving, accurate, drift-free. ■ Excellent for field or shop. And *will not* become obsolete!

Why buy an old-fashioned semi-accurate non-NTSC rainbow generator when you can get all the extra benefits of a 100% TRUE NTSC COLOR GENERATOR for the same money.

See your EICO dealer today for a free demonstration.

## Unbeatable Value COMPLETE COLOR/BW TV LAB

With the 380 — plus just the 369 & 435 — you're ready for *anything* in Color/BW servicing: EICO 369 Sweep/Marker Generator gives easiest, fastest visual alignment of color or B&W TV and FM RF and IF circuits. Five sweep ranges from 3-220mc. Four marker ranges from 2-225 mc. Crystal marker oscillator. Post injection of markers. **\$99.95 kit, \$149.95 wired.**

EICO 435 Direct-Coupled Wideband Scope. DC-4.5mc with 3" flat-face CRT. Zener calibrator. Outperforms 5" scopes three times its price. **\$109.95 kit, \$159.95 wired.**

## How about FM-MX Stereo?

Just add EICO 342 FM-MX Signal Generator: Gives both composite audio and FM RF outputs. Inputs for stereo audio, critical A/B tests. **\$149.95 wired.**

\*The NTSC (National Television Systems Committee) color signal is based on the fact that each transmitted color is produced by an NTSC-defined relationship between a 3.58 MC reference and a 3.58 MC chroma modulated subcarrier, with each color having a standard NTSC brightness component. This is the basis upon which all color-TV broadcasters must operate. There are no separate rules for color-TV reception, or color test sets.

**EICO** EICO Electronic Instrument Co., Inc.  
131-01 39th Ave., Flushing, N.Y. 11352

ET-1

### Send me FREE:

- "Definitive Comparison of NTSC and rainbow generators FROM THE SERVICEMAN'S VIEWPOINT."
- 32-page catalog on 200 EICO best buys.
- Name of nearest dealer.

NAME.....

ADDRESS.....

CITY.....STATE.....ZIP.....

... for more details circle 113 on postcard



# WHAT'S SO GREAT ABOUT OAKTRON SPEAKERS

?

SUPPLYING  
ALMOST  
EVERY MAJOR  
MANUFACTURER  
OF RADIOS  
AND TV,  
OAKTRON  
HAS ONE OF  
THE WIDEST  
RANGES OF  
SPEAKERS  
ON THE  
MARKET.

THE  
DISTINCTIVE  
BLUE  
SPEAKERS  
FROM  
OAKTRON  
ALL HAVE  
TRUE  
ALUMINUM  
VOICE  
COILS

ALUMINUM VOICE COILS  
ELIMINATE WARPAGE FROM  
HUMIDITY AND OVERLOAD  
HEAT. YOU GET INCREASED SEN-  
SITIVITY AND LONGER LIFE. BETTER  
QUALITY MEANS BETTER RELIABILITY.  
BEST OF ALL, THEY COST NO MORE THAN  
PLAIN SPEAKERS. CHECK YOUR LOCAL DIS-  
TRIBUTOR FOR COMPLETE DETAILS OR WRITE

YOUR BLUEPRINT TO BETTER SOUND  
 **AKTRON**  
INDUSTRIES, INC.  
MONROE, WISCONSIN

## Japanese Radio

ELECTRONIC TECHNICIAN, without a doubt, is one of the most informative magazines I have ever read. I would appreciate it very much if you could send me the address of Standard Radio Corp., makers of or importers of a miniature Japanese, seven transistor radio, model "micronic Ruby SR-G430." I need a diagram and parts list.

M. A. RODRIGUEZ  
Hialeah, Fla.

• *Standard has moved recently. Their new location is 23-08 Jackson Blvd., Long Island City, N.Y.*

## We're Loaded He Says

As you know, many technicians come into this field every day and they do not have available information that your fine magazine has published over the years. I have just recently discovered your publication. After one issue of ELECTRONIC TECHNICIAN, I have received more valuable information than from six issues from other sources. But I wish there was some way to obtain the information from past issues. Maybe you'll put the best articles in book form some day.

RON HUSTON  
Good Hope, Ill.

## Needs Old Schematic

I have been receiving ET for about one year and find it to be very helpful. Perhaps a reader can help me locate a schematic for a Zenith all-band radio, model 6S152. This is a vintage model from the mid to late 30s.

ROBERT SPACHMAN  
Souderton, Pa.

## Likes Transistor Articles

I find your articles on transistor theory and circuits very informative. Every article on color TV is thoroughly studied.

PETE FEHR  
Red Deer, Alberta, Canada

## Metz Combo

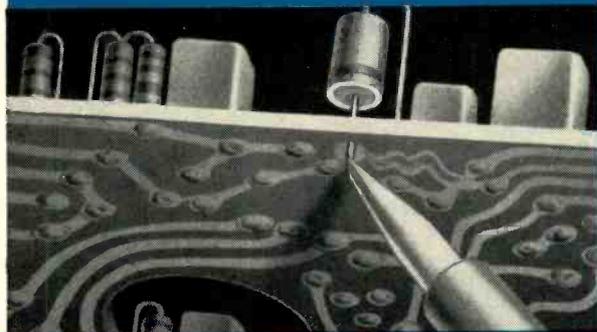
I need parts list and schematic for a Metz model 1706 stereo/radio combination. Can any reader help me with the address of the manufacturer? Your magazine is tops.

GERALD TYNER  
New York, N.Y.

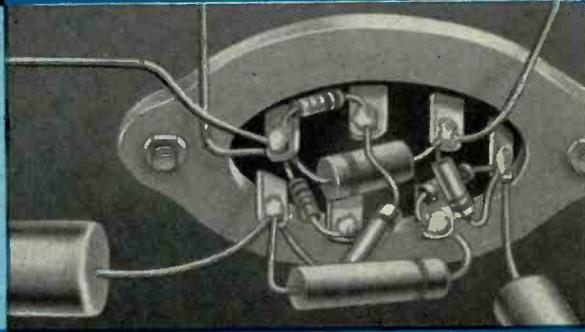
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# Did you ever...

... lift a wire-lead component from a printed wiring board for testing ?



... test or replace a capacitor or resistor on a crowded tube socket ?



## CUT YOUR TIME IN HALF with **KWIKETTE**\* Soldering Aids ... the revolutionary

connectors that practically let you do "in-circuit" component testing!



(six times actual size)

WIRE FLUX SOLDER

The KWIKETTE SOLDERING AID is not just another wire spring connector! It has a Copperweld wire inner core, an intermediate layer of flux, and an outer jacket of solder ... all you need is heat!

KWIKETTES are now included with ALL Sprague pre-packaged wire-lead service-type capacitors at no extra cost to you! Whenever you need replacements, insist on Sprague Capacitors from your parts distributor and you'll automatically get your KWIKETTE component connectors ... the biggest boon to the service technician since the soldering gun!

### FREE TRIAL PACKAGE!

10 free KWIKETTE Soldering Aids are yours for the asking! Simply send your postcard request to KWIKETTE Center, Sprague Products Co., 65 Marshall Street, North Adams, Mass. 01247. Don't forget to include the name of your Sprague Distributor.

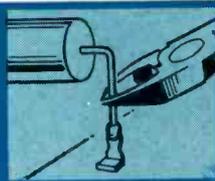
\* trademark

65-6107R1

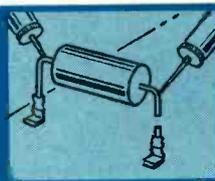
WORLD'S LARGEST MANUFACTURER OF CAPACITORS

JANUARY 1967

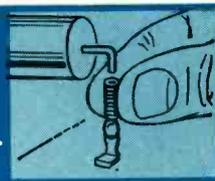
SNIP LEAD ...



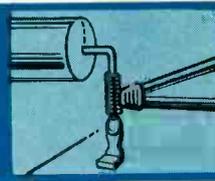
TEST ...



SLIP ON KWIKETTE ...



APPLY HEAT!



**SPRAGUE**<sup>®</sup>  
THE MARK OF RELIABILITY

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# The most experienced all-channel amplifiers keep getting better and better

Blonder-Tongue pioneered and developed the industry's first all-channel, all-transistor TV signal amplifier. That was more than two years ago. During that period this top-rated original design has brought superior all-channel and color reception to homes located in all areas.

Now, we are employing the better performing silicon transistor in these amplifiers. The result: 40% more gain in the lowband, 100% more in the highband, greater ability to handle strong signals without overloading and better signal to noise ratio. Color or black-and-white TV reception on any and all channels from 2 to 83 is better than ever.

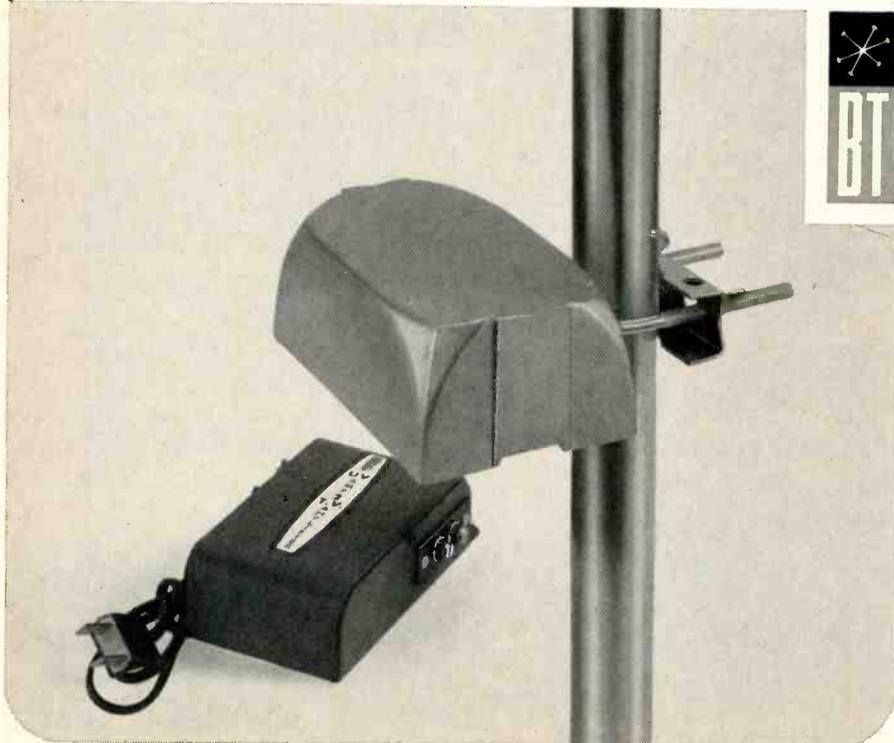
Only Blonder-Tongue gives you a choice of all-channel, color-approved amplifiers:

**U/Vamp-2**—mast-mounted, deluxe 2-transistor UHF/VHF amplifier. Weatherproof housing. Remote power supply. AC operated. Separate UHF and VHF 300-ohm inputs and outputs. Ideal for separate UHF and VHF antennas.

**Coloramp-U/V**—same as the U/Vamp-2 except it has a single UHF/VHF input. Matches the new all-channel antennas.

**V/U-All-2**—deluxe 2-transistor indoor UHF/VHF amplifier. Can drive up to 4 TV sets. Has built-in 2-way splitter with excellent impedance match and isolation for interference and ghost-free reception.

These UHF/VHF amplifiers are just one more reason to go all-channel from antenna to TV set with color-approved Blonder-Tongue TV products. Of course, we also have a full line of top quality VHF, VHF/FM and UHF-only amplifiers. Write for free catalog #74. Blonder-Tongue Laboratories, Inc., 9 Alling Street, Newark, N. J. *Blonder-Tongue, the name to remember, for TV reception you'll never forget*



... for more details circle 108 on postcard

## LETTERS TO THE EDITOR

### From Cover to Cover

We have subscribed to and read your wonderful magazine for many years. I read every copy from cover to cover and really enjoy most of the articles. Your current series on TV service business is well received and helps us to improve our own business. Many times I have wanted to write you to thank you for the fine job that you are doing, but just didn't seem to have the time. Keep it up.

CHARLES VARBLE JR.  
St. Ann, Md.

### Clough Bringle Generator

I need a coupling transformer, part CB-1389, for a Clough Bringle model 79B beat frequency audio signal generator. Can any reader tell me where I can get a replacement or if not, furnish technical information regarding the design of this transformer?

JOHN SKINNER  
Waverly, Ohio

### Semiconductors From A. to Z

Are tear sheets of your series "Semiconductors From A to Z" available? Our instrument technicians would like to study basic transistor theory and your article looks simple enough to understand.

JOSEPH J. KELLY  
Knolls Atomic Power Lab.  
Schenectady, N.Y.

• We are sending tear sheets of the article up to date.—Ed.

### Needs Old Tubes

I appreciate your fine magazine. I need two 35A3s and two 35D5s and can't seem to locate them around here. Can any reader help me?

HAROLD KOUTSKY  
Latrobe, Pa.

### Needs Old TEKFAX

I need some TEKFAX (Circuit Digests) prior to 1963 if any reader would like to part with them.

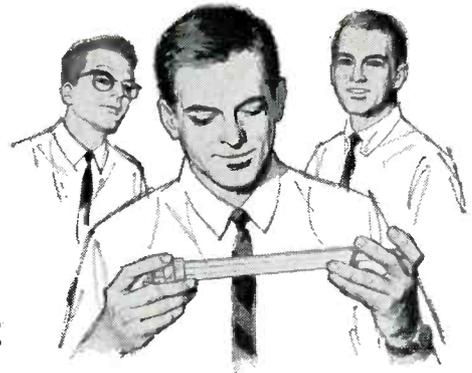
DAVID LONGO  
Stoneham, Mass.

### Shell Tube Tester

Can anyone help me get information on a tube tester chart for a Shell Electronics tube tester, model 18?

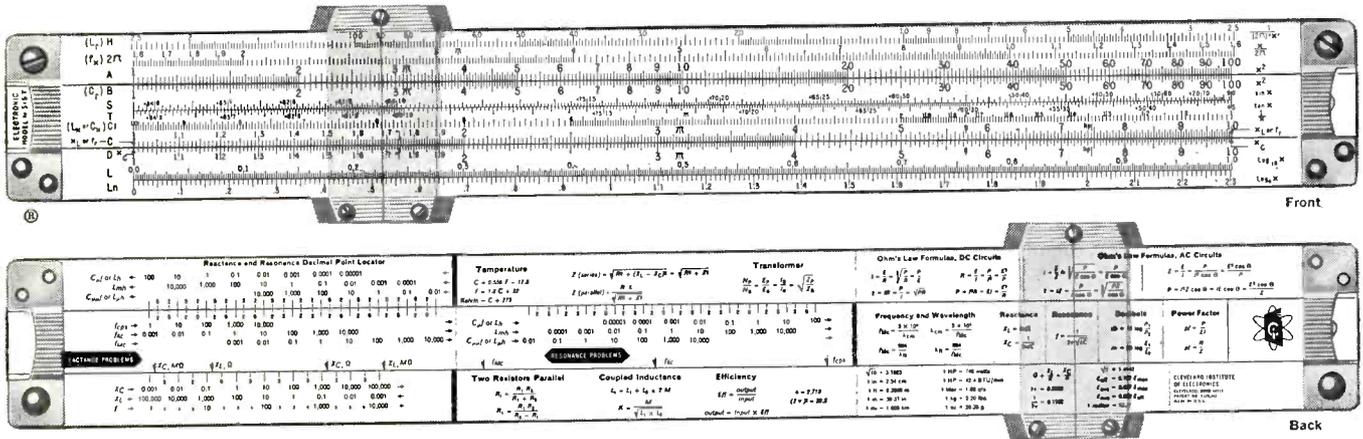
LARRY BORACCI  
Hyampon, Calif.

Be the man who's always  
first to say: "I've got  
the answer right here."



START USING THIS REMARKABLE

# ELECTRONICS SLIDE RULE



**SOME DAY EVERYONE** in electronics may have a slide rule like this. Till then, the man who uses one will seem like a wizard as he solves reactance and resonance problems in 12 to 20 seconds—without pencil and paper.

This is a professional slide rule in every detail, a full 10" long, made exclusively for Cleveland Institute of Electronics, to our rigid specifications, by Pickett, Inc. It can be used for conventional computation as well as special electronics calculations. All-metal construction assures smooth operation regardless of climate.

Handsome top-grain leather carrying case has heavy-duty plastic liner to protect slide rule; removable belt loop for convenient carrying. "Quick-flip" cover makes it easy to get rule in and out of case.

You also get four full-length **AUTO-PROGRAMMED™** Lessons, which teach you how to use the special electronics scales on the slide rule. These lessons have been carefully designed to meet the same high educational standards as the electronics career courses for which our school is famous. Even if you've never used a slide rule before, you'll soon whiz through the toughest problems with this CIE rule.

**Deliberately underpriced.** Many men in electronics have told us that this unique slide rule, leather case, and 4-lesson course easily add up to a \$50 value. But we have deliberately underpriced it at less than \$25. Why? Our reason is simple: we are looking for men in electronics who are ambitious to improve their skills...who know that this will require more training. If we can attract you with the low price of our slide rule and course—and impress you with its quality—you are more

likely to consider CIE when you decide you could use more electronics training.

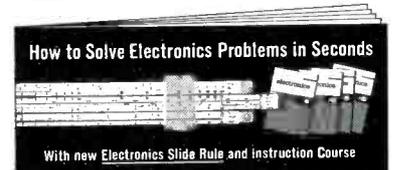
**Send for free booklet.** See for yourself why this amazing slide rule and course have made such a big hit with busy electronics men everywhere. No obligation, of course—just an opportunity to get in on the best offer ever made to people in electronics. Just mail coupon, or write Cleveland Institute of Electronics, Dept. ET-114, 1776 East 17th St., Cleveland, Ohio 44114.

**CIE Cleveland Institute of Electronics**  
1776 East 17th Street, Cleveland, Ohio 44114

MAIL THIS COUPON FOR **FREE BOOKLET**

**Cleveland Institute of Electronics**  
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Please send me without charge or obligation your booklet describing CIE Electronics Slide Rule and Instruction Course. **ALSO FREE** if I act at once: a handy pocket-size Electronics Data Guide.



Name \_\_\_\_\_ (please print)

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_



Accredited Member National Home Study Council  
A Leader in Electronics Training... Since 1934

ET-114

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## EDITOR'S MEMO

### Time to 'Take Stock'

About this time of the year, every good businessman sits down and reviews his operations for the past year. He also takes a long hard look at his assets and liabilities and compares the figures with those existing a year ago. He then drafts an operations-plan for the coming year—perhaps for two or more years.

According to the boys who have played around with the "Monte Carlo system," we all get about as many breaks in our favor, over a given period of time, as we do breaks against us. Our chances are about even. But the guys who succeed most are those who have used both the flow and the ebb periods in the tides of life to their advantage.

Home entertainment, two-way audio and radio communications equipment service-dealers and technicians have the tide-flow in their favor today. But only the wide-awake, the alert and aggressive ones are taking full advantage of the flow.

While the cost of food and household furnishings and many other things have gone way up in the past five or six years, the cost of comparable equipment handled by service-dealers has gone way down. A B/W TV set, for example, that cost \$100 six years ago, now sells for around \$83. A color set that went for \$600 seven years ago, sells for about \$500 today. Not only that, but technological improvements give the customer more convenience- and use-value for his money. And this is just one good selling point you can use advantageously to boost your sales and service to higher levels in the coming year.

We're riding on the crest of a color TV boom. There's a demand for more and better antennas. The demand for more radios, phonographs, tape players, tape recorders and other equipment is firm.

Sure, customers are more sophisticated and discriminating. They want more values and better service for their money. But the wise businessman is giving them more.

And there's a shortage of good technicians—especially in color TV. But, if you don't already have one or more apprentices in training, it is a must in your plans for 1967.

Yes, it's time to take stock. And if you find you're not better off today than you were a year ago, you'd better move fast and do something about it.



which  
capacitor  
?



AEROVOX



You can get your customer's TV cowboy programs back fast and sure with Aerovox-Brand exact replacement electrolytics. No guesses, no "maybes" and no chances with possible call-backs... Aerovox actually stocks 1212 twist prong AFH electrolytics—and this means off-the-shelf delivery—not "We'll have to get it for you" (someday).

Aerovox-Brand 'lytics are available in singles, doubles, triples, and quads. Both standard and COLOR CERTIFIED units feature ruggedized prongs and mounting terminals, high purity aluminum foil construction, improved moisture resistant seal, and continuous 85°C. operation.

Tame that cantankerous set with an Aerovox-Brand Electrolytic. Your Aerovox Distributor has a perfect fit—and he will deliver exactly what you want... fast! Ask him for the Aerovox Serviceman's catalog #SE-565—or ask us. We will be happy to send one your way.



**AEROVOX CORPORATION**  
DISTRIBUTOR DIVISION NEW BEDFORD, MASS.

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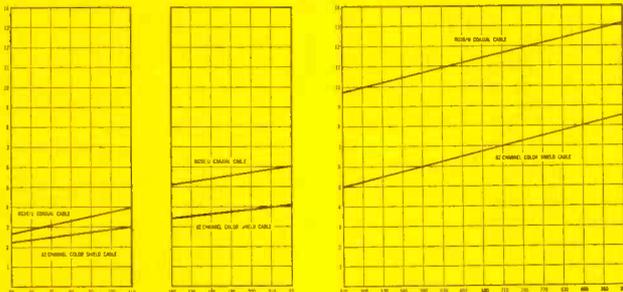
**NEW!**

# JFD<sup>®</sup> COLOR SHIELD-82 COAXIAL CABLEMATCH SOLVES THE 75 OHM INSTALLATION PROBLEM



If you've been vexed by the questionable need for a 300-75 ohm matching transformer at the antenna when installing coaxial cable, here's good news. The new JFD 75-ohm Color Shield-82 Coaxial Cablematch comes with the **matching transformer already attached** to the cable and ties directly to the 300 ohm output. Solves two big antenna installation problems: (1) When you want to use coaxial cable simply connect JFD Color Shield-82 (with the "built-on" transformer) directly to the JFD LPV antenna terminals—for minimum possible loss, and, (2) save time and money by having the transformer as part of the 75 ohm cable (instead of the antenna). No waste. No work. No separate parts or fittings to connect or disconnect. No losses through fittings and connectors. Simply beautiful!! Beautifully simple. Great for color, too!

Available in three lengths at your JFD distributors, complete **WITH ATTACHED 300-75 OHM MATCHING TRANSFORMER**

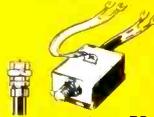
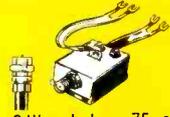


VHF INSERTION LOSS—JFD 82-CHANNEL COLOR-SHIELD CABLE VS RG59/U CO-AXIAL CABLE  
 UHF INSERTION LOSS—JFD 82-CHANNEL COLOR-SHIELD CABLE VS RG59/U CO-AXIAL CABLE

Whether you install antenna system in homes, motels, stores or multiple dwellings—rely on the new JFD 82-channel Color Shield-82 with pre-assembled matching transformer for the clearest pictures in sight—color, and black and white.

| Model    | Length  | List    |
|----------|---------|---------|
| CS82-50  | 50 ft.  | \$11.25 |
| CS82-75  | 75 ft.  | \$14.25 |
| CS82-100 | 100 ft. | \$17.00 |

TO INSTALL COLOR SHIELD-82 COAXIAL CABLEMATCH DIRECTLY TO TV RECEIVER, USE A JFD 82-CHANNEL COLORMATCH/SPLITTER MATCHING TRANSFORMER...

|   |   |   |
|---|---|---|
| <br><b>Model MT54</b><br>List \$3.50 | <br><b>Model MT56</b><br>List \$7.50 | <br><b>Model MT58</b><br>List \$8.95 |
| VHF, UHF, FM Indoor 75-ohm-300 ohm Matching Transformer. With coaxial cable "F" fitting.                                | 2-Way Indoor 75 ohm-300 ohm Matching Transformer with separate VHF and UHF outputs, plus coaxial cable "F" fitting.     | 3-Way Indoor 75 ohm-300 ohm Matching Transformer with VHF, UHF and FM outputs. With coaxial cable "F" fitting.            |
| Accessories Included<br>1 "F" Connector   | Accessories Included<br>1 "F" Connector   | Accessories Included<br>1 "F" Connector   |

ATTRACTIVELY PACKED ON CONVENIENT CLEAR-PAK CARD



TO INSTALL COLOR SHIELD-82 COAXIAL CABLEMATCH DIRECTLY TO A 75 OHM AMPLIFIER OR SYSTEM, USE A JFD SIGNAL SPLITTER...

|  |   |
|--|---|
| <br><b>Model SC42-75</b><br>List \$7.95 | <br><b>Model SC72-75</b><br>List \$10.95 |
| 75 ohm VHF/UHF/FM single input—75 ohm VHF/UHF/FM two-set signal splitter. Includes coaxial cable "F" fittings.             | 75 ohm VHF/UHF/FM single input—75 ohm VHF/UHF/FM four-set signal splitter. Includes coaxial cable "F" fittings.               |

See your distributor—or write for Form 6735.

**JFD ELECTRONICS CO.**  
 15th Avenue at 62nd Street, Brooklyn, N.Y. 11219  
 JFD International, 64-14 Woodside Ave., Woodside, N.Y. 11377 JFD Canada, Ltd., Canada  
 JFD de Venezuela, S.A., Avenida Los Haticos 125-97, Maracaibo, Venezuela



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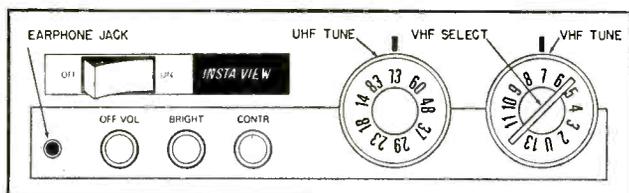
# TECHNICAL DIGEST

## GENERAL ELECTRIC

### Insta-View Circuitry — Circuit Description

The Insta-View circuitry featured in several G-E "C" Line TV models keeps the electron tube filaments in a pre-heated standby condition when the receiver is not being used. This provides instant viewing when the set is turned on instead of having to wait for the usual warm up period.

A special Insta-View switch is located on the front control panel. For normal receiver operation, this switch

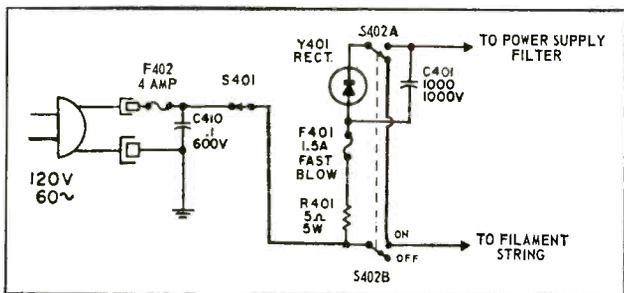


is left in the ON position and the receiver is turned ON and OFF with the main ac switch on the volume control.

For Insta-View operation, the ac power switch on the volume control is left in the ON position, and the receiver is then turned ON and OFF with the Insta-View switch.

From the schematic diagram we see that a DPDT switch (S402) is used to provide the standby condition. When the ac power switch (S401) is in an ON position, switch S402 provides a means of switching both the filament string and the rectifier output.

When in the OFF position, S402B removes the normal ac line voltage from the tube filaments while at the same time, S402A removes the rectifier output from the B+ power supply filter circuit and connects it directly to



the filament string, supplying a pulsating dc voltage to the tube filaments. The average voltage will then be much lower than the normal filament string voltage, but it is sufficient to maintain the tubes in a partially heated condition.

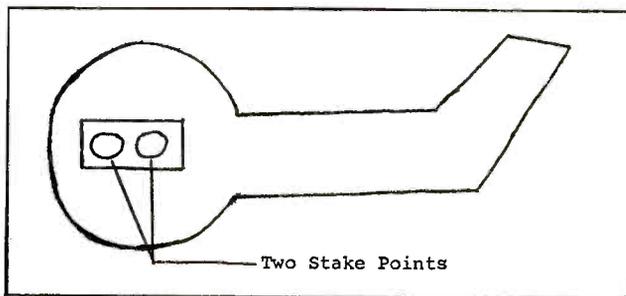
When the Insta-View switch on the front control panel (S402) is pushed to the ON position, the rectifier output is connected to the power supply filter circuit, supplying B+ voltage to the chassis, and the full ac line voltage is applied to the filament string.

The manufacturer recommends that the receiver be turned completely off if it is to be left unattended for an extended period of time. To turn the receiver off completely, rotate the OFF-VOL. knob fully counter-clockwise to the stop.

## Record Changer Balance Arm Shaft — Replacement

The balance arm shaft is now being supplied in two separate parts to eliminate the necessity of tearing the changer down for its replacement. This two piece balance arm shaft may be installed by using the following procedure.

1. Remove the balance arm.
2. Remove the defective balance arm shaft.
  - a. The damaged lever on the balance arm shaft may be removed with a pair of long nose pliers.
  - b. The balance arm shaft may then be pulled out from the top of the changer.
3. Install the new balance arm shaft in the same location that old one was removed from.



4. Turn the changer upside down and place a metal block or other hard object under the balance arm shaft. (The metal block will serve as an anvil.) A small block may be used to balance the changer in this position.
5. Place the balance arm foot on the balance arm shaft. With the end of the balance arm lever in its slot, the shaft must be oriented with its flat end facing the corner occupied by the tone arm island.
6. Remove the rubber bumper. Item no. 135.
7. A small center punch may now be inserted into the hole vacated by the rubber bumper, and the end of the balance arm shaft may be staked with the center punch and a hammer. A most effective stake may be accomplished by staking the end of the balance arm shaft in at least two spots as shown in the diagram.
8. Replace the rubber bumper and balance arm to complete the repair.

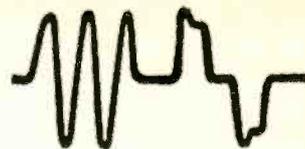
Replacement parts have reportedly been changed, and the balance arm shaft, part no. EA80X133, now supplied in two parts will bear the same part number as the previously cataloged one piece balance arm shaft.

## OLYMPIC

### TV Chassis CTC-20 — Up Dating Chassis and Service Hints

The following circuit changes will bring the CTC20 Chassis up to date, through run 16:

**To minimize background noise reduced by run 13:** Install a second 4.5MHz trap (L118, part no. CL35311) with a new 18pf capacitor (C152, part no. CCD18051)



## Choosing electrolytic capacitors for color TV



When you need to replace an electrolytic capacitor in a color television, it pays to select the best. Your customer has a lot of dough invested in his color set, and he won't settle for less than top performance. And his eye can see sub-standard performance in color that would go unnoticed in black-and-white.

Color TV is tough on electrolytics. Ambient temperatures run hotter, because of the greater number of tubes and resistors inside crowded cabinets. Ripple currents are higher, so the capacitor has to do a better job of getting rid of internally generated heat. Voltage ratings are higher, too; most electrolytics in color TV are 400 volts or higher.

It's no surprise that leading color TV makers are pretty darn particular about the electrolytics that they use as original equipment. They demand a true high-voltage, high-temperature, high ripple capacitor... not one that's simply made to sell at bottom price. And meeting these demands is the way Mallory got to be the top supplier of electrolytics for color TV. We're the guys who pioneered the 85°C capacitor, who have consistently increased ripple current capacity, and who have the reputation of leadership in high voltage ratings.

Here's our tip of the month. To save yourself time, get a copy of our new cross reference, "Exact Replacement Metal Can Electrolytic Capacitors for Color TV". It lists the original part number and the catalog number of the corresponding Mallory replacement for 38 leading color TV manufacturers. To save yourself costly call backs, use only the best... and that's one of the Mallory FP-WP series, made to original equipment specs. To get everything you need for color TV service, see your Mallory distributor. He stocks Mallory power resistors, circuit breakers, carbon and wire-wound controls and Discap® ceramic capacitors.

For a copy of the Color TV cross reference, ask your Mallory Distributor, or write to Mallory Distributor Products Company, a division of P. R. Mallory & Co. Inc., Indianapolis, Indiana 46206.

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in series with the trap, between the high side of the color control and ground. Adjust the trap for a minimum interference beat in color picture.

**For improved ventilation obtained by run 14:** Drill ventilating holes into the high-voltage cage cover.

**Run 15 was changed to prevent shifting of yoke:** Use Emery tape on each side of yoke ring, part no. PP35348.

**To prevent shifting of convergence yoke:** Add masking tape to the neck of the CRT under the convergence yoke.

**To increase brightness on all CTC20 Chassis:** Set the screen controls in proper relation to the bias switch: This is done by setting the bias switch at a minimum position and adjusting the screens to proper intensity. The bias switch then remains at the minimum position.

**To improve picture quality:** Add a 0.0022 $\mu$ f, 20% disc capacitor (C150, part no. CCD222M2) on the terminal strip adjacent to the contrast control ground lug.

**To sharpen picture detail:** Adjust the IF response, causing the picture carrier to fall at a 40 percent point on the IF alignment curve. This is done by realigning the second IF transformer (T206). Shops without alignment equipment can adjust the second IF transformer by turning the top slug counterclockwise  $\frac{1}{2}$  to  $\frac{2}{3}$  turns.

**To improve picture quality by run 16:** Put a jumper across C122 and R119 mounted on a terminal strip on the top center of the chassis, thereby shorting these two parts out of the circuit.

**To improve picture stability:** Brightness fluctuations that occur when the volume control is advanced beyond mid-position can be eliminated by connecting the screen grid of the 6AD10 tube to a +280v supply rather than the +140v supply. This is done by removing the yellow wire from points FF on the signal board and connecting a jumper wire from pin 10 of the 6AD10 tube (junction of C212 and FF points, which is the exposed lead going to the top side of the vertically mounted capacitor C122) located adjacent to the tube and the +280v terminal on the board. (This is a tall pin at the edge of the board that has a red lead attached to it.)

**To increase the brightness control range:** Bridge resistor R729 (a 100K  $\frac{1}{2}$ w resistor) with another resistor of approximately the same value. R729 is in series with the brightness control.

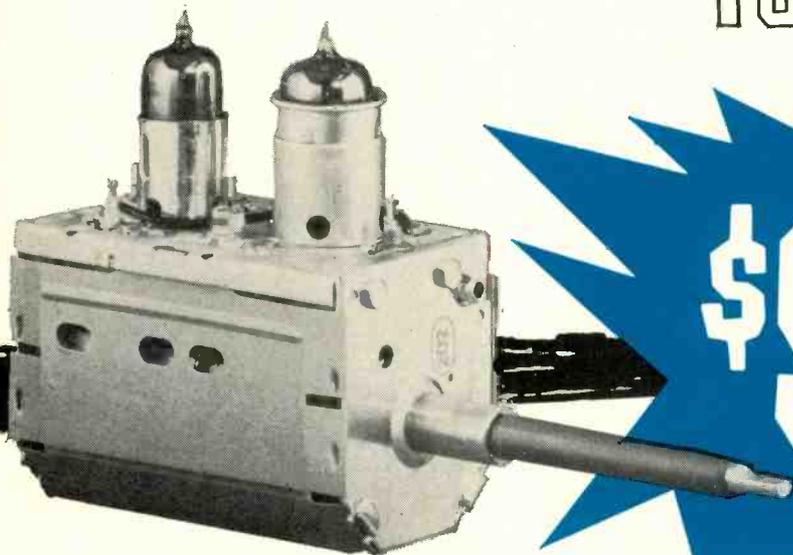
A kit is now available for modifying the CTC20 chassis up through run 15. This kit (part no. PP35398) contains one 4.5MHz coil (L118), one 18 pf capacitor, two pieces of Emery tape and one holder for capacitor C216 (part no. 1N32586).

**The manufacturer has suggested some service hints** should certain symptoms occur in current or older models of the CTC20 chassis. These suggested corrections are not required in every chassis and are intended only as a guide in the event of a failure.

Should a black vertical line appear near the right side of the raster, particularly on low UHF channels, the problem is probably Barkhausen oscillation and can be corrected if the 6KD6 tube is replaced.

The relay circuit breaker may be open, possibly after the unit has been shipped. This will occur if the degaussing coil has become shorted to the CRT shield. To correct this problem, the chassis and shield should be removed. Once the short has been located and insulated with tape, care

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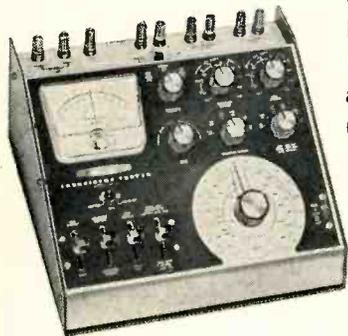
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## TECHNICAL DIGEST



should be taken to make certain the shield does not cut into the coil again.

The memory tuning action may become inoperative if the HF channel indicator knob has been forced on the shaft. This will cause the gears to mesh incorrectly. The problem can be corrected by removing the VHF knob from the front. Then, using long-nose pliers, inside the cabinet, pull the indicator knob slightly forward. After reassembling, the fine tuning knob should have a light "spring action" indicating that the gears are now properly disengaging when switching channels.

Lack of detail, weak or smeared color and a 920kHz beat in the picture may appear if the IF and traps are out of alignment. Before commencing alignment, check the position of capacitor C215, which is part of the 47.25MHz trap (L201). If it is leaning toward the coil or at an angle in the other direction, the over-all alignment will be affected. After it has been straightened up, an alignment job may not be necessary.

### WESTINGHOUSE

TV Chassis V2483-1-2-3 — Tuner Replacement

The manufacturer indicates that two different transistor VHF tuners were used for these chassis. If the original tuner is part no. 470V171D01/3, it can be replaced by another tuner having the same part number. If, the original tuner is part no. 470V168D01/3, however, a conversion kit is required for its replacement. A conversion kit, no. 110V003H23, must be ordered separately, and permits the installation of part no. 470V171D01/3 tuner.

In addition to installation instructions, the conversion kit includes one 756V105B01 switch, one 771V725A01 retainer and switch, plus five 760V056S04 screws, retainers and tuner mountings.

### PHILCO-FORD

TV Chassis 16JT26 and 16JT26A, IF Sensitivity and

#### AGC Overload — Servicing

The manufacturer has found that technicians are having difficulty servicing transistor circuits—particularly when low IF sensitivity and/or AGC overload is the apparent problem.

In servicing a TV receiver, it is helpful to know the normal range of voltages and wave shapes expected at different test points. In servicing any transistor equipment, it is well to review some precautions that should be taken:

- All transistors are voltage sensitive and in no case should voltages be applied to the transistor in excess of the voltage shown on the schematic.
- All voltages must be correctly polarized.
- The soldering iron should be electrically isolated from all circuits and care should be taken not to overheat semiconductors.
- Be sure that the ground side of all test instruments, including VTVM and scope, is firmly tied to the TV chassis before using the test probe.
- Any transistor's emitter-to-base junction is extremely sensitive to voltage. Use only the low ohm scale of the multimeter to measure the reverse re-

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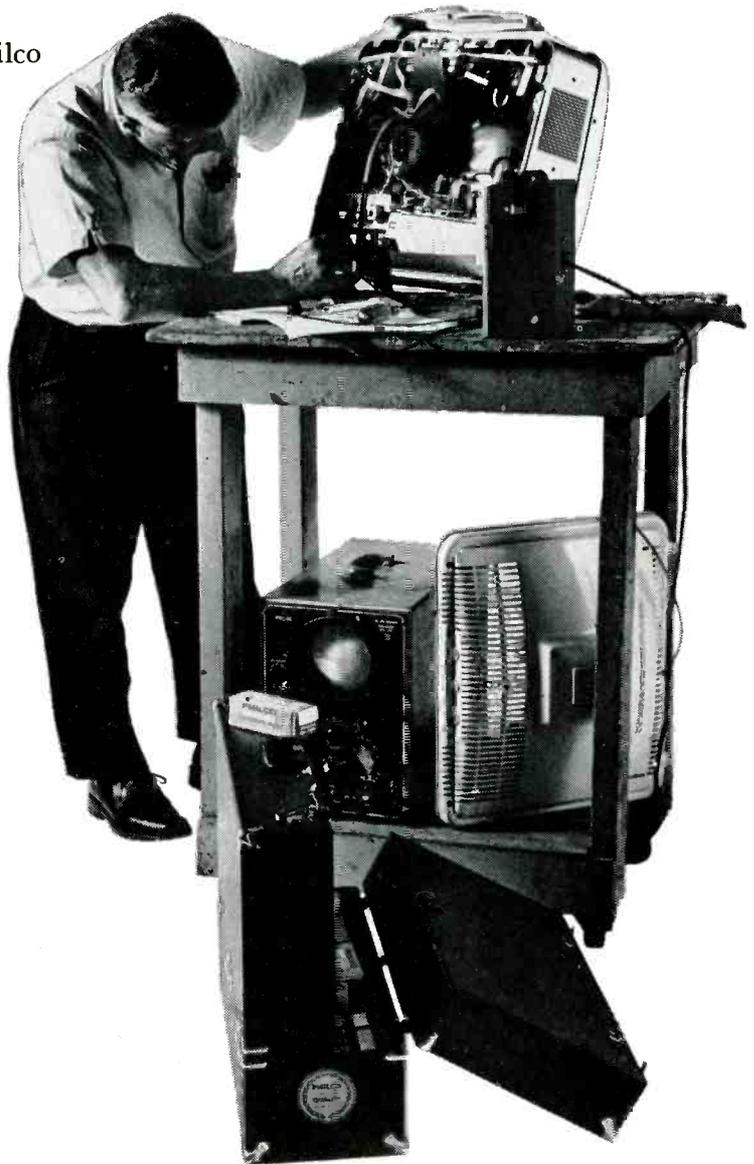
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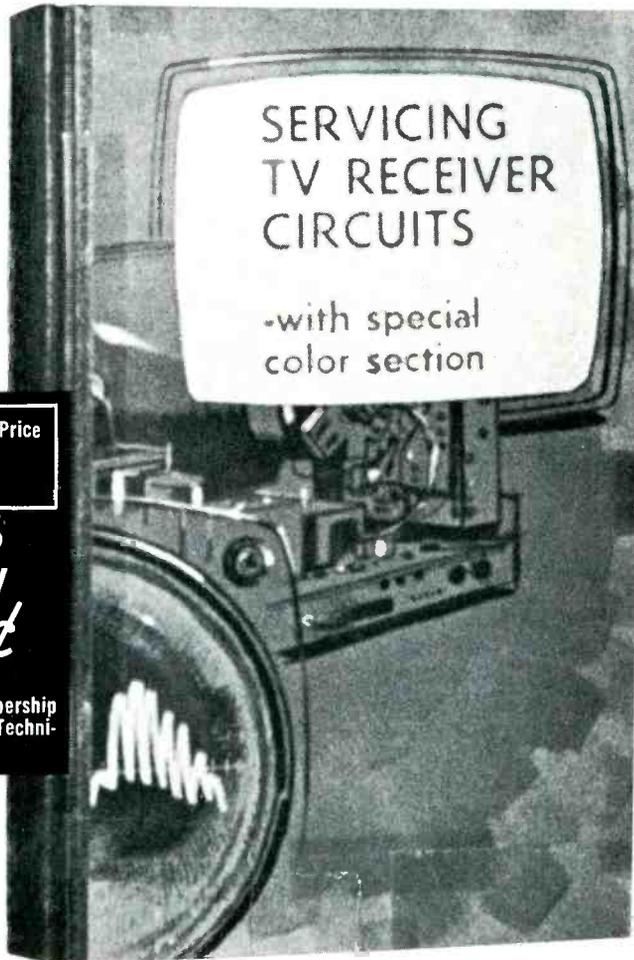
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Developing a Methodical Approach  
Troubleshooting Sync Circuits  
Vertical Sweep Servicing Tips  
Troubleshooting Noise Circuits  
Troubleshooting AFC Circuits  
Troubleshooting Synchronizing Circuits  
Troubleshooting Multivibrators  
Troubleshooting Horizontal Sweep  
Selecting Yoke Replacements  
Solving HV Flyback Problems  
Troubleshooting B+ Circuits  
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Eliminating Unwanted Oscillations  
Understanding Transistor Circuits I  
Understanding Transistor Circuits II  
Servicing Transistor TV Circuits

### COLOR SECTION:

Color Television Basics  
Basic Color TV Circuitry  
Understanding Chroma Circuitry  
Details of Color Sync Circuitry  
Details of Color Demodulation  
Blanking and Gating in Color Sets  
Color TV High-Voltage Circuits  
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Chroma Circuit Servicing I  
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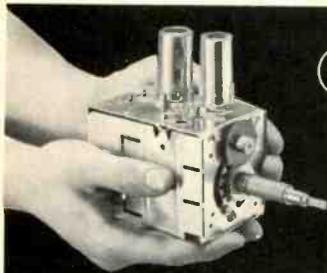
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## TECHNICAL DIGEST

istance. The reading in all cases should be infinite resistance.

The tuner AGC bias at lug M32 will vary from approximately +1.2v in fringe areas to +4.0v in a very strong signal area. Zerovolts or grounding this point will cut the tuner off. If it becomes necessary to apply an external bias to this point, do not use a negative voltage or more than a +5.0v supply or damage to the transistor or diodes may occur.

The voltage at the IF bias lug H24 will vary from +2.5v in a fringe area to approximately +5.0v with a strong signal. If it is necessary to apply an external bias to this test point, care should be taken not to apply any negative voltage or a positive voltage of more than +5.0v.

The normal peak to peak signal at the second detector lug M14 should be from 2.0v to 2.5v with approximately 30 percent sync.

TABLE I

| Suspect Component | Fault    | Picture Tube     | Test Point M32 | Test Point M24 | 2nd Detector P.P. Volts |
|-------------------|----------|------------------|----------------|----------------|-------------------------|
| C25 3µf AGC       | Open     | Oscillation      | +6V            | +5V            | 6 to 7V P.P.            |
| TV 16             | CE Short | White Raster     | +1.2V          | +3.3V          | 0                       |
|                   | CE Open  | White Raster     | +1.2V          | +3.3V          | 0                       |
| TV 17             | CE Short | White Raster     | +5.0V          | +6.0V          | 0                       |
|                   | CE Open  | Dark Grey Raster | +1.2V          | +3.3V          | 6 to 7V P.P.            |
| TV 18             | CE Short | White Raster     | +6.0V          | +6.3V          | 0                       |
|                   | CE Open  | Dark Grey        | +1.2V          | +3.3V          | 6 to 7V P.P.            |

| Input Signal   | Picture   | AGC RF        | AGC IF    | 2nd Det. Output | Possible Causes  |
|----------------|---|---------------|-----------|-----------------|--|
| Strong or Weak | White No video                                  | +5 to +6      | +6V       | 0               | TV 17 or 18 CE short, video tube cut off   |
| Strong or Weak | White No video                                  | low +1.2V     | low +3.3V | 0               | TV 16 open or cut off  |
| Strong         | Grey, little or no video                        | low +1.2V     | low +3.3V | Approx. 7.V     | D1 open D2 open or shorted. TV 17 or 18 cut off. This type would appear normal under fringe conditions |
| Strong         | Overloaded                                      | Nearly normal |           | Over-loaded     | TV 16 partly defective, 2nd Det. diode D5 partly bad (low rev. R) last I.F. (L5) mistuned appreciably. |
| Strong         | Excessive contrast or grey with little contrast | Nearly normal |           | High            | D2 low in rev. R   |

Table I can be used as a guide when it is suspected that one of the transistors, diodes or capacitors listed have failed.

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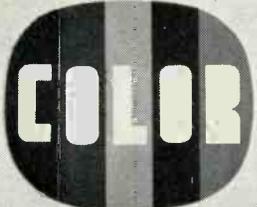
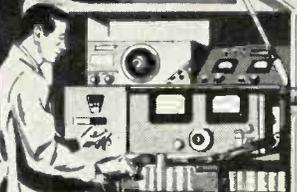
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Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

## TECHNICAL DIGEST

### MAGNAVOX

Color TV Chassis T911/T918/T919/T920—Color Sync Problems

Either the color killer detector diodes, CR701A & CR701B or the color phase detector diodes, CR702A & CR702B, can be the cause of intermittent loss of color sync, poor color sync or in some cases, even loss of color. These diodes are specified as matched pairs, which means that they have identical characteristics. If one of the diodes should suffer a change in characteristics, operation of the circuit will be impaired. The usual resistance checks will not be satisfactory in determining if the suspected diode has changed characteristics. If you suspect that either the killer detector or phase detector are at fault, the following check is suggested:

Connect a color bar generator to the receiver and set it for a normal color bar display. Remove the 3.58MHz oscillator tube, V708, and ground the junction of R756A and R756B in the color killer detector circuit. Under these conditions measure the dc voltages developed across each diode to ground with a VTVM. Check the phase detector diode first and compare the voltage readings. On a typical receiver the cathode of CR702A measured +53v and the anode of CR702B measured -56v. The polarity of the voltages are opposite, but we are concerned with the difference in amplitude which in this case is 3v. Voltages on CR701A and CR701B measured +55 and -55v respectively. These readings are satisfactory since as much as a 10 percent difference is within allowable tolerance. In other words anything more than a 5v difference in this case would indicate that the diodes should be replaced.

The value of the voltages measured at these points will vary from set to set and will also depend on the level of the burst signal as supplied by the signal source. If the burst level is low the voltage readings will also be lower. The important point is the difference (if any) between the voltages measured across each of the diodes. Under ideal conditions there should be no difference.

If either the killer or phase detector causes poor color sync, replace the matched pair of diodes. Do not replace just one diode. These are stocked as matched pairs under Part No. 170733-1.

### GENERAL ELECTRIC

Model 11R61 Radio—Incorrect Printing on Cabinet Back

Some model 11R61 radios have been shipped from the factory with an incorrect tube chart on the cabinet back.

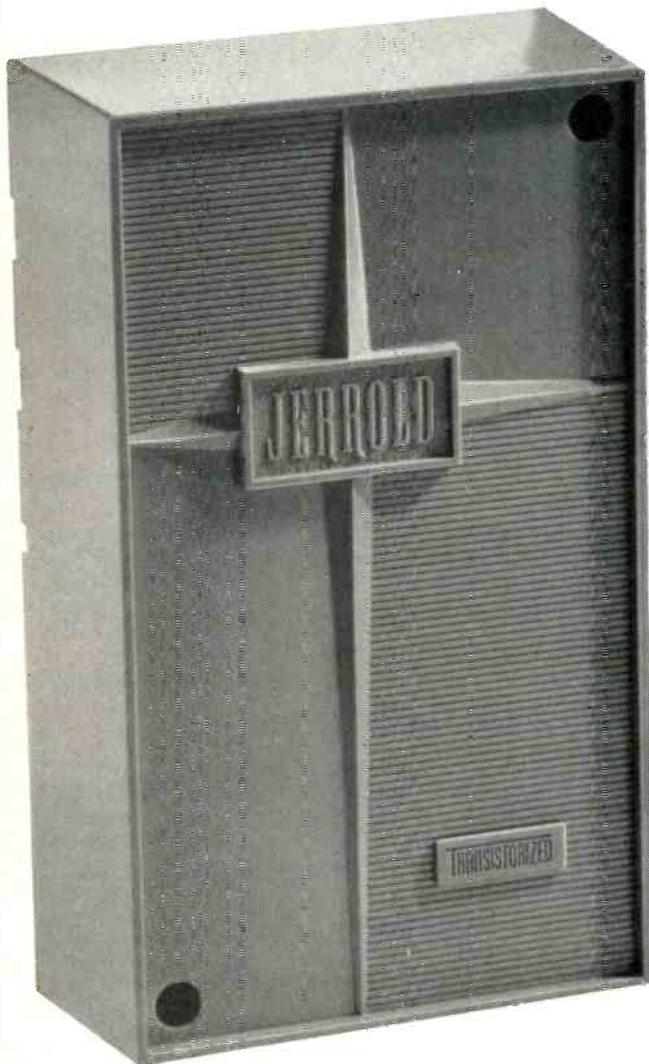
The set is equipped with a 50C5 tube; on some sets, the tube chart shows a 35C5.

#### MOVING?

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

# Going to profit here?

# Then profit here.



82 Channel TAC-4  
List Price \$79.95

VHF Only Model TC-88  
List Price \$39.95

## New Jerrold 82 Channel Coloraxial Home System makes perfect sales mate with Color TV Antennas

Look around you. Every home—every new housing development—is a potential profit-making sales spot for you and the TAC-4 Home Master TV System. Here's why:

*TAC-4 makes good color TV go a long way.* Every color TV set needs a top-grade antenna for good reception. TAC-4 makes this good reception possible anywhere in the house by providing extension antenna outputs in various rooms for portable TV and FM sets as well as extra sets. *You can tie-in a TAC-4 with every antenna sale.* And don't forget, it's a handy sales feature that housing developers like to use to help sell a home.

*TAC-4 handles all 82 TV channels* (color and black and white) as well as FM. It's the industry's *first* amplified coupler that can handle all present and future channels. Just connect the antenna to the input

and then connect four or more sets to the outputs.

*TAC-4 is easy to install.* Coaxial inputs and outputs make connections simple. Coaxial cable can be run right along with other electric wires—without interference with the signal. And cail backs are practically unheard of because the amplifier is completely solid-state.

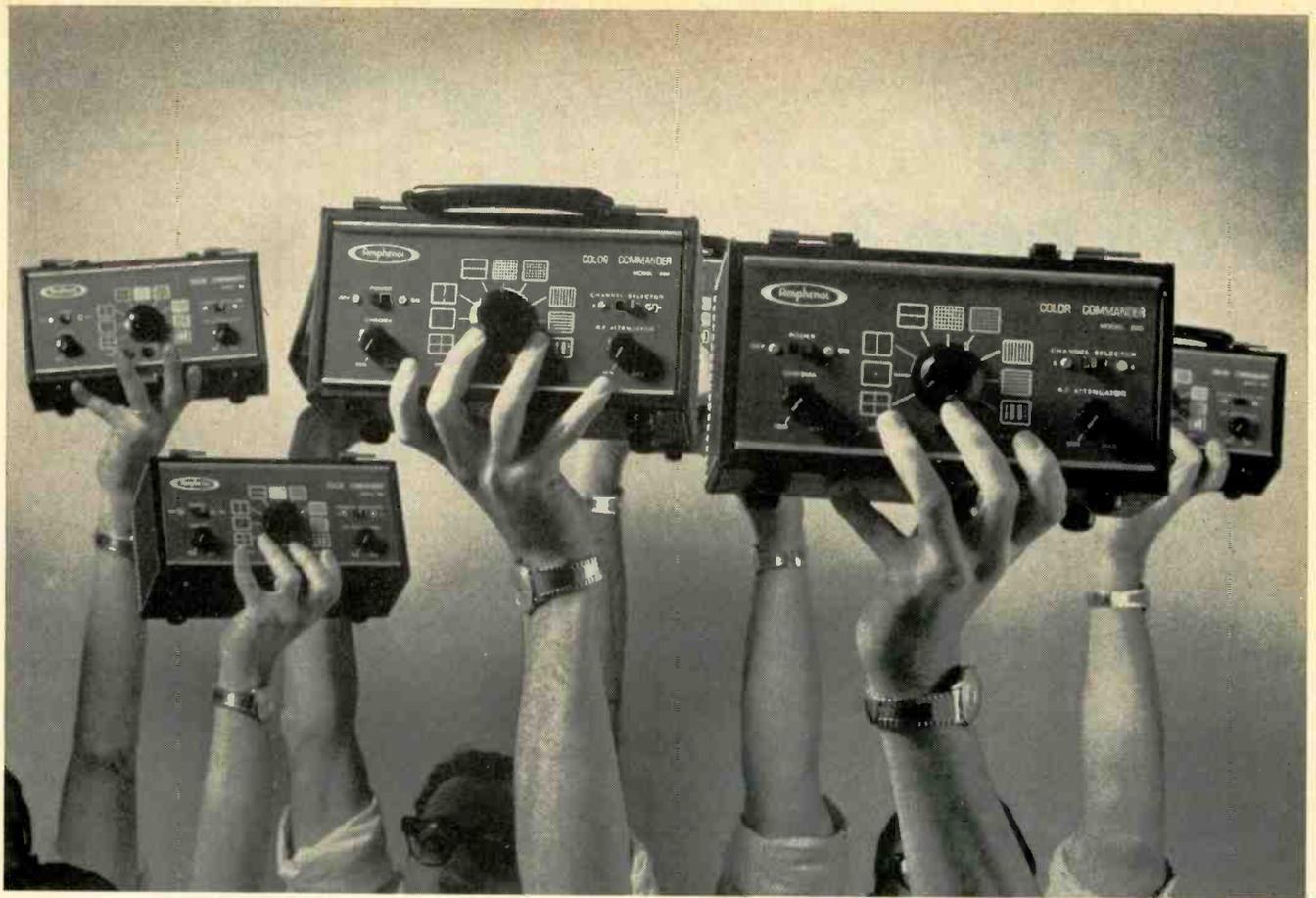
*TAC-4 pleases customers.* It's the first truly professional installation for assuring better TV and FM reception anywhere in the house. It's the superior amplifier-coupler to sell with any TV set or antenna such as the Jerrold Pathfinder series. Sell them together. Customers get top reception. You get top profits.

For more details, see your distributor.

# JERROLD

DISTRIBUTOR SALES DIVISION  
401 Walnut St., Phila., Pa. 19105

... for more details circle 121 on postcard



## Suddenly, everyone's a Watch Watcher!

And for a good reason. Service dealers found out we were right when we said Amphenol's Color Commander color bar generator would save them enough time for two or three extra service calls a day.

What's it all about? We're so sure we can save you as much as 18 minutes a call, we're including a \$10.95 Timex watch with every Color Commander purchased—just so you can prove it yourself.

And if the Color Commander doesn't save as much time as we say, return it within 10 days and keep the Timex watch with our compliments.

What makes us so sure? Amphenol's exclusive technique of color alignment which features a:

1. Single crossbar to immediately center the raster.
2. Single dot for fast, consistently accurate static convergence.
3. Three-bar color array to isolate your working bars—the 3rd, 6th and 9th.

### Join the Watch Watchers

If you take advantage of this limited-time offer today, your Color Commander can be paying for itself in extra income tomorrow. For the name of your nearest Amphenol distributor, contact your nearest Amphenol Sales Division office or write Dan O'Connell, Head Watch Watcher, Amphenol, Box 134, Broadview, Illinois 60153.

### Watch Watcher Offer

With every lightweight, compact, completely solid-state Amphenol Model 860 Color Commander we'll include a \$10.95 Timex for you to time your savings. If the Color Commander doesn't save you time, return it within 10 days and keep the watch with our compliments.

**\$169.95\***

Model 860AC \$20.00 higher\*

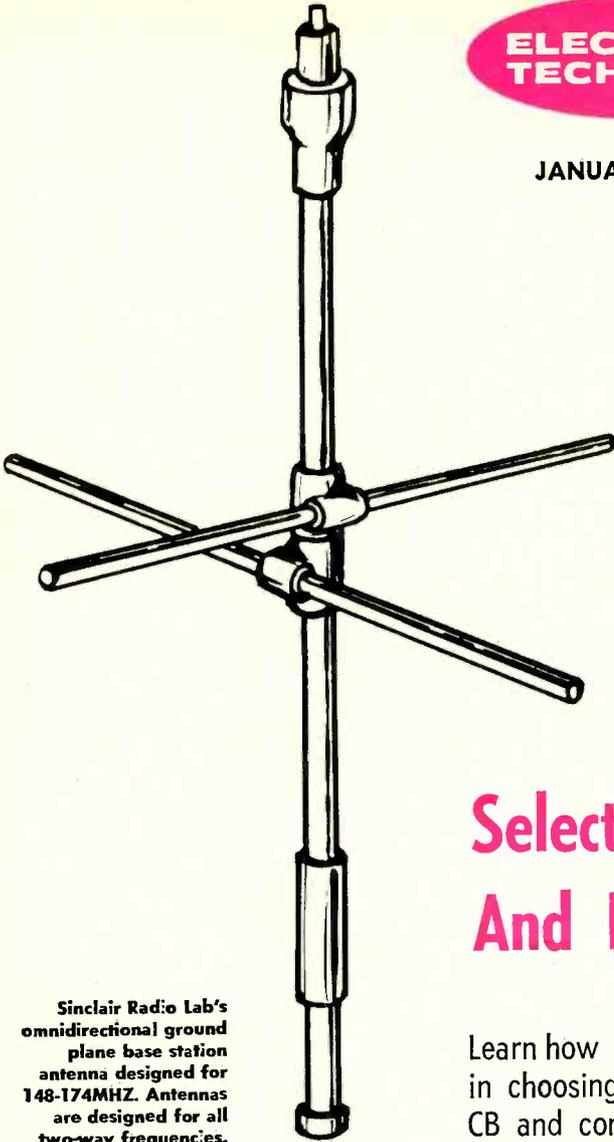
\*Suggested resale prices



**AMPHENOL**

... for more details circle 102 on postcard  
ELECTRONIC TECHNICIAN

JANUARY 1967



Sinclair Radio Lab's omnidirectional ground plane base station antenna designed for 148-174MHZ. Antennas are designed for all two-way frequencies.

## Selecting 2-Way Mobile And Base Station Antennas

Learn how to do a better job in choosing a radiator for your CB and commercial-grade customers

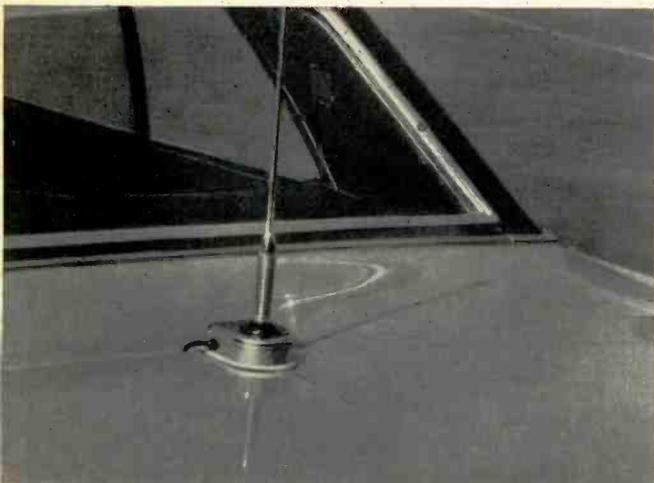
■ Some communications technicians, for various reasons, do not consider all factors involved when selecting the antenna to be installed for a two-way equipment user. But this is not entirely the fault of the technicians concerned.

Not a few manufacturers, for example, work up costly technical material covering their products which ultimately ends up by collecting dust on distributor counters, or finds its way into the "dead-end" hands of two-way equipment users or do-it-yourselfers. The men who *buy* and *install* the antennas for the user seldom see this valuable material. And much of the "battered-up" material that goes directly to the user, written in gobbledygook

terms, serves little or no purpose except to create false expectations and confusion in the two-way equipment user's mind. It is the communications service-dealer and his technicians who decide *what* type antenna to install under particular circumstances.

Imagine, if you can, a CB user, a busy country doctor, for example, approaching his service-dealer and asking for a "whizbang-type, tail loaded woofgoof" antenna to replace the busted one on his car. The "doc" produces a piece of literature which speaks directly to the CB user and it states in flowery terms that the antenna is the hottest thing on the market today. The flowery claims lead the "doc" to

C/P (Shakespeare Co.)  
style 173 mobile antenna.

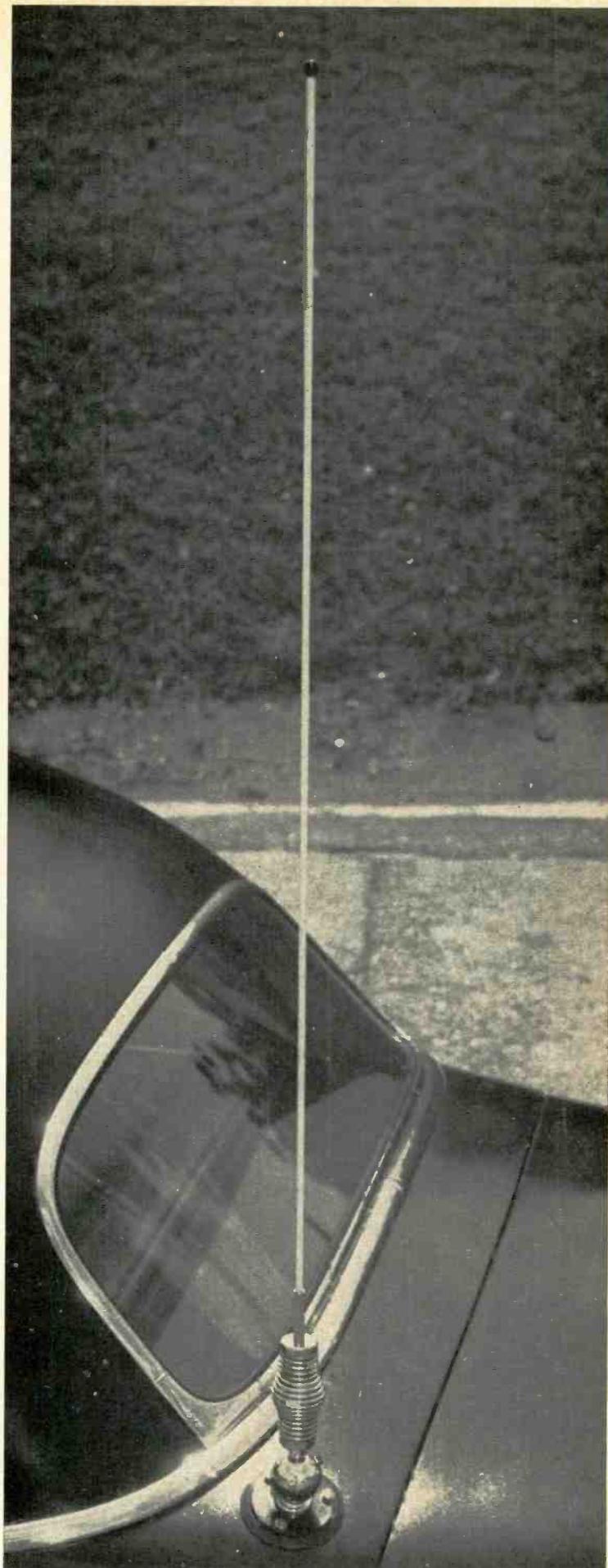


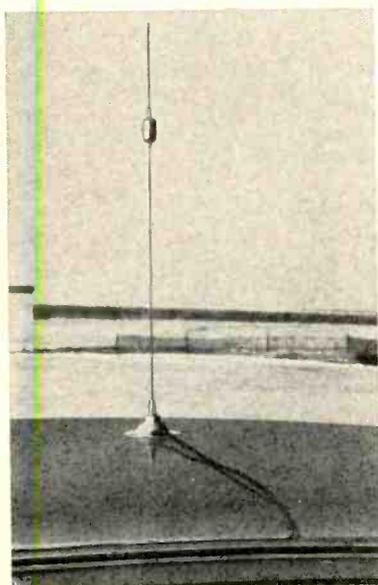
E-Z Mobile Antenna Mount  
Co.'s mounting base used  
on car trunk.

## Antennas . . .

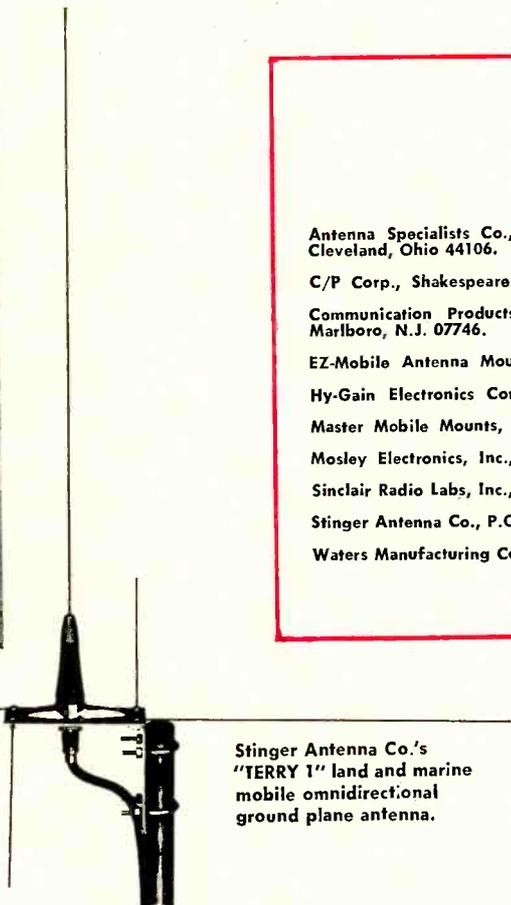
believe that the antenna will guarantee contact with his office nurse from anywhere in five counties—so he thinks he needs one. "There's nothing to install, nothing to adjust. It won't rust, creep, bend or bofflewah and it will literally snake its way through protruding brush, overhanging tree branches, etc.," the literature explains. But even the bulk of these confusing claims are valid because manufacturers have no way of knowing the particular conditions under which their products will be used. Here, then, arises the need for qualified technicians to do the selecting and installing. The literature addressed to the user is simply a waste.

You know, then, what kind of antenna the "doc" will get. It will





HyGain Electronics Corp.'s TQRMB mobile CB antenna has magnet in base to hold antenna atop



Stinger Antenna Co.'s "TERRY 1" land and marine mobile omnidirectional ground plane antenna.

### Table I

Antenna Specialists Co., Div. of Anzac Industries, Inc. 12435 Euclid Ave., Cleveland, Ohio 44106.

C/P Corp., Shakespeare Co., RFD 3, Columbia, S.C.

Communication Products Co., Div. of Phelps Dodge Electronic Products, Marlboro, N.J. 07746.

EZ-Mobile Antenna Mount, Inc., P.O. Box 277, Algonac, Michigan.

Hy-Gain Electronics Corp., 8587 N.E. Highway 6, Lincoln, Neb. 68501.

Master Mobile Mounts, 4215 W. Jefferson Blvd., Los Angeles, Calif. 90016.

Mosley Electronics, Inc., Bridgeton, Mo. 63042.

Sinclair Radio Labs, Inc., 523 Filmore Ave., Tonawanda, N. Y. 14152.

Stinger Antenna Co., P.O. Box 10605, Dallas, Texas 75247

Waters Manufacturing Co., Wayland, Mass. 01778.

be the kind your communications technician decides to install to give your customer the best possible service—based on the technician's experience and understanding of the particular customer's needs and requirements. And most two-way communications equipment users always leave this to the judgment of the men who have served them well in the past—usually through top-notch TV-radio service. But, as previously indicated, some technicians are not technically prepared to do this. They do not consider the primary technical factors involved.

#### Technical Factors

It requires considerable study of antenna basics, a knowledge of various designs and careful reading

of technical-data prepared by antenna manufacturers, before a two-way antenna—either mobile or base station—can be intelligently selected. Additionally, you'll need to know all details regarding a particular customer's needs and requirements.

As most technicians already know, the antenna is the determining factor as far as effective transmission and reception is concerned. We know—especially those of us who have "swished" a VFO across various ham bands for years—that a 10w output connected to a high-gain antenna will work rings around a "California kw" which is tied to an aluminum clothes-line or equivalent type antenna. It is the same with two-way radio—whether CB

or regular commercial-type equipment, whether base station, land or marine mobile. The place to increase communications range and efficiency is in the antenna—not in the final amplifier—because this is limited by law.

Field information received from a wide variety of sources over a period of years indicates that poor antennas or improper installation of antennas account for most of the radiation inefficiency experienced by CB radio users. Most, but not all, of this radiation inefficiency arises because of confusion created in the public do-it-yourselfer mind regarding the nature of CB radio.

Effective radiated power (ERP) averaged around 2.5w in the field cases studied. A good 5w CB trans-

## Antennas ...

mitter, properly loaded to a well-designed antenna, is good for a lot more ERP. And a well-designed base station antenna can boost 3.5w output power to upward of 35 effective watts. There're more-watts-per-dollar in antennas than in transmitters.

We cannot cover antenna basics in an article of this length. A number of easily obtainable books cover antenna fundamentals in detail, and articles dealing with two-way antenna fundamentals have already been published. (One, for example, is "Base Station and Mobile Antennas," ELECTRONIC TECHNICIAN, January 1963.)

Therefore, we assume that you are already fully acquainted with various antenna designs used for two-way communications — land and marine—mobile and base-station types. This knowledge must include the essential design details of quarter-wave whips (top, center or base-loaded), coaxials, ground planes, multi-elemented beams, broadbanded yagi-types, corner reflectors, etc. It is also necessary to know the characteristics of each antenna type and their design variations. Basic designs are limited but variations seem to go on forever. If you need this information it can be obtained from the manufacturers listed in Table I.

Now, let's look at some specific factors involved in antenna selection.

We are concerned with both electrical and mechanical factors when selecting antennas for particular two-way applications. Some important electrical characteristics include forward or over-all gain, input impedance, front-to-back ratio

specified in db, VSWR and bandwidth. Some mechanical characteristics include the type of material used in the antenna's construction, length or over-all dimensions, wind-loading data, weight, etc. Whether the antenna is unidirectional, bidirectional or omnidirectional is another factor to be considered in base-station antenna installations. In almost all cases, omnidirectional antennas are used in land and marine mobile installations.

The coverage desired by a base station will determine the type of antenna directivity required. One base station, for example, may require equal coverage in all directions. In this case, an omnidirectional type antenna would be used. Another base station located near the center of a narrow city which stretches along a lakeshore or river bank may require a bidirectional type radiator. A base station located near the edge of a city may require a unidirectional antenna or one having a cardioidal pattern like that shown in Fig. 1.

Most manufacturers of good two-way communications antennas furnish horizontal field-strength patterns with their antenna specifications. Unidirectional and bidirectional patterns are shown in Fig. 2. A typical horizontal radiation pattern of a base-loaded vertical mobile whip antenna mounted on a flat surface or a vehicular rooftop, is shown in Fig. 3. This pattern will be altered if the antenna is trunk or bumper mounted.

Some antennas are available which are designed for "switchable" directivity. And other special types are designed for side-mounting on existing or new steel masts. ■

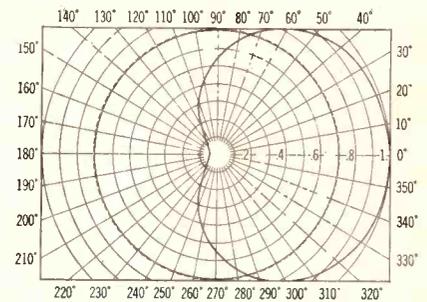
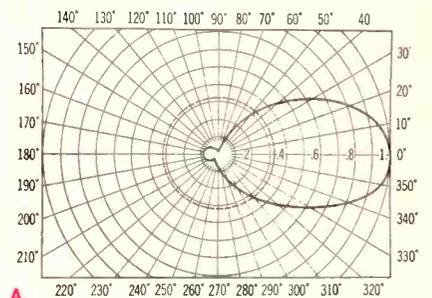
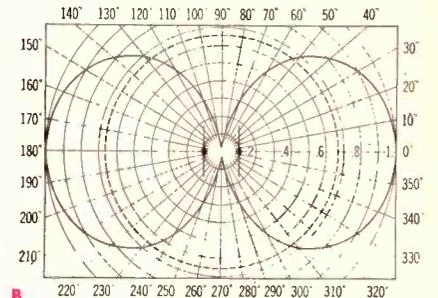


Fig. 1—Horizontal field strength pattern of a coaxial cardioid antenna compared to a top-mounted vertical dipole shown in dotted circle. Antenna gain is 3db. Courtesy of Communication Products Co.



A



B

Fig. 2 (A)—Horizontal field strength pattern of a dual yagi unidirectional antenna. This particular antenna has a 9db gain and consists of two 3-element yagi's fed inphase and spaced 1/2 wave apart. (B)—Horizontal field strength pattern of an end-fire monopole bidirectional antenna. Courtesy of Communication Products Co.

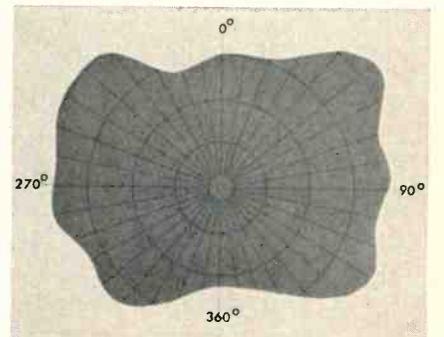


Fig. 3—Typical horizontal radiation pattern of a CB-type base-loaded vertical mobile whip antenna when flat surface or vehicular rooftop mounted. Courtesy The Antenna Specialists Co.

# The Growing Pains of CB Radio

## A Report

Will the citizens radio service be saved or will it continue to degenerate into a huge group of 'hobbist party lines?'

■ The Class D citizens' band area of two-way communications has shown steady growth since it was authorized by the Federal Communications Commission late in 1958. But this growth has been accompanied by some intense pains. And it is obvious that much of the pain still remains.

This fact is clearly indicated by a recent report from the Citizens' Band Section of the Electronic Industries Association (EIA) which said that "it is supporting the efforts of Chairman Rosel Hyde, of the Federal Communications Commission, to eliminate FCC rule violations by manufacturers and users of citizens' band transceivers." Some manufacturers and distributors have been guilty of circulating misleading and unethical advertising material directed to the general public. But a ray of hope for alleviating some of CB radio's growing pains does appear on the horizon. Let's explore the EIA move a little closer.

As reported by EIA, FCC Chairman Hyde cited the problem in a letter sent to approximately 90 CB equipment manufacturers. EIA

asked the commission to defer action until its CB Section could study Hyde's letter.

The EIA also reported that James E. Barr, FCC Chief of Safety and Special Radio Services, attended its fall conference at San Francisco in October 1966 and said that "Commission Chairman Hyde's letter was aimed at soliciting industry cooperation in supporting rules governing CB operators."

According to the EIA, the letter pointed out that "some manufacturers encouraged user violations in advertisements claiming that (1) a particular transmitter has capability beyond the 23-channel legal limits; (2) that power may be increased beyond the 5-w limit; (3) that the unit may be used in more than one radio service; (4) that the unit may be switched to a low-power, unlicensed service."

EIA's CB Section admitted that such advertisements had appeared, but told Mr. Barr that known violators had indicated the practice would be discontinued.

EIA's CB Section pledged an "affirmative approach" to the potential user in advertising and

through distribution of "dos and don'ts" literature to purchasers of CB equipment and encouragement of salesmen to provide guidance in the proper use of the equipment. It was noted that 30 representatives of 16 CB equipment manufacturers attended the EIA CB meeting.

#### Other Sources of Pain

This all sounds encouraging, but what about the tens of thousands of CB-station licensees who still operate on the Class D CB bands as "hobbyists," using the bands as if they were amateur radio bands? What about do-it-yourselfer type newsstand magazines (where some CB manufacturers still advertise their wares) who still publish articles and other information which suggest in many subtle ways that CB radio is in the "hobby" area? And what about "CB Clubs" whose very existence promote the hobby-concept of CB radio? (We are not referring to those clubs organized to assist in Civil Defense, to aid motorists, etc.) The legitimate CB user is interested only in the communicating facilities of his equipment. It has less technical, social or other significance than his car radio, home TV or Hi Fi set.

There is at least one publication now in existence which, ostensibly, is devoted to the *user* of CB radio equipment. It claims to be a CB publication devoted to two-way radio users! ("Two-way radio" covers a lot of territory.) Among other things, the publication deals simultaneously with basic electronics and the technical aspects of both CB and amateur radio equipment. Again, questions arise. Who, besides the electronics student, the amateur and the professional communications technician is interested in basic electronics or the technical aspects of CB and amateur radio equipment? That's easy to answer: The *hobbyist*.

The "hobby concept" is so widespread and deep-rooted in CB radio that it can furnish the base for a hobbyist publication. And the continued existence of this concept can destroy the original reason for opening the Class D citizens band for legitimate "John Doe" communications.

Part of the blame for this messy state of affairs can certainly be placed before the FCC's portals. But the original rules have now been revised, clarified and made less ambiguous. Some of the rat-holes, however, have been stuffed with adobe. They should be filled with steel-reinforced cement. (See "The New Look in Citizens Band Radio," *ELECTRONIC TECHNICIAN*, April and June, 1966.)

The primary purpose of Class D authorization was made clear by the FCC in 1964: CB radio is "a

radio" as a hobby—avoiding the necessary Amateur operators license. Amendments to the FCC's rules now make this clear as outlined in Part 95 of the rules.

CB radio was not designed to be used in place of ham radio, a fine and legitimate hobby. An article, "This Roaring CB Business," (*ELECTRONIC TECHNICIAN*, January 1965) listed 99 legitimate uses for CB—but it did not include "Rag-Chewers Clubs" that use various subterfuges to circumvent FCC rules



A 6-channel CB two-way radio especially designed for use in the Highway Emergency Locating Plan (HELP). Courtesy Pearce-Simpson.

means of communicating between units of a single licensee. Inter-station transmission or communications between units of different stations is permitted under certain conditions and restricted to seven individual channels. These inter-station communications are limited to five consecutive minutes with a five minute silent period and call sign identification." And even these bands are not authorized for hobbyist or ham-radio type communications.

Class D CB radio gave the business man, the housewife, the salesman and the doctor—plain John and Mary Doe—two-way communications channels for their private convenience.

CB was not intended for use by those who wanted to "play with

All this was made very clear in our November 1964, "Editor's Memo." It bears repeating:

"The Federal Communications Commission has finally taken the 'bull by the horns' in an effort to preserve the Citizens' Radio Service. The FCC is trying to make CB work as originally intended: to permit any citizen, previously ineligible for other radio services, to establish private two-way radio communications systems for business and personal convenience.

"CB channels were established by the FCC in 1958 to serve the private interests of citizens over 18 years of age—but it was not to be used as a diversionary toy.

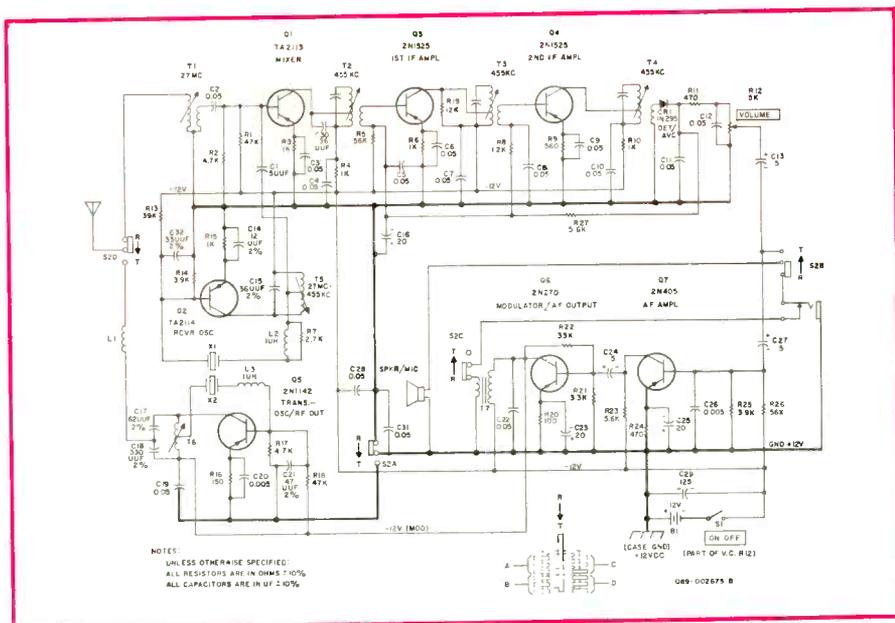
"Pleasure boat owners were given an economical method of voice contact with the boat house or home;



CB radio plays an important role in short range marine communications.

Schematic of a transistorized hand-held CB transceiver by Hallicrafters.

Raytheon transistorized CB transceiver is only half the size of tube models.



campers and hunters could roam safely through deep woods. Doctors, salesmen, construction workers, TV-radio service technicians and civil defense organizations could use CB as an effective communications medium. And just plain 'John Doe' could use CB to call his home from a car, inching its way along a snow-blocked highway or a mid-town traffic jam, to report being late for dinner.

"But many CB license holders have been using CB equipment as a substitute for amateur radio equipment—without having to assume "ham" licensing responsibilities. Citizens radio was being jammed by illegal talk, promiscuous transmission and even music broadcasts by irresponsible individuals.

CB radio was fast becoming a giant hobbyist party line.

"We believe the overwhelming majority of the 700,000 CB station license holders will eventually benefit by present and subsequent FCC regulations. We believe proper regulations will help CB radio grow and become one of the important sales and service sectors in the two-way communications market.

"As single-sideband CB equipment becomes more widely used, the CB bands can easily accommodate many more transceivers. And at an average cost of about \$350 for a two-way installation, this is a multi-million dollar market that no one can ignore."

But FCC regulations are still being flagrantly violated by the

hobbyist group which is strongly entrenched in CB radio—and their cause is still being supported by some manufacturers, distributors and various do-it-yourself hobby-type publications.

### Technical Progress

In the technical area, citizens band radio has moved forward in great strides. Equipment has gone solid-state. It has become more compact, more efficient and more reliable. Better antennas have been designed.

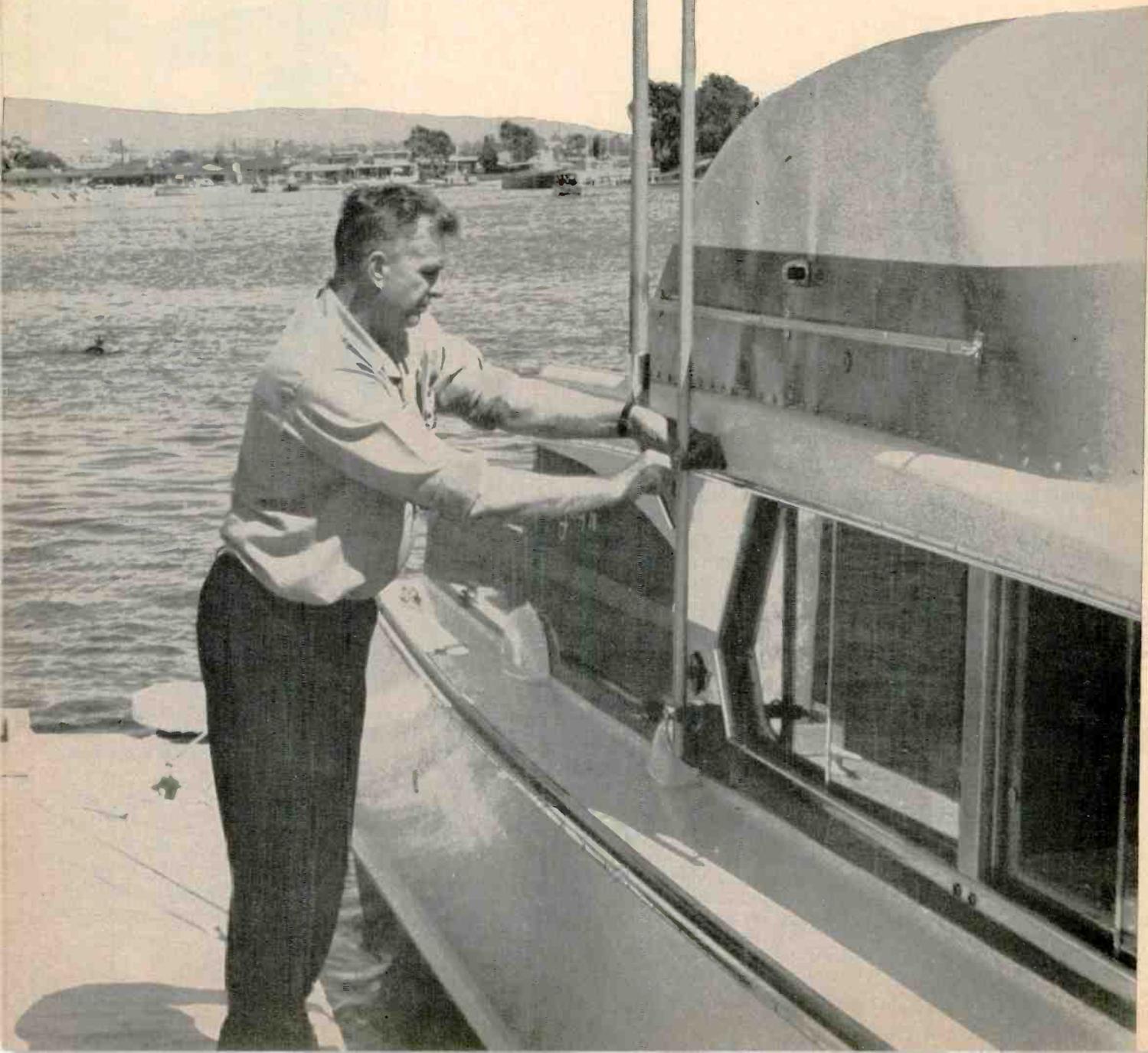
Selective calling is being used more widely. Single-sideband (SSB) equipment, to allow added spectrum space, is being designed and used. Power supplies have be-

*continued on page 85*



Because Mr. Butcher must spend most of his time in the field, his truck is "a shop away from the shop." Practically every call is a "house call" since it is not practical to haul most marine electronic gear from the boat to the shop for routine service.

# Operating



# A Marine Electronics Dealership

One-man service-dealer business thrives on extra service to pleasure boat owners

■ Just mention the words "successful dealership" of any type and the local "business wizards" will start spouting such phrases as: "A lot of money behind them . . . choice location . . . no competition . . . lots of advertising . . . he's got an in with the . . ." and so on down the line. It just happens that none of these apply in the case of George "Butch" Butcher of Electronics Marine. He is a prime single-brand dealer of Newport Beach, Calif., and has been for the past 12 years. What's more, he's succeeded in this spot despite some obvious drawbacks. Let's see why.

Mr. Butcher started with a sound financial position but it should be pointed out here that the exclusive dealership was taken away from a much larger organization with many times the available investment capital. Although his sales and service shop is properly housed, it's hardly in a choice "heavy traffic" location. In fact, many people have difficulty finding the street.

Mr. Butcher feels that this location is good, however, "for this type of business." Although off the beaten path, it's still easily accessible to the central part of Newport Beach. The quarters provide for a complete service shop, office, two display windows and enough storage

Much of Mr. Butcher's time is spent installing and servicing two-way radio antennas. Most boat owners do not understand the importance of a good antenna and ground on their radiotelephone systems.

space for about \$12,000 worth of stock and spare parts.

What about competition? Anyone even slightly familiar with Newport Beach, knows there are more marine electronics dealers per square foot than seems possible. There are four full time, and about 20 part-time, sales and service organizations in a one-square-mile area.

Advertising? George Butcher does buy advertising in the Yellow Pages, and he does use direct mail (to registered boat owners in the area) but his total advertising bill represents less than 3 percent of his total operating expense.

Does he have an "in." Yes, if you consider an "in" the 600 satisfied customers who never bother to look for equipment and service elsewhere. How does he do it?

## Commercial Versus Pleasure Boats

Originally, Mr. Butcher's business was aimed at the commercial boat operator. Prior to World War II, he operated a marine electronics dealership servicing only commercial boats in nearby San Pedro. After WWII and the Korean War (Butcher is a Lt. Commander in the Naval Reserve) he decided that the pleasure boat field would expand and was here to stay. A greater variety and quantity of lower-priced gear was being made available to the average pleasure boat owner. This meant a change in sales approach. His customers were no longer interested in how their profits could be increased by

electronic equipment, but in how their *safety and convenience* could be increased. Safety and convenience are the key words when selling a pleasure boat owner, since you are usually talking about the boat owner's entire family.

"Boating is a family affair these days, and you've got to sell the wife, the kids and possibly an aunt or uncle," Mr. Butcher says. "But I am not selling equipment for the manufacturer, nor am I selling for myself. I am *buying* equipment for my customers. In effect, I am their agent."

A one-man shop of any type has a blind spot in customer contacts and Butcher is no exception. Because his workday is spent in the field, there's little time to meet with customers and discuss problems, new equipment, etc. To overcome this, the work schedule is arranged to keep all of Saturday as "Customer's Day" at Electronics Marine. When possible, all in-shop work is done on that day. This ties in nicely with most of Mr. Butcher's regular customers who are working people and want to transact their business on Saturday.

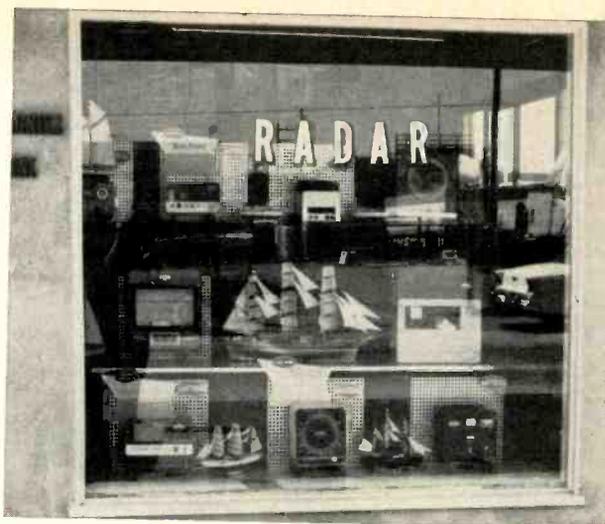
## Service Facilities

An up-to-date and properly equipped service shop is essential for any marine electronics dealer. It's no problem at all to invest \$2000 or \$3000 (or even double that) in test instruments alone. Add another \$1000 for spares and tubes. And this does not include machine

The sales and service shop is properly housed, but is not in a heavy traffic location. The complete service shop, office and display areas provide sufficient space for about \$12,000 in stock and spare parts.

With each installation a custom job, Mr. Butcher makes sure the unit is operating properly and that the customer knows how to operate it.

A must for any electronics dealership is a well-equipped shop with an adequate parts supply.



shop or carpentry tools and equipment.

Although Mr. Butcher does all of his own electronics service and installation work, he often calls in an independent contractor whenever the need arises for a ship's electrician, carpenter or mechanic—such as with an autopilot or radar installation. "It is physically impossible to install heavy units of this type by yourself," Mr. Butcher says. "Besides, a radar or autopilot almost always requires extensive carpentry or heavy electrical work. So, I call in a contractor, get an estimate for his part of the job and we install the heavy equipment together on the appointed day." By working with the same contractors regularly, this provides additional sales leads.

"All pleasure boat installations are custom installations," according to George Butcher. "And this point cannot be stressed too much. Quite often people will buy off-the-counter electronic gear from another source and then ask me to install or service it. They even drag in marine electronic gear from Los Angeles

discount houses about 70 miles away. In all but a very few cases, I tell them of my 'priority system.'

"First priority is given to the equipment which I have installed. Second priority is to all other equipment which my supplier makes (many of my competitors will work only on equipment they have installed). Third priority is to equipment made by another company which is tied to the brand I handle. Fourth priority is all other equipment." Mr. Butcher says he is available to work on fourth priority equipment on a "next week" basis.

#### Service After Sales

"I don't expect to make much, if anything on service," George Butcher smiles, "but without service I would close my doors very soon. He spends 80 percent of his time in some form of service activity, but when it comes to dollar volume this figure is inverted with sales accounting for 80 percent of the gross income.

All of Mr. Butcher's customers know that they will receive his

personal attention before, during and after every sale. The manufacturer of the equipment he handles gives a 90-day warranty. Mr. Butcher extends this to one year for both *labor and parts* at his own discretion. If he feels that a part should not have failed, say, at 10 months, he contacts the manufacturer and goes to bat for a free replacement. Naturally, the extension of the labor warranty is out of his own pocket, but it's worth it, Mr. Butcher believes.

After he does service work above and beyond the factory warranty period, he submits a regular bill itemizing what was done. But this bill is marked "No Charge." This makes a pleasant surprise for customers, and brings his reliability-after-the-sale to their attention in a way that they do not forget.

#### Customer Training

Lack of customer understanding is the big drawback to marine electronics, Mr. Butcher believes. Many boat owners simply do not know how to operate their equipment and,



George Butcher prefers an electronic telephone answering system instead of a "live" service. He feels this eliminates "fouled up" messages. A customer will often happily describe his particular problem in detail to a machine, where he feels that an answering service operator would not understand the problem.

as a result, do not get maximum benefit from it. Since they don't understand what's wrong, they blame the equipment, the dealer who sold it to them and the whole marine electronics field.

A classic example of this is the radio direction finder. Each DF must be calibrated for the particular boat. Metal objects aboard ship (metal rigging, superstructure, etc.) will distort and even blank out radio waves arriving along their line of bearing to the DF antenna. This results in inaccurate readings of certain bearings. The DF can be moved to another location aboard ship or a deviation table can be made up for the most convenient location. Although most DF instruction books spell out this condition, many boat owners are not aware of the problem or, if they recognize the problem, are not able to make a deviation table without help. Many DFs have been "tossed overboard" for just this reason.

Mr. Butcher *insists* on the opportunity to teach each customer correct operating procedures for all

items of equipment he sells. After the equipment is installed and operating to his satisfaction, Mr. Butcher *checks out the customer* on the spot. This is not always necessary for commercial boat installations (most commercial operators are experienced skippers), but it is absolutely essential for the great majority of pleasure boat owners.

Once satisfied that the customer can put to sea with the particular unit, he allows about two or three weeks for them to "get used to the feel of it underway," then he checks them out again. By this time, the customer is either thoroughly satisfied with his equipment or Butcher is fully aware of the customer's problems. As any dealer knows, when the customer is unhappy he may or may not let you know about it. But you can rest assured that he will tell his friends about his problems! This spreads the word around fast in a specialized field like marine electronics, and can quickly ruin a reputation. A routine callback after each sale nips unhealthy talk in the bud.

Another problem in customer education is *clarifying* manufacturers' claims—or at least filling in the gaps where manufacturers fail to "tell all." A prime example of this is in radiotelephone (marine band or CB) antennas and grounds. The proper installation of a marine antenna can double or triple the operating range of a CB or marine band radiotelephone. Contrary to what some manufacturer's say (or fail to say), a good ground connection is of equal importance to the antenna in determining efficiency of a marine radiotelephone system. Many customers are not even aware that any form of ground is required.

As part of a continuing education program, all marine band radio channels are monitored continuously at the sales office on a late model receiver. This was done originally to solve the problem of explaining to potential customers exactly what radiotelephone or direction finding equipment would do for their boating activities and how they operate.

These and countless other running commentaries on "Butch" Butcher's operations give insight as to how he has made his big catches in marine electronics. Not everybody has the same philosophies about running their businesses — nor the same success. ■

# Replacing Flyback Transformers In Color Sets

Make your troubleshooting and repair jobs easy by using organized procedures

■ Replacing flyback transformers in most early TV color chassis is not as difficult as it was in early B/W chassis. And, considering that most service technicians have now learned the basic replacement techniques involved through years of experience with B/W TVs, the over-all situation can be viewed optimistically.

Additionally, color flyback transformers are better made today than comparable B/W components were years ago — and they give less trouble. Many present day flyback manufacturers, for example, use an insulating rubber coating around the HV winding which prevents the wax from dripping from the windings if the transformer overheats.

It is important to remember, however, that more leads are attached to color flybacks than on B/W transformers. And we must also realize that many more components are connected to the color flyback windings. Finally, although color set horizontal output tubes look similar to the one used in B/W chassis, it draws a lot more current. This point, as we shall see later, is important to remember.

A lead from the outside of the color chassis flyback windings goes to the cap of the HV rectifier tube. In the older color sets a focus rheostat was tied to the flyback transformer. In most present color sets the rheostat has been replaced by a variable inductance coil. Other components wired to the color flyback are the horizontal centering

control, HV focus rectifier and solid-state rectifier.

Some technicians find it easier to replace a defective flyback with an original-type part. Others find it equally easy with "exact" or "universal replacement" substitutes. But in certain geographical areas, or localities, lack of immediate availability of an original-type part may pose a problem. In some cases, this problem may postpone a repair longer than the customer will tolerate.

## Isolating a Defective Flyback

When you find there's no raster on an improperly operating set, but the audio is normal, the trouble can usually be traced to the horizontal sweep section. One procedure requires that the tubes involved be substituted first. Then touch the HV probe from your VOM or VTVM to the 2nd anode connection at the CRT. You should have 25kv at this point. If you do not have a HV probe, get one. You can't service color flyback circuits efficiently without one. Trouble in the HV section is frequently difficult to isolate and besides, correct adjustment cannot be made without a HV probe.

In the event that no HV exists, check the fuse, circuit breaker, horizontal output, damper, rectifier and horizontal oscillator tube. After these components are checked, then check the flyback transformer.

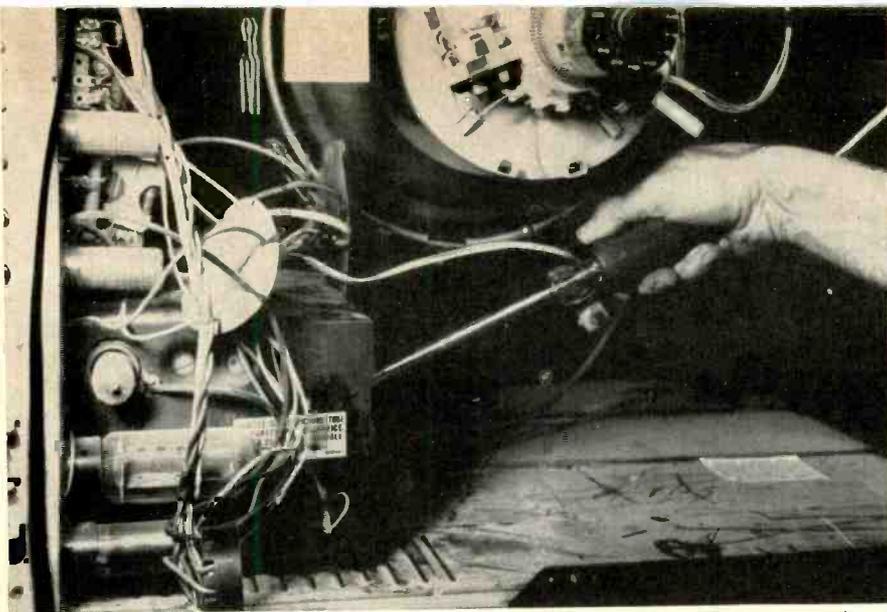
A defective flyback can usually be isolated by using one or more

of the normal human senses: sight, hearing or smell. Look for burned, scorched or arc-over marks on a flyback. Listen for arcing or arc-over around the windings. This is especially important where connecting wires enter the HV windings and under the metal HV cap. A warm or wax-melted-down flyback will indicate heavy current drain. You may also find a pile of melted wax on the chassis, under the flyback.

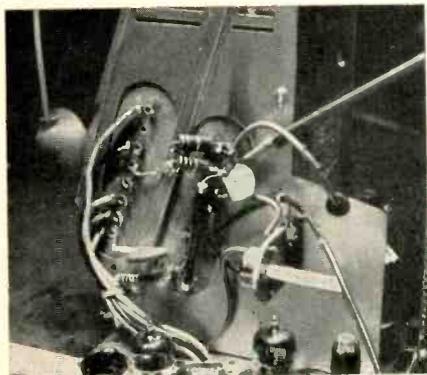
Check the flyback terminal connections for arc-over or a burned insulation board. Sometimes a wisp of smoke will lead you to a burned section of the terminal board or a tube socket. Look for burned resistors and capacitors connected to the flyback.

Many experienced TV technicians determine the flyback output by removing the HV rectifier cap and checking the arc between the HV lead and the blade of an insulated-handle screwdriver. If the arc jumps from one to two inches, there is generally enough high voltage. Anything under a half-inch arc will indicate a defective flyback or other HV circuit trouble.

After the HV probe has indicated insufficient HV output, check the grid voltage on the horizontal output tube. First remove the plate cap from the H<sub>OT</sub>. If the drive voltage is close to that specified on the schematic, the trouble is probably in the flyback circuit. Now replace the H<sub>OT</sub> plate cap and insert a current meter between the



Discharge the HV lead and 2nd anode connection before attempting to replace a flyback transformer. After the chassis has been removed and before removing the metal cage, discharge the HV lead once again.



Pencil points to arc-over burn on a Sylvania DO5 chassis. All wires must be removed from metal cage before flyback can be replaced.

TABLE I

| Terminal | Wire Color            |
|----------|-----------------------|
| 1        | Black                 |
| 2        | Red                   |
| 3        | Yellow                |
| 4        | Red and Yellow Stripe |
| 5        | Red and Green Stripe  |
| 6        | Grey                  |
| 7        | Brown                 |

tube's cathode and ground of the tube. This current should not be more than 225ma and will normally read around 210ma. Many older color receivers have a plug-in "U" shaped wire that makes it easy to check the HOT cathode current. If not, remove the cathode connection from the chassis and insert the current meter between this wire and chassis.

Resistance checks of the various flyback windings will sometimes show up an open or shorted transformer. A shorted turn or two will not provide accurate readings on a low VOM or VTVM scale, however. The suspected flyback can be checked more accurately with a flyback tester or a new flyback can be substituted.

#### Marking Terminal Connections

Assuming the flyback is known

to be defective, the first thing is to mark all terminal wire connections. Many different opinions exist among TV technicians regarding the correct way to mark the flyback terminal wires. Any good method of maintaining color coding of each wire to a given terminal of the flyback is permissible (see Table I). A good method to use is to mark the color-coded wires on the flyback circuit schematic. Not only will the correct wires be placed on the corresponding numbers, in replacement, technicians can acquaint themselves with the flyback circuit and in case of another similar flyback replacement, the color code is listed on the wiring diagram (see Fig. 1). Another good method is to use regular electrician's numbering tape—wrapping duplicate numbers on each wire and its proper terminal.

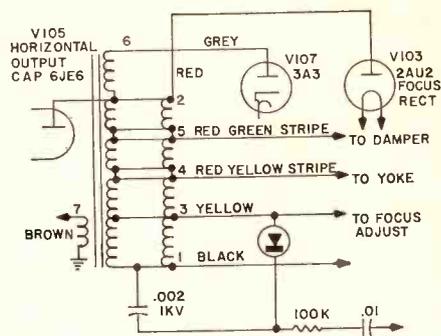


Fig. 1—Marking flyback color code on a schematic will aid in future replacements.

Look up the manufacturer's exact part number. If not in stock, phone your parts distributor. Sometimes, even a long distance telephone call will save time, a lot of correspondence and the correct replacement can often be located.

One advantage of an exact replacement is similar physical size, electrical characteristics and exact terminal numbers. If the component part will not arrive for a few days, tape the schematic diagram inside of the color cabinet. Also Scotch tape any marked terminal connection to the flyback metal cage.

Do not attempt to remember where the connections go. There are too many of them. If the wires are not correctly marked when removing a flyback, the flyback circuits must be checked out for correct hookup. A slip up here may not only damage a new flyback, but it is also possible to end up with insufficient voltage or inadequate width (see Fig. 1). Making mistakes here will create additional loss of precious time and discouraging results.

#### Removing HV Cage

In some cases the HV terminal wires must be unsoldered before the HV cage is removed. Some of these transformers are in sets like Admiral and Sylvania. Many older models, as in RCA chassis, must have the metal cage removed before you can get at the flyback terminal wires.

In either case, it is best to remove connecting brackets or other com-

ponents that may interfere with replacing the flyback. First remove the damper, horizontal output and focus rectifier tubes since they are usually in the way. Also remove the shunt regulator wires, HV cable and the top cage assembly. In many models the HV rectifier socket and HV cable are attached to the top cover. These wires or cables will pull through holes or slotted areas and need not be unsoldered.

Removal of the horizontal centering control and focus control may be necessary before the flyback can be removed. Generally, the high voltage cage is fastened to the color chassis with ¼ in. metal screws. All loose components and screws should be placed in a plastic container for safe keeping.

### Replacing the Flyback

When the correct flyback transformer has been obtained, check all terminal connections and the flyback winding, to see if any physical damage has occurred in shipment. It is rather disgusting to go to the trouble of replacing a new flyback that has been damaged in shipment. The flyback must be removed and another flyback must be obtained, mounted and wired in place.

Mount the new flyback transformer into the same position as the original position and start the wiring procedure. It is best to proceed carefully and replace each wire in numerical order. Then recheck the color-coded wires and terminal connections against the schematic. A slip-up here may result in injuring or destroying a new flyback transformer. Place each component or part previously removed back in its exact original position and solder all wires and cable leads.

Make firm, round soldering beads on each flyback terminal. A sharp edge or piece of exposed wire strand may cause hissing, firing and arcing at this point. Dress down the soldered leads and lay them into their original position, if possible.

Watch for the heater leads going to the high voltage socket, on top of the shielded cage. In some cages there are small plastic clips to hold these heater leads.

Before switching the color set on; check over the wires going to the flyback for correct terminal connections, once again. After the chassis is checked out and operating, apply a dab of corna dope to each soldered terminal.

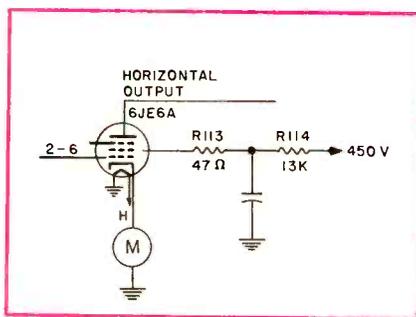


Fig. 2—Connect a milliammeter in the HOT cathode when checking total current or when adjusting efficiency coils for "dip."

### Current and Voltage Check

A final current and HV check should be made before the color receiver is returned to the owner.

High voltage should also be adjusted to the value specified by the manufacturer, usually 25kv on 25in. sets. Make sure your HV probe is accurate. It should be rechecked once a year against a known HV probe or source.

Insert a current meter in series with the cathode of the HOT (see Fig. 2). Adjust the efficiency coil, if one is used, for a "dip" or minimum reading. Check the current reading against the set manufacturer's service data. In present color receivers, the HOT draws 210ma.

Now check to see if the raster "blooms" when the brightness control is advanced. If the HV and current adjustments are not made properly, a flyback can be easily destroyed. Too much current will cause the flyback to break down, arc over and start a fire.

Several other components must be checked before "buttoning up" the HV cage. Check the focus control, focus coil and efficiency coil or control for open or shorted turns. Many times these components can be defective and will cause a new flyback to fail. Of course, all HV and horizontal tubes should be checked and replaced with new ones if required. If the focus or boost rectifiers are in any way defective, replace them.

### A Flyback Case

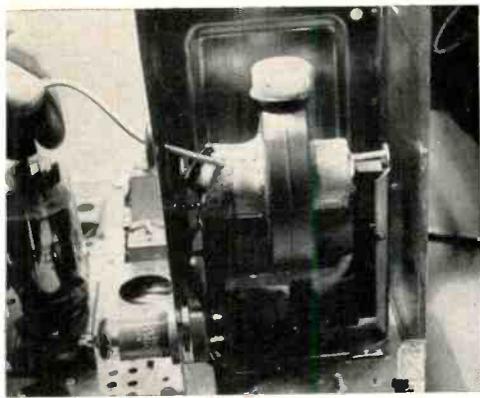
An Admiral chassis came into the shop which lost brightness after the set was on for about an hour. The picture also went blurry and out of focus.

All HV tubes were substituted but did not help. We found that the windings were arcing in the flyback transformer. A new transformer was substituted—but the original symptoms remained!

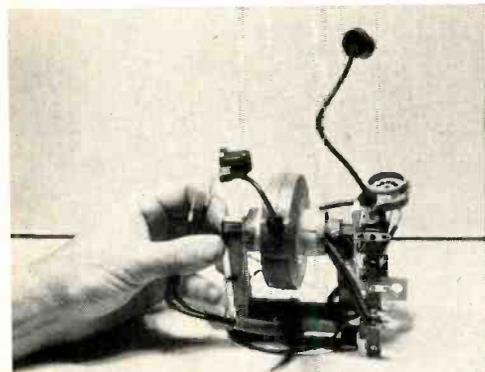
The HV probe was connected to the VTVM and we measured 26kv on the 2nd anode connection at the CRT. But the focus voltage was low—about 3kv. We have frequently found high resistance focus controls defective, so we automatically replaced the focus control in this set. The control did not solve the problem and within a few minutes the focus voltage dropped to 1.2kv.

All the capacitors and high meg-ohm resistors were checked and appeared good. This led us to believe that the trouble was in the yoke or the new flyback. We decided to make more resistance checks in the flyback circuit.

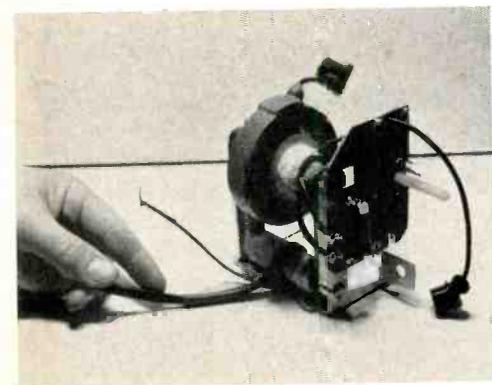
The resistance of the various flyback windings were very close to specifications. Then we checked from the HV winding to the focus coil windings and found a resistance of 50K. We double checked against the schematic and pulled tubes—but came up with the same readings. This measured resistance was between terminals 8 and 9 of the flyback. The actual resistance between



Rear view of an RCA HV cage with the back cover removed. The metal cage must be removed before the flyback terminals can be marked.



New RCA flyback showing the focus tube socket mounted on the transformer board.



RCA flyback with focus control and a high megohm resistor mounted on the insulated board.

these terminals should be infinity.

To make absolutely sure we were correct, the set was switched on for about 20 minutes, and then switched off. We again measured the resistance between terminals 8 and 9—it was now 15K!

This is an extreme case, of course, but you can find an occasional new part that is defective and cause a "dog." Never rule out trouble in a new component.

### Charred Remains

We found the flyback burned to a crisp in an Admiral 4D11 chassis. In fact, the HV socket and 3A3 tube were melted down into a heap. The customer said he was watching a favorite program when smoke started to pour out the back of the color receiver. He put the fire out with a fire extinguisher but a lot of damage had already occurred.

The only way to fix the mess was to replace everything in the high voltage cage. New wires were installed from other components to the flyback. When the chassis was switched on, the high voltage and current adjustments were properly made to insure that this same trouble would not occur again.

### No Brightness

Constant "sizzling" and no brightness was the complaint in an RCA CTC16E chassis. This trouble was easy to find for you could see the arc beneath the metal cap on the flyback transformer. This high voltage 3A3 rectifier plate cap sits down into the metal ring on top of the flyback winding. Also, we found a black scorched rubber cover pointing to the trouble.

It is best not to try to repair a flyback winding but replace it with an original part number. In this case an RCA part number 113992 did the trick. Again the high voltage and current checks were made before the color receiver was returned to the customer.

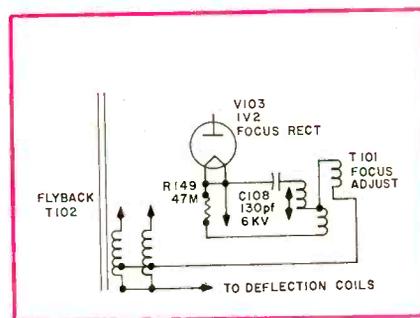
About the same trouble was found in a new DO5 Sylvania color chassis. After the chassis was warmed up for ten minutes the raster would go out of focus and loud "popping" sounds were heard around the flyback cage. The actual trouble could be seen around the solid-state focus rectifier. Arcing had taken place between the two terminals that held two 470K resistors. Only this time the arcing was not within the flyback winding but inside of the terminal board. A

new flyback was the only answer.

### Arcing Cables

Many times a flyback may be damaged by arcing high voltage cables, burned high voltage socket and a cracked shunt regulator wire—outside the shielded cage.

A Zenith 29C20 chassis had excessive firing between shunt regulator wire and the glass shell of the 3A3 high voltage rectifier tube.



Location of focus adjustment coil in Admiral chassis 2D11.

This trouble was intermittent but after the set was on a few hours the arcing began.

When the arcing got under way between the shunt regulator wire and rectifier tube, long sparks jumped between deflection yoke and purity magnet assembly. The purity ring assembly had a ground wire going directly to the chassis. At the same time firing developed in the 6DQ5 horizontal output tube. There was gobs of melted wax under the flyback transformer. Actually, the trouble developed from the break-down of the shunt regulator cap wire and then fired across to the high voltage rectifier tube.

Since the Zenith chassis was a few years old, all the HV cables and wires were replaced. A new flyback was installed having a new plastic high voltage socket. Current and high voltage adjustments were made and the color chassis is still operating without the snap, crackle, and pop sounds. ■

# Semiconductors

Understand the difference between junction and insulated-gate, field-effect transistors and your troubleshooting will be easier

The Sixth Article in a continuing series

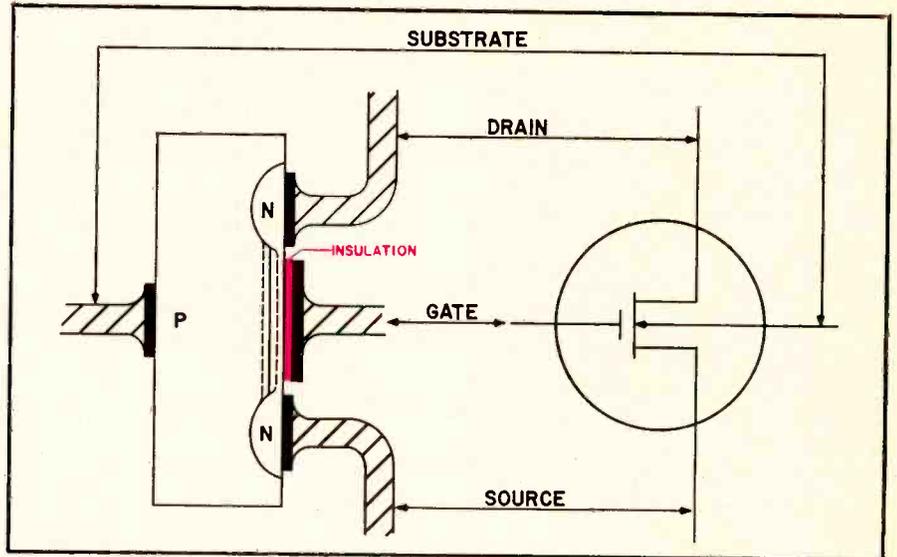


Fig. 1—The structure of a depletion-type MOS.

■ We have seen that many characteristics of the junction FET are superior to those of regular transistors. Many of the characteristics of still another type of semiconductor are even superior to these. This new component is called a depletion-type, insulated-gate, field-effect transistor, and is composed of metal-oxide, semiconductor material. For simplicity we will refer to it as a depletion-type MOS.

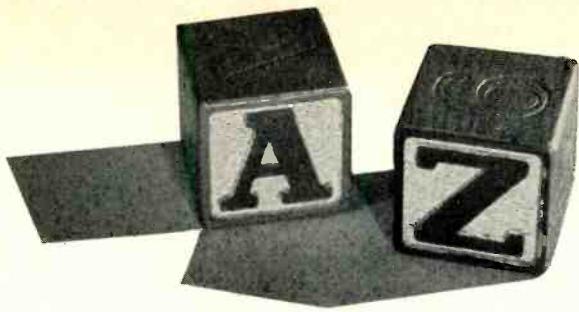
## Composition of a Depletion-type MOS

The depletion-type MOS, like other semiconductors, contains P- and N-type material. The arrangement of this material is shown in Fig. 1. A slice of P-type silicon material, called substrate, contains two pockets of N-type material located about  $5 \times 10^{-4}$  in. (0.0005 in.) apart. They are joined by a thin channel, which is also of N-type material. Leads are secured to each

pocket, and current can flow from one pocket to the other, through the channel, in the same manner as it flows through the junction FET's rod of P-type material. The pocket in which the current enters is called the *source* while the pocket that the current leaves is called the *drain*.

Unless the N-type material is negatively charged with respect to the P-type substrate, the current traveling from source to drain is restricted to the N-type material by the P-N junctions along its path. Since the current is traveling through only the N-type material, the depletion-type MOS' source and drain leads can be interchanged in a circuit and current will flow through the N-type material in the opposite direction — the drain has become the source while the source has become the drain.

A  $4 \times 10^{-6}$  in. (0.000004 in.) layer of silicon dioxide forms nearly a perfect insulation between the chan-



# from A to Z

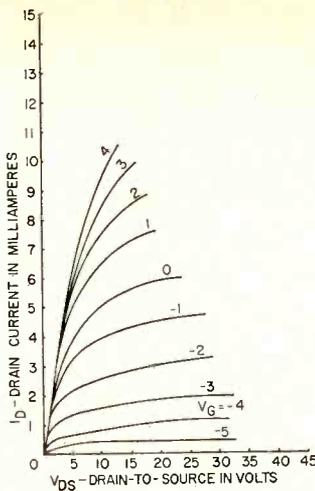


Fig. 2—The characteristic curves of a depletion-type MOS.

nel and the gate lead. The electric field, resulting from a charge applied to the gate lead, has the effect of altering the channel's thickness. When a negative charge is applied to the gate lead, the channel becomes thicker and is able to conduct more current. When a positive charge is applied to the gate lead, the channel becomes thinner and is able to conduct less current.

If the depletion-type MOS contained an N-type substrate with pockets and channel of P-type material, positive charges applied to the gate lead would enable the semiconductor to conduct more current while negative charges would restrict current flow.

The arrow shown in Fig. 1 represents the substrate lead. The direction it is pointing indicates that the substrate is of P-type material. If the arrow pointed in the opposite direction, it would indicate that the substrate was of N-type material. For low frequency use the substrate lead and source lead are normally connected together.

## Gate Resistances

Unlike regular transistors and junction FETs, the depletion-type MOS has a gate current independent of forward bias. The gate resistance may exceed  $10^{15}\Omega$  while its capacitance may be less than 1pf. With these characteristics, the gate is capable of holding a charge for several hours when out of a circuit. It has been claimed that some have even been able to hold their gate charge for days.

Although the gate resistance is very high, the oxide coating, insulating the gate from the channel, is so thin that it can be easily punctured

by the application of excessive external voltages as low as 20 to 30v. For this reason it is very important that MOS components be handled with extreme care. A few feet of insulated wire, charged to twice the gate's breakdown voltage, could possibly destroy the gate insulation. Static charges generated by a technician may be sufficient to puncture the insulation and ruin the MOS. For this reason it is advisable to work with a grounded soldering iron, and guard against static charges from test instruments when working with MOS circuits.

## Depletion-type MOS Characteristic Curves

The characteristic curves of a depletion-type MOS is shown in Fig. 2. We can see, for this particular semiconductor, a gate charged more negatively than the source results in a reduction of the drain current while a gate charged more positively than the source increases the drain current. The gate voltage curves in Fig. 2 are further apart in the area where the gate voltage is zero and closer together at larger positive or negative potentials. This indicates that when a signal is applied to a gate with zero bias, the gain will be greater than when a signal is applied to a gate with a positive or negative bias.

## A Depletion-type MOS Common-source Circuit

A common-source circuit (Fig. 3) can be designed for a depletion-type MOS with the characteristics shown in Fig. 2. In this circuit, the gate resistor ( $R_G$ ) merely serves to prevent static charges from breaking through the MOS' insulated gate

and, if necessary, to load the input signal to the desired amplitude.

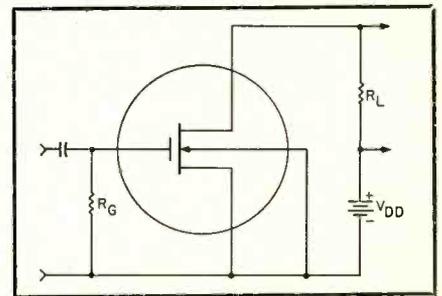


Fig. 3—A depletion-type MOS common-source circuit.

This resistor does not bias the gate of the semiconductor.

The voltage source ( $V_{DD}$ ) and load resistor ( $R_L$ ) for this circuit can be determined by drawing a load line (Fig. 4) similar to those shown in two earlier articles of this series. This line falls across the curves in such a manner that a gate voltage signal ( $\Delta V_G$ ) produces a maximum drain-to-source voltage signal ( $\Delta V_{DS}$ ) without clipping the signal or overloading the semiconductor. This load line represents a load resistance

$$(R_L) \text{ of } 2K \left( \frac{30v}{15ma} \right)$$

and a voltage source of ( $V_{DD}$ ) of 30v.

A 2v input signal ( $\Delta V_G$ ) is shown (Fig. 4) to result in a 5.5v output signal voltage ( $\Delta V_{DS}$ ) and 2.75ma output signal current ( $\Delta I_D$ ). From these figures we can calculate the circuit's voltage gain

$$(A_v = \frac{\Delta V_{DS}}{\Delta V_G} = \frac{5.5v}{2v} = 2.75).$$

Since this semiconductor has an insulated gate, the gate current is insignificant. The very small input signal current ( $\frac{\Delta V_G}{R_G}$ ) results in a

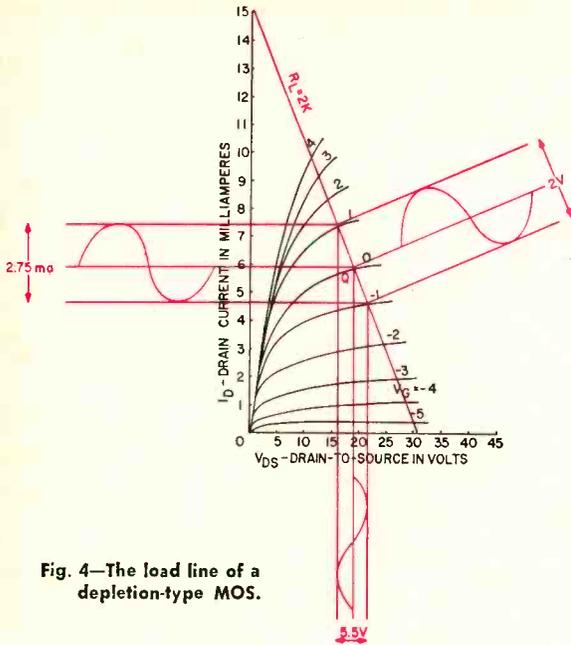


Fig. 4—The load line of a depletion-type MOS.

significant output signal current ( $\Delta I_D$ ). This current gain ( $A_i$ ) is too large to be a practical unit of measure.

#### Composition of an Enhancement-type MOS

The enhancement-type MOS is still another kind of insulated gate semiconductor. Its arrangement of P- and N-type material (Fig. 5) is nearly the same as that of the depletion-type MOS (Fig. 1). The depletion-type MOS' substrate of P-type material contains two pockets of N-type material joined by a thin channel of N-type material. When a negative charge is applied to the gate lead, the channel becomes thicker and is able to conduct more current. The enhancement-type MOS, however, contains no channel of N-type materials. The two pockets are separated by the substrate of P-type material. When a positive charge is applied to the gate lead, a portion of the substrate changes from P-type to N-type material and a channel of N-type material is formed.

The entire region between the source and the drain of the enhancement-type MOS must be covered by the gate electrode and insulation. The channel would not otherwise reach from source to drain pockets. Since the depletion-type MOS contains a permanent channel, the gate electrode and insulation can be located slightly away from the drain region. Although the entire channel

is not then affected by the gate electrode, the semiconductor benefits from a substantial reduction in feedback capacitance between the drain pocket and the gate electrode. The drain-to-gate capacitance of the enhancement-type MOS is, therefore, larger than that of the depletion-type MOS.

The drain and source leads of the enhancement-type MOS can also be interchanged, and its gate resistance is of similar value.

The arrow shown in Fig. 5 represents the substrate lead. The direction it is pointing indicates that the substrate is of P-type material. If the arrow pointed in the opposite direction, it would indicate that the substrate was of N-type material. For low frequency use the substrate lead and source lead are normally connected together.

#### Enhancement-type MOS Characteristic Curves

The gate of an enhancement-type MOS, like the base of a regular transistor, must be forward biased to encourage current flow. The basic difference in the biasing of these two semiconductors results from the difference in the input current that they require. The greater base current required by a regular transistor limits its biasing resistances to values given in terms of thousands of ohms (K), while the negligible gate current required by an enhancement-type MOS permits biasing resistances with values

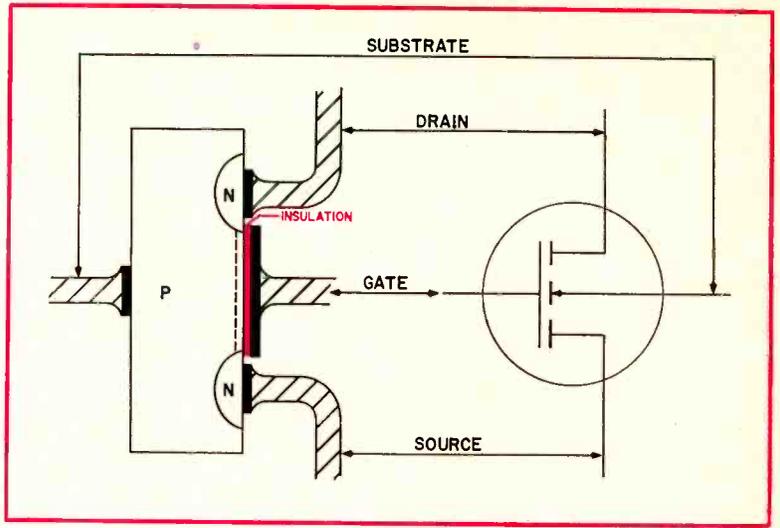


Fig. 5—The structure of an enhancement-type MOS.

given in terms of millions of ohms (M).

The characteristic curves of an enhancement-type MOS are shown in Fig. 6. The curves for higher bias voltages tend to be slightly further apart than those for lower bias voltages. This is unlike the curves of a regular transistor which tend to be closer together at higher biasing currents than at lower biasing currents.

#### Enhancement-type MOS Common-source Circuits

The enhancement-type MOS common-source circuit shown in Fig. 7 is very similar to the com-

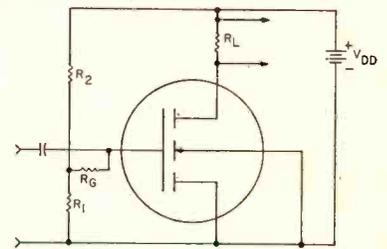


Fig. 7—A simplified common-emitter circuit for an enhancement-type MOS.

mon-emitter circuit of a regular transistor. A load line (Fig. 8) drawn on the semiconductor's characteristic curves can be used to determine the values for the components in the circuit. For this particular load line the voltage source ( $V_{DD}$ ) is 24v, the load resistance is 1.3K and the Q-point for the gate voltage ( $V_G$ ) is 6v.

Since the gate current of an

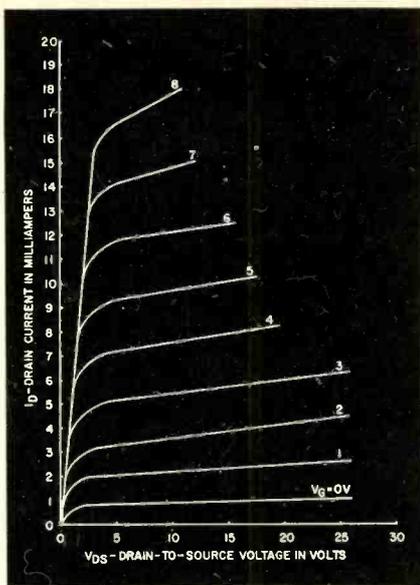


Fig. 6—The characteristic curves of an enhancement-type MOS.

enhancement-type MOS is negligible compared to the base current of a regular transistor, this current need not be considered when determining values for  $R_1$  and  $R_G$ , and we can assume that the same current ( $I_1$ ) flows through both resistors. This current ( $I_1$ ) is equal to the voltage source ( $V_{DD}$ ) divided by the total resistance across it ( $R_1 + R_G$ ), or  $[V_{DD} = I_1(R_1 + R_G)]$ . The gate voltage ( $V_G$ ) is equal to the value of the resistance across it ( $R_1$ ) times the current ( $I_1$ ) flowing through that resistor ( $V_G = I_1 R_1$ ). The ratio of the gate voltage to the voltage source can be used to determine the values of the biasing resistors.

$$\frac{V_G}{V_{DD}} = \frac{I_1 R_1}{I_1(R_1 + R_G)} = \frac{R_1}{R_1 + R_G}$$

The value of  $R_1$  must be low enough to prevent static charges from destroying the internal gate resistance of the semiconductor and, if necessary, to load the input signal to the desired amplitude. For this circuit we will arbitrarily assign this resistor the value of 20M (Let  $R_1 = 20M$ ). The corresponding value of  $R_G$  can then be calculated.

$$\frac{6v}{24v} = \frac{20M}{20M + R_G}$$

$$480M = 120M + 6R_G$$

$$6R_G = 360M. R_G = 60M.$$

A 60M resistance is so large that moisture or other contamination of the circuit wiring can alter the effective value of  $R_G$  by shunting it. This could increase the current flow

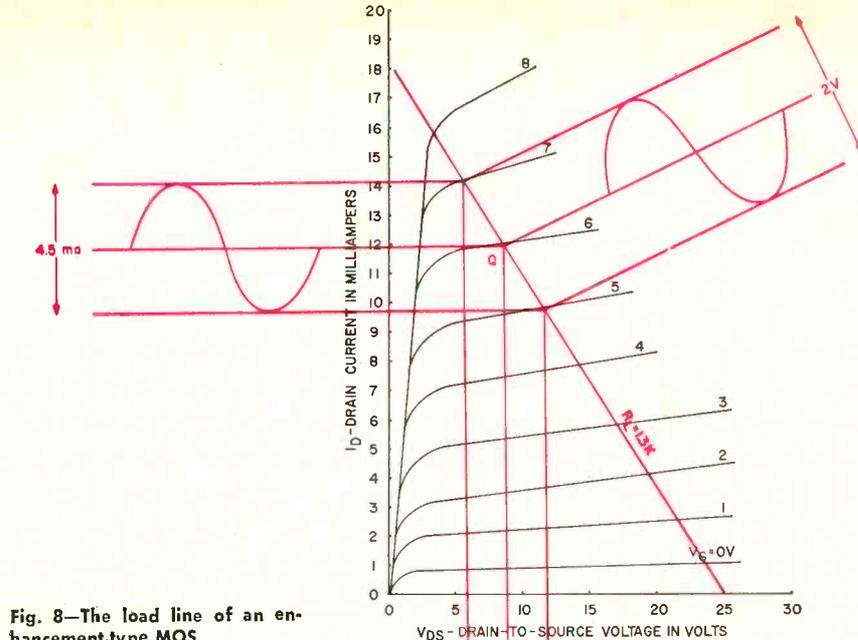


Fig. 8—The load line of an enhancement-type MOS.

in the bias circuit and increase the voltage drop across  $R_1$ , increasing the gate voltage ( $V_G$ ).

The circuit can be modified (Fig. 9) to permit the use of lower values

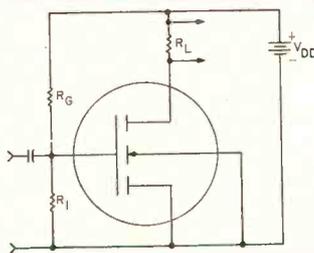


Fig. 9—An improved common-source circuit for an enhancement-type MOS.

for resistances  $R_1$  and  $R_2$  without loading down the semiconductor's gate impedance. Since the gate current is very small, the gate voltage ( $V_G$ ) is essentially the voltage drop across resistor  $R_1$ . If we let the total value of the shunting resistors equal 1M (Let  $R_1 + R_2 = 1M$ ), we can calculate the value for each resistor.

$$\frac{V_G}{V_{DD}} = \frac{R_1}{R_1 + R_2} \cdot \frac{6v}{24v} = \frac{R_1}{1M}$$

$$24R_1 = 6M. R_1 = \frac{1}{4}M = 250K.$$

$$R_2 = 1M - 250K = 750K.$$

The load line in Fig. 8 shows us how the circuit in Fig. 9 functions. A 2v input signal ( $\Delta V_G$ ) results in a 6v output signal voltage ( $\Delta V_{DS}$ ) and a 4.5ma output signal current ( $\Delta I_D$ ). From these figures we can calculate the circuit's voltage gain

$$(A_v = \frac{6v}{2v} = 3).$$

Since this semiconductor has an insulated gate, the gate current is insignificant. A very small current resulting from the input signal flows across resistor  $R_G$  and through the bias circuit. The value of this current can be calculated

$$(\Delta i_{in} \approx \frac{\Delta V_G}{R_G} = \frac{2v}{20M} = 0.1\mu a).$$

The circuit's resulting current gain ( $A_i$ ) can be calculated from this information.

$$A_i = \frac{\Delta I_D}{\Delta i_{in}} = \frac{4.5ma}{0.1\mu a} = 45,000.$$

As was the case with the depletion-type MOS, the current gain for the enhancement-type MOS circuit is too large to be a practical unit of measure.

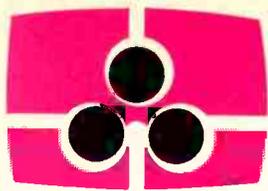
### General MOS Characteristics

The unique characteristics of MOS devices seem to make them the semiconductor of the future. Except for VHF, almost any electron-tube circuit can be easily adapted for the MOS.

Enhancement-type MOS components are relatively independent of temperature when operated at low drain currents, with some rated for operation with junction temperatures as high as 200°C. MOS components, in general, seem to be less sensitive to temperature than other semiconductors and electron tubes.

Although noise levels are usually

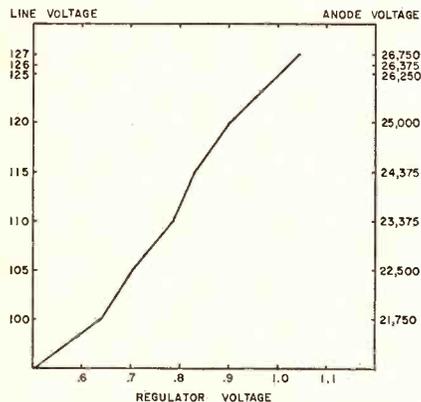
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# COLORFAX

## Setchell-Carlson Compares Line Voltages With Other Voltages in S

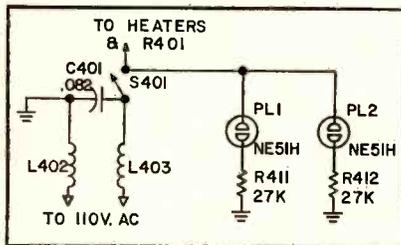
Two 23-in. and three 25-in. Setchell-Carlson Color-TV receivers were checked for various line voltages.



When setting up the experiment, 120vac was used as the normal line voltage. At that line voltage, the high voltage was adjusted to 25kv. The resulting voltages are shown in the graph.

## Replacing Incandescent Bulb With Neon Bulb in Canadian G-E Chassis

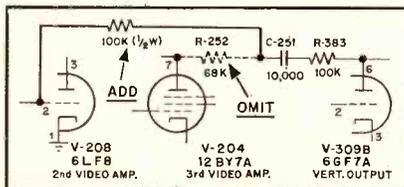
The "Portacolor" chassis has been slightly modified to use a standard



neon bulb, NE51H, in place of the currently used incandescent bulb, G-E #756. The circuit changes are only in the pilot light circuit of chassis code "V."

## Vertical Retrace Blanking in DuMont Color Chassis

A circuit modification will improve the vertical retrace blanking of chassis 120814 coded with triangle "F" (or higher letter), 120822, 835 coded



with triangle "E" (or higher letter), 120844, 858, 859, 868 coded with triangle "B" (or higher letter).

A resistor, R252 (68K, 1/2 w), should be removed from the circuit, and another resistor (100K, 1/2 w) should be added between a capacitor, C251 (10,000pf), and pin 2 of V208 (6LF8, 2nd video amplifier). This resistor should be installed on the etched circuit side of PC2, the video and sound board. Insulating sleeving should be used on the resistor leads to prevent the possibility of short circuits.

## Replacing Terminal Strips in Philco-Ford Color Sets

Because of the high voltage on the terminal points of strips B1 and B2, it is essential that in the event of replacement, these strips be exact factory replacements.

Strips B1 and B2 are reportedly made of a special material to withstand humidity, heat and other environmental conditions. The manufacturer warns that never, under any circumstances, should they be replaced with a standard terminal strip.

For the locations of terminal strips B1 and B2, refer to your schematics of color chassis 16QT85A, 16NT82 and 17KT50. Terminal B1 contains 6 lugs and is part no. 76-10310-41, while terminal B2 contains 5 lugs and is part no. 76-10310-42.

## IRC Announces Exact Replacement High-Voltage Resistors

Exact replacement, original-equipment, high-voltage resistors for color-TV receivers are reportedly being marketed by IRC. According to the manufacturer, the Type MV is an axial lead, film-type resistor rated at 6kv and available in two ranges, 4.7k and 6.6k, ±20 percent. The mechanical spacing of the helical resistance path is said to allow uniform voltage gradient throughout the resistor length.

## Bench Repair Hints for 21-, 23-, and 25-in. Canadian G-E Receivers

When a chassis is brought in for repairs, it is not necessary to have the convergence assembly plugged in to obtain a vertically linear picture.

You can easily make up dummy

loads for the vertical output transformer. Take an 8-pin plug (for 21-in. models) or a 9-pin plug (for 23- and 25-in. models) and connect a 120Ω resistor across pins 1 and 2. When inserted into the convergence socket, the vertical output transformer will be loaded and a linear display, with no foldover, will appear on the test CRT.

## Magnavox 6JE6 Tube Failures in Horizontal Frequency Circuits

The failure of the horizontal output tube (6JE6) in the T911, T918, T919 and T920 color-TV chassis can be caused by a defect in the horizontal oscillator circuit, which causes the oscillator frequency to multiply. Such a problem can be caused by shorted turns in the horizontal frequency coil L501A. In this case the frequency may double or triple and as a result there will be little or no grid drive on the output tube. If the horizontal output tube is allowed to operate for any length of time under these conditions, it will eventually get too hot and break down.

When replacing a 6JE6, check the horizontal frequency coil by going through the horizontal hold adjustment as follows:

1. Short out the sine wave coil (L501B) with a jumper to ground, a convenient place to do this is across capacitor C528. Also short to ground the grid (pin 9) of the sync separator V703B.
2. Adjust the horiz. hold control to bring the oscillator into frequency. If you cannot bring the oscillator close to proper frequency it is possible that L501A has shorted turns and the coil assembly should be replaced with a new one, part no. 360960-3 replacement.

After making the replacement, repeat steps 1 and 2 to set the frequency. Since the sine wave coil L501B is part of this assembly, it will also have to be adjusted. To do this, remove the jumper across C528, but leave the jumper in place from the sync sep. grid to ground and then adjust the sine wave coil until the picture stops moving horizontally, which indicates that the oscillator is set to the proper free-running frequency.



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breather, make a few more  
calls and still have time  
to play with the kids.

### \*RCA's new Hi-Lite Color Tube with Perma-Chrome

If you've been waiting half an hour for the picture tube to warm up every time you repair or install a set, here's good news. RCA's new rectangular Hi-Lite Color Tubes with Perma-Chrome lock colors in place instantly, eliminate distorted color as the set warms up. Colors are true and unchanging

from turn-on to turn-off. Saves hours of set-up time. New Hi-Lite Color Tubes with Perma-Chrome now in RCA Victor consoles. **New service switch in all 1967 color chassis.** Three-position for Normal, Service and Raster. When Raster is selected, all video and noise is removed from

the color picture tube, leaving a noise-free Raster. Purity is adjustable without removing an IF tube or using other means to remove noise and/or interference from the screen.



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# COLORFAX

## RCA Begins Color Set Production at Memphis Plant Four Months Ahead of Schedule

Substantial production of color TV receivers is taking place at RCA's new plant in Memphis, Tenn.

"Only ten months from ground breaking, we now have two color production lines in operation and a third is scheduled to start shortly," President Robert W. Sarnoff says.

Mr. Sarnoff addressed a luncheon meeting of business and civic leaders of Memphis, sponsored by the local Chamber of Commerce, following a tour of what he described as "the world's most modern TV plant."

"Only two years ago," Mr. Sarnoff said, "the most optimistic projections foresaw industry sales of 2.5 million color sets by 1966. Latest forecasts indicate total industry volume of nearly 5 million sets this year—or almost double the earlier estimate. This will generate retail sales of 3 billion, equalling for the first time the combined dollar volume of all other home entertainment

products, including black-and-white TV.

"The color market has expanded so rapidly, in fact, that the present challenge to manufacturers is to catch up and keep pace with demand. RCA is well geared to meet a growing share of this demand. In anticipation of the color boom, we have been building plant capacity and production know-how on a major scale for the past 12 years. In the past two years, we have allocated \$156 million to expand our facilities for the manufacture of color tubes and receivers and other home entertainment equipment."

Mr. Sarnoff praised the employees of the new Memphis plant for demonstrating "their capabilities most impressively. They have quickly mastered the techniques for producing color television sets—the most complicated consumer product ever created."

## Sylvania Raises Prices Of Some 21 and 25-in. Color Sets

Entertainment Products Div. of Sylvania Electric Products raised retail prices of color TV receivers by an average of 2.1 percent, effective October 1.

John T. Morgan, president of the marketing arm of the company, said the price increases are being initiated to offset the recent higher costs of materials going into color sets, particularly copper, receiving tubes and cabinets.

The current price increases affect the majority of 21 and 25-in. models. Prices of 19-in. sets remain the same.

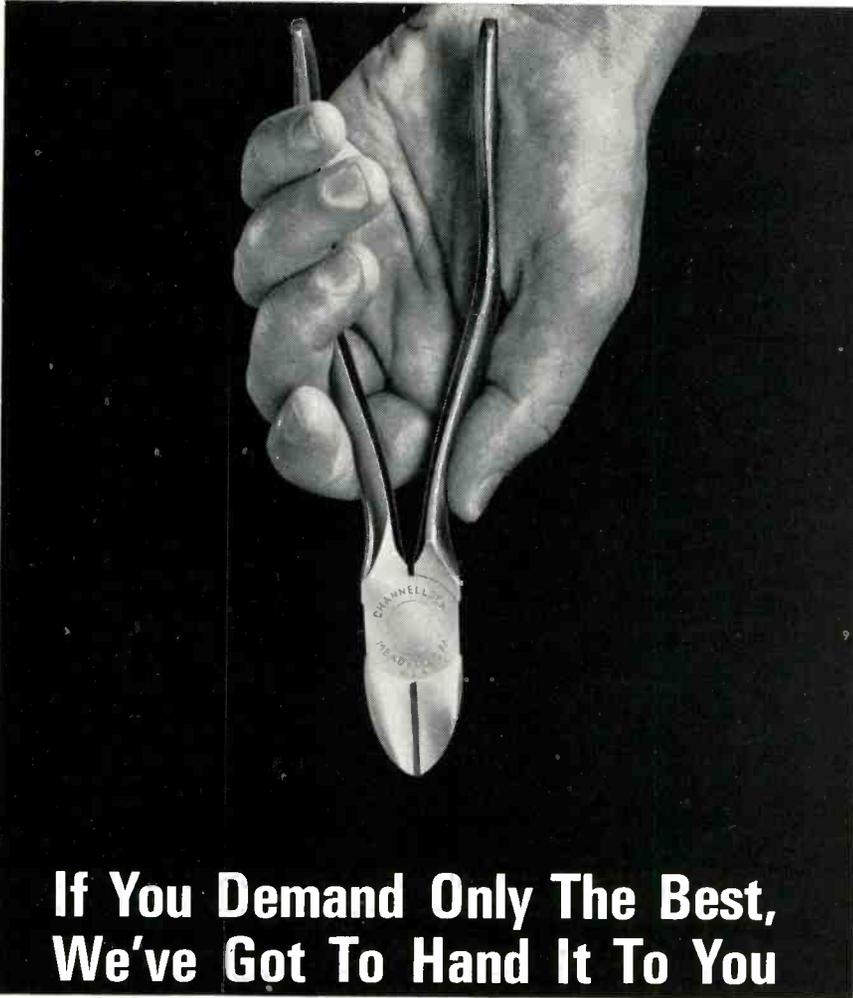
In retail dollar terms the price increases are in the \$10 to \$25 range with the exception of two home entertainment models which are up \$55.

## Design Change in Setchell-Carlson Tuning Light Circuitry

All Setchell Carlson color-TV receivers shipped after Oct. 15, 1966 incorporate improved circuitry to enhance tuning light performance.

The improved circuitry is incorporated in the advanced CA8, CBC8 and CD8 units. To better suit local conditions, a threshold control has been provided on the rear of the CA8 unit. This control should be adjusted for proper tuning light indication at optimum tuning on all channels.

On those receivers shipped prior to October 15, 1966, which display herringbone at the indicated tuning point, the condition can usually be cleared up with a slight adjustment of the 41.25MHz sound trap. Turn the top slug in the 4th IF can (CBC7 unit) approximately 1/8 turn clockwise and reset the micro tuning control.



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## CATALOGS AND BULLETINS

### TV Antenna Distribution 400

A four-page catalog describes VHF, UHF and FM, solid-state amplifiers and preamplifiers, mixing networks, tap-offs, splitters, filters, cable equalizers and low-loss cable. Jerrold Electronic.

### Test Instruments 401

A line of test instruments is described in a 12-page catalog. Included are instruments for TV, transistor equipment, capacitor analyzers and VOMs, plus a CRT rejuvenator and checker, color generator, and VTVM. B & K Div., Dynascan.

### Barretters & Thermistors 402

Barretters for detecting audio modulation over a frequency range of dc to 18GHz, and thermistors for measuring high power signals, are described in a four-page brochure. Weinschel Engineering.

### Periodic Table 403

A fully colored, up-dated edition of THE PERIODIC TABLE OF THE

ELEMENTS CALENDAR reportedly contains all of the latest verified elements and the latest approved and authenticated atomic weights based on Carbon-12. Also shown are the group number, atomic number, valence, symbol, boiling point, freezing point, ionization potential, atomic configuration, naturally occurring isotopes and other pertinent data for each element. Price \$3.00. International Rectifier.

### Electron Tubes 404

A 28-page catalog plus a seven-page insert describe the characteristics of over 560 electron tubes. These range from audio tubes and rectifier diodes to vidicon camera tubes and microwave tubes. Amperex.

### Electronic Kit Catalog 405

Over 250 electronic kits are listed in a 108-page catalog that illustrates actual kit assembly manual pages. Also included is a stereo system planning guide to assist in the selection of matching Hi Fi components. Heath Co.

### Electrical Tapes 406

A four-page brochure now available contains property tables and other information on 10 different types of polyester tapes. 3M Co.

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# NEW PRODUCTS

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

## Tuner Cleaner 700

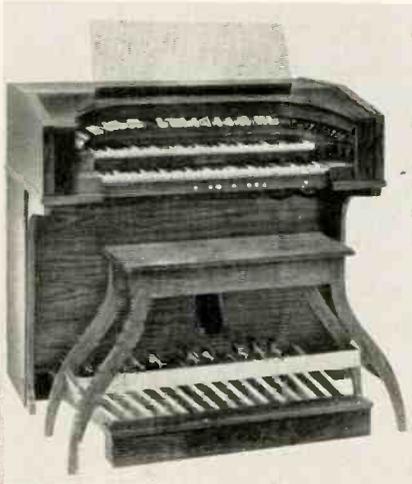
Announced is a tuner cleaner designed for cleaning nuvistor and



transistor TV tuners. It is reportedly safe on all plastics used in TV tuners. Chemtronics, Inc.

## Theatre Organ Kit 701

Announced is a fully transistorized theatre organ that is sold in an assemble-it-yourself kit form. The theatre organ features a traditional horseshoe shaped console, a 25-note pedalboard, and two full 61-note key-



boards. There are 48 stop tablets and the pitch registrations available range from 1ft to 16ft. Priced \$1350. Schober.

## Two-Way Radio 702

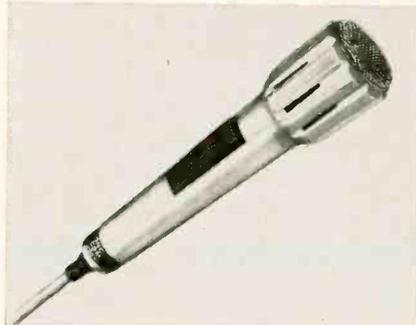
A crystal controlled 100mw super-heterodyne transceiver features a



built-in meter for checking battery strength. Price \$29.95. E. F. Johnson.

## Dynamic Cardioid Microphone 703

Announced is a dual impedance, dynamic microphone, which reportedly has a cardioid polar pattern with a 16 to 20db uniform front-to-back

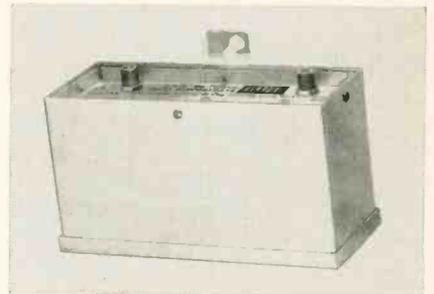


rejection of sound. The cartridge is mounted in a rubber sleeve to protect it against physical shock and to reduce noises produced from microphone handling. The manufacturer indicates that the microphone is designed with an acoustical windblast screen to control voice "popping" and make close "miking" sound crisp and clear. Specifications indicate an 80Hz to 10kHz frequency range, a sensitivity of  $-59\text{db @ 1kHz}$  with a

50K impedance, and a sensitivity of  $-83\text{db @ 1kHz}$  with a  $200\Omega$  impedance. Sonotone.

## VHF Antenna Preamplifier 704

A solid-state preamplifier is designed to provide 30db gain to sharpen up TV signals. The pre-



amplifier unit is reportedly weatherized for mast or indoor mounting, while the power supply is indoor mounted to provide low-voltage ac to the preamplifier, acting as a feed-through for the amplified signal to the receiver. Models are supplied tuned to any specific VHF channel or for the 88 to 108 MHz FM band. Jerrold.

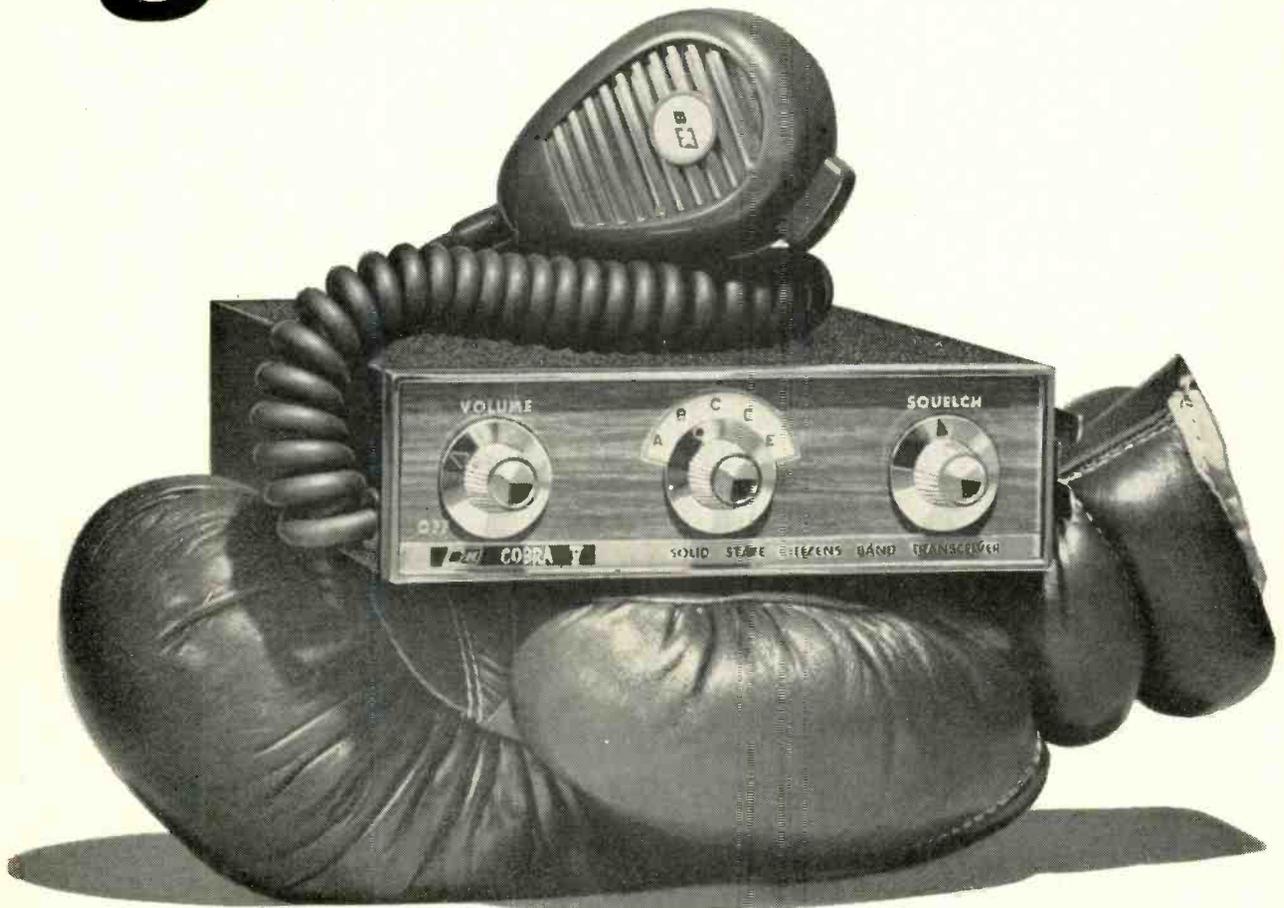
## Relay Tool Kit 705

A service tool kit designed for adjusting, calibrating and servicing re-



lays, contacts and electro-mechanical equipment, is announced. The kit, contained in a leather zipper case, includes the following tools: a spring adjuster, armature bender, arm bender, relay spring duck bill plier, burnisher and a 0-50g relay spring tension gauge. Jonard.

# punchy galore



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## NEW PRODUCTS

### Radio Telephone Control 706

A telephone control head is introduced, which is designed to replace standard 2-way radio mike/speaker/control head functions to convert a "radio" into a "telephone." A self-contained, solid-state, digital decoder reportedly responds discretely to one seven digit number out of a possible ten million with no digit restrictions. A filter built into the system is de-



signed to permit speech plus signaling over duplex channels regardless of their busy condition. Simultaneous signaling over multiple channels achieves a trunking advantage to greatly increase system efficiency and make more efficient usage of the crowded RF spectrum. Mobiles signaled on all channels simultaneously stand a much better chance of "connect" offering a particular advantage to those roaming through foreign service areas. The manufacturer indicates that the control head complies with the signaling standard recently adopted by the National Association of Radiotelephone Systems for Radio Common Carrier nationwide service. Secode Corp.

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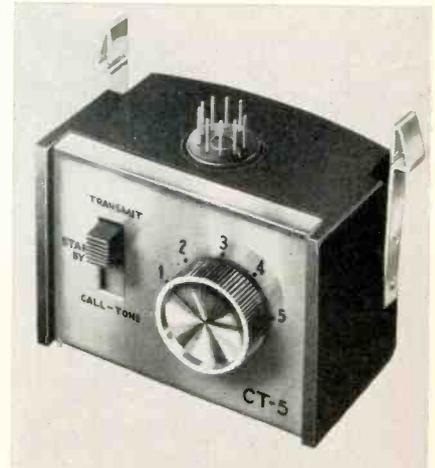
Here for the first time, is an antenna with the unique ability to discriminate between the desired signal and unwanted noise! A complete absence of minor lobes and an extremely high front to back ratio are characteristics of these antennas. This is made possible by the development of the Free Space Standing Wave Magnetic Drive Antenna system (F.S.M.). The outstanding electrical qualities, combined with the simplified mechanical construction of this system yields a total performance package unparalleled in today's market. 4 models, 60-inch to 180-inch boom, all modestly priced.

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### CB Call-Tone Selector 707

A call-tone selector designed to eliminate having to continually listen to unwanted calls and "hash" on the air, is now available. This selector



allows up to five transceivers to selectively signal each other on each transceiver channel, with a frequency controlled tone. Only the transceiver tuned to the tone of the calling transceiver will allow the signal to pass. No sound will pass if the tone is absent or of another frequency. The unit is designed to plug into built-in sockets on the base of the manufacturer's line of transceivers. Fanon.

### Radiotelephone Antenna 708

A fiberglass antenna is now available for use with VHF/FM marine radiotelephones. The antenna is 51 in. long and has a half-wave end-fed radiating element fed through a high efficiency, broadband transformer which is grounded to reduce noise pickup. No ground plane or hull ground reportedly is required. Frequency range 156-162MHz, impedance 52Ω, power rating is 200w. International Communications.

... for more details circle 131 on postcard

**Wrench Sets**

**709**

Forged wrench sets are available in vinyl tool bags that are designed to be personalized with the name and address of the user. To personalize the bag, all the user reportedly does

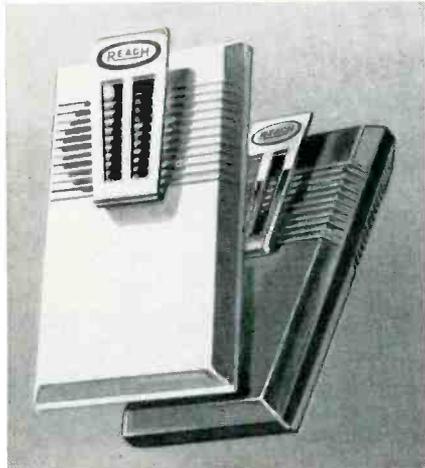


is write his name on a specially pre-treated panel appearing on the clear plastic face of the bag. According to the report, the marking is permanently fixed, whether a ball point pen or pencil is used. The manufacturer indicates that all the wrenches are forged of fine-grain controlled steel, heat-treated, chrome-plated and highly polished. Kraeuter Tools.

**Pocket Pager**

**710**

A low-frequency, induction, FM receiver is now available for selective calling and voice instructions. Weighing approximately 5¾ oz., the pager operates on 2 size "N" cells and reportedly turns itself ON and OFF automatically whenever a message is

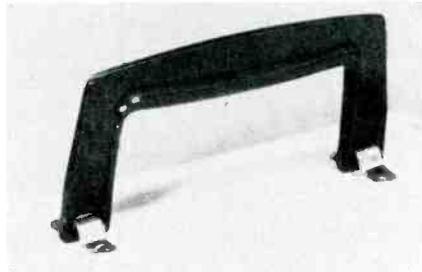


directed to it. Two models are available for operation from either one-tone or two-tone codes. Console encoders are designed for up to 61 different one-tone codes or up to 3540 two-tone codes. The manufacturer indicates that no FCC licensing is required since a closed loop system confines the signal to the vicinity of the building where the pagers are used. Additional features include: all silicon transistor circuitry, encapsulated modular construction and stable audio. Reach.

**Plastic Handles**

**711**

A line of polystyrene, molded handles is available. These handles reportedly can withstand strain and im-



pact, have good shock and abrasion resistance, and can be molded in any color with a variety of surface textures. Bruce.

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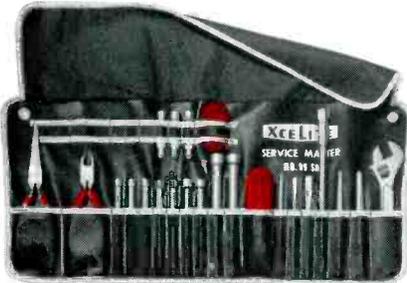
ELECTRO-VOICE, INC., Dept. 172T; 663 Cecil St. Buchanan, Michigan 49107  
Please send the free E-V booklet on choosing communications microphones. I am interested in the following areas of two-way radio:  Amateur  Aviation  CB  Business.

NAME \_\_\_\_\_  
COMPANY \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
CITY \_\_\_\_\_ STATE \_\_\_\_\_

**Electro-Voice**  
SETTING NEW STANDARDS IN SOUND

... for more details circle 114 on postcard

# SERVICE MASTER... EVERY TOOL YOU NEED 99% OF THE TIME



complete 23-piece kit for radio, TV,  
and electronic service calls

**2 HANDLES:**  
shockproof plastic.  
Regular 4" length  
... 2" Stubby. Inter-  
changeable. Patented  
spring holds snap-in  
tools firmly in place.

**9 NUTDRIVERS:**  
High Nickel chrome  
finish, 3/16" to 1/2"

**3 STUBBY  
NUTDRIVERS:**  
1/4", 5/16", 3/8"

**EXTENSION BLADE:**  
Adds 7". Fits  
both handles.

**3 SCREWDRIVERS:**  
Two slotted...  
3/16", 3/32"  
#1 Phillips

**2 REAMERS:**  
1/8-3/8", 1/4-1/2"

**ADJUSTABLE  
WRENCH:**  
6" thin pattern,  
1" opening

**LONG NOSE PLIER:**  
"Cushion Grip",  
2 1/4" nose

**DIAGONAL PLIER:**  
"Cushion Grip"  
hand-honed  
cutting edges

**ROLL UP KIT:**  
Durable, plastic-  
coated canvas.  
Compact, easy-  
to-carry.

Ask your distributor to show you kit 99 SM

# XCELITE

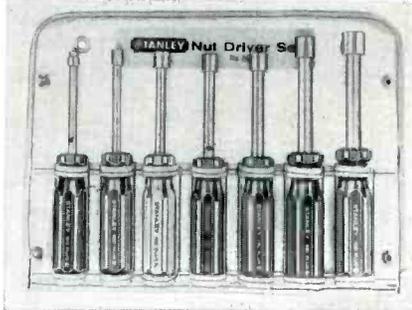
XCELITE, INC., 14 Bank St., ORCHARD PARK, N. Y.  
Canada: Charles W. Pointon, Ltd., Toronto, Ont.

... for more details circle 140 on postcard

## NEW PRODUCTS

### Color-Coded Nut Drivers 712

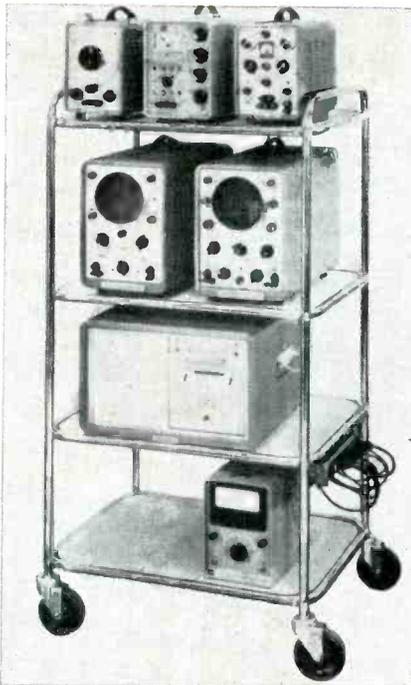
A new nut driver in 7 color-coded sizes for TV, radio and appliance technicians is introduced. The drivers feature chamfered sockets for a fast



fit over hex nuts and hex-headed bolts, and hollow shafts for long bolts. Seven sizes range from 3/16 to 1/2 in. List price \$8.86. Stanley Tools.

### Test Instrument Cart 713

An all-welded, stainless-steel cart, designed to carry test instruments and other equipment, is introduced. The



cart's deck shelves sit on 3/8-in. steel rods welded to 1-in. stainless steel tubing, which are mounted on stainless steel legs with 5-in. swivel castors at the bottom. Openings between decks are 13in., 14in., and 17 1/4 in., from the bottom up. Up to 600 lb of equipment can reportedly be handled by the mobile cart. A 6-outlet receptacle, featuring 6 female plug outlets, an ON-OFF light switch, fuse and a 10-ft cord, is included. Cambridge Electronics.

# 349 PHONO CARTRIDGES!



# 459 PHONO NEEDLES!



## NEW! PHONO AND TAPE RECORDER WHEELS, DRIVES, BELTS!

**E-V** That's how many models are listed in the current Electro-Voice phono needle and cartridge catalogs. With more being added as you need them.

No other single source offers such variety—all built to the highest industry standards. All are exact replacements that install quickly, to give your customers "like new" performance—or better!

Electro-Voice models are listed in your Photofact files, or ask your E-V distributor for free copies of the E-V catalogs. It's your guarantee of complete customer satisfaction!

**ELECTRO-VOICE, INC.**, Dept. 177T;  
663 Cecil Street, Buchanan, Michigan 49107

**Electro-Voice**  
SETTING NEW STANDARDS IN SOUND

... for more details circle 115 on postcard

ELECTRONIC TECHNICIAN

# A million miles a day!



## Your packages go wherever Greyhound goes when you ship by Greyhound Package Express

Greyhound goes over a million miles a day, over more than 100,000 miles of routes, serving more than twenty-five thousand cities, towns and villages throughout the U.S.A. Your shipments go wherever Greyhound goes, aboard regular Greyhound buses, when you

specify Greyhound Package Express. Ship anytime at your convenience—24 hours a day, 7 days a week, weekends and holidays, too. Schedules are fast and frequent. Your shipments get there faster, (often in a matter of hours) because they get moving sooner. Save time!

Save money! Save trouble! Ship C.O.D., Collect, Prepaid, or open a Greyhound Package Express Charge Account. For information on service, rates and routes, call Greyhound, or write: Greyhound Package Express, Dept. 53-A, 10 S. Riverside Plaza, Chicago, Ill. 60606

### It's there in hours and costs you less

| For Example                   | Buses Daily | Running Time    | 20 lbs. | 30 lbs. | 40 lbs.* |
|-------------------------------|-------------|-----------------|---------|---------|----------|
| BOSTON—<br>NEW YORK           | 28          | 4 hrs. 5 mins.  | \$2.00  | \$2.35  | \$2.60   |
| LOS ANGELES—<br>SAN FRANCISCO | 25          | 9 hrs. 15 mins. | 2.10    | 2.45    | 2.80     |
| PITTSBURGH—<br>CLEVELAND      | 12          | 2 hrs. 45 mins. | 1.80    | 2.05    | 2.40     |
| INDIANAPOLIS—<br>CHICAGO      | 10          | 4 hrs. mins.    | 1.90    | 2.20    | 2.55     |

\*Other low rates up to 100 lbs. Lot shipments, too.



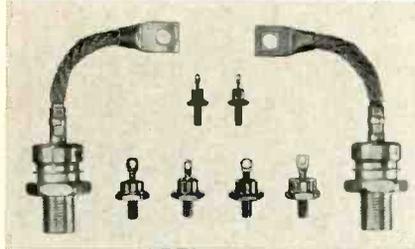
One of a series of messages depicting another growing service of The Greyhound Corporation.

... for more details circle 118 on postcard

# NEW PRODUCTS

## Silicon Rectifiers 714

A line of high-current, silicon rectifiers reportedly feature a diffused junction, low thermal resistance, low



forward voltage drop and low leakage current. Designed to meet military and industrial specifications, the rectifiers are available in voltage ratings from 50v to 1.5kv and current ratings from 1½a to 250a. The units are sealed in a welded case and feature a one-piece terminal. Semiconductronics.

## Delay Timer 715

A series of automatic reset delay timers with dial adjustment, are available in seven time ranges, from a



maximum setting of 5.6sec to a maximum of 4min 40sec. Dial adjustment on the face of the timer facilitates setting of the desired time. The timers provide a controlled delay through a 15a, snap-action, SPDT switch that is independent of the timer motor circuit. The switch can be in an ON or OFF condition, as desired, during the delay period. List \$14.50. Industrial Timer Corp.

## Nylon Pliers 716

Glass filled, nylon pliers developed for bending transistor and other com-



ponent wires without nicking or causing other damage, are introduced. They are reportedly highly resistant to abrasion, non-magnetic, heat and acid resistant. The manufacturer indicates that the long-nose pliers are suitable for holding components during soldering and can be held very close to soldering iron tips since they are unaffected by the heat. Heat from the tips does not escape into the pliers but remains in the wires being soldered. Price \$2. Engineering & Electronic Devices.

## Heat-Shrinkable Tape 717

An irradiated, heat-shrinkable tape with a meltable wall for use as insulation and protection in electronic



applications, is available. It is reportedly useful in applications where the product configuration prohibits the use of tubing or as a replacement for insulating boots. The tape is designed to flow into its own wrappings and adhere to cables and other components forming a snug mechanical fit and a watertight seal. Electronized Chemicals Corp.

**JUST OUT!**

**TRANSISTOR SPECIFICATIONS & SUBSTITUTION HANDBOOK**  
**1967 EDITION** only \$2.95

**THE Transistor Book of the Year!**

over 6,000 American and foreign transistors, their specifications and over 15,000 substitutions.

**ALSO Includes these Universal Replacements:**

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**at your Parts Suppliers now, or order below:**

Enclosed please find \$ \_\_\_\_\_ (plus 10c postage for each book) for the following:

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- Principles of RF Power Amplifiers.....\$1.95
- Principles of Transmission Lines.....\$1.95
- Antenna Principles and Wave Propagation.....\$2.95

TECHPRESS, INC.  
 Brownsburg, Indiana  
 46112

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 City and State \_\_\_\_\_

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 Subscription rates for all other countries available on request.

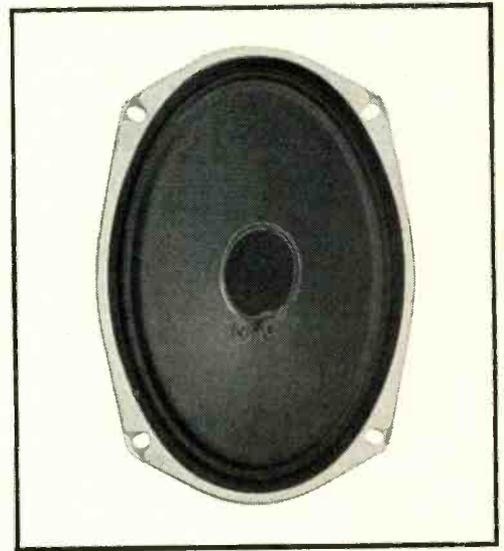
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# This part speaks for the whole radio.



## 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



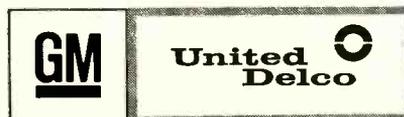
have Delco Radios as original equipment, you are assured of a vast pre-sold market.

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?

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



MARK OF EXCELLENCE



Here's the cardioid mike that delivers ALL the audio quality of the \$100-plus cardioids, but sells for at least \$40 less! (List price — \$59.50 everywhere.) The Turner 600 may be held by hand or stand . . . either way, you're assured of top performance, with no 'pop' and no feedback.

Whether you're buying, selling, or simply recommending cardioid microphones that are ideal for any recording job (monaural or stereo) . . . try Turner 600's first. It's the best \$100-plus microphone that \$59.50 will ever buy.

**THE TURNER MICROPHONE COMPANY**  
 946 17th Street N.E. Cedar Rapids, Iowa  
 In Canada: Tri-Tel Associates, Ltd.  
 Export: Ad Auriema Inc., 85 Broad Street, New York, N.Y. 10004

## Shortwave Listening Reportedly Gaining in Popularity

The market for shortwave radios is reportedly being stimulated by a widening popularity of shortwave listening among teenagers and overseas travelers. According to William B. Keepin, manager of the radio department of North American Philips Co., this accelerating interest by these two affluent segments of the consumer market offers important sales potentials to distributors and service-dealers.

Mr. Keepin estimates that during the past 5 to 10 years the over-all market in shortwave receiving equipment has more than doubled. He reports that more than \$60 million are being spent yearly for equipment with shortwave bands, and he predicts that by 1970 some \$75 million will be spent annually for all types of shortwave radios.

Mr. Keepin also cites the fact that many schools have recognized the educational advantages of shortwave listening and have encouraged the formation of shortwave listener clubs. Educators, he notes, have long realized that shortwave listening offers a "painless" means for students to learn about electronics, geography, modern languages and current events.

## Too Few Frequencies Allocated for Communications

San Francisco's communications chief warns that police and fire department radio frequencies are dangerously crowded in the nation's large cities. According to Burton H. Dougherty, general manager of the Dept. of Electricity, a major disaster could find policemen and firemen without adequate radio communications unless steps are taken to provide some operating frequencies.

This situation, he said, indicated that "the growing national traffic jam between radio-TV broadcasting stations, land mobile communications systems, industrial and commercial two-way radio users is almost certain to create additional public safety communications problems for major metropolitan cities throughout the nation."

He said radio industry figures show that two-way radio usage has increased from 86,000 licensed units in the United States in 1949 to more than two million today. According to industry estimates this figure will increase to five million units by 1977, if adequate frequencies can be found.

Channels assigned to two-way radio service have remained at a constant five percent of the total broadcast air space during the past few years. Linked to this is an assortment of messenger services, taxi drivers and other businesses.

## Turntable Guarantee Retroactively Extended to Three Years

The one-year guarantee on Acoustic Research Turntables has been retroactively extended to three years. Owners of turntables purchased under the one-year guarantee are also automatically covered.

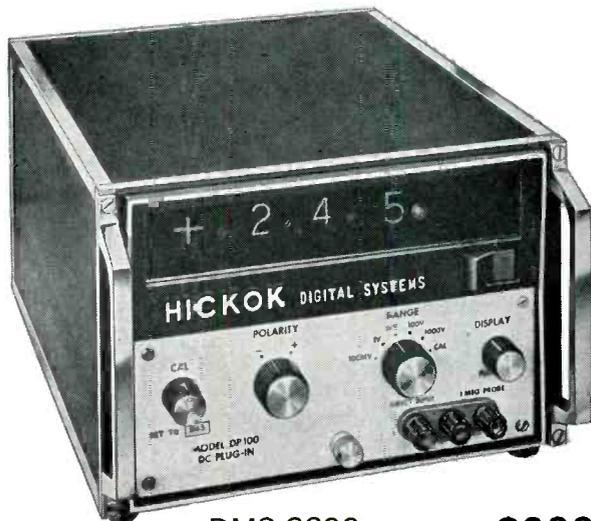
In 1961, the same company retroactively extended their speaker guarantee from one to five years.

Both guarantees reportedly cover all repair costs including parts, labor, reimbursement for freight each way and even a new shipping carton if necessary.

. . . for more details circle 139 on postcard

# Brand **NEW** FROM **HICKOK**

## DMS-3200 Digital Measuring System



DMS-3200 Main Frame **\$320**  
(shown with DP-100)



DP-100  
DC Voltmeter  
Plug-in  
**\$175**

DP-150  
1 MC Counter  
Plug-in  
**\$195**

DP-170  
Ohmmeter  
Plug-in  
**\$240**

DP-200  
Capacity  
Meter  
Plug-in  
**\$240**

DP-140  
Event Counter  
and  
Slave Plug-in  
**\$75**

### HIGHLIGHT FEATURES

- 3-digit Biquinary Tube Read-out
- Plug-in Flexibility
- All-electronic
- Fully-transistorized
- Modular Design
- Fully Field-tested
- Automatic Polarity Indication
- Automatic Decimal Point Indication

#### AS A DIGITAL DC VOLTMETER (DP100 Plug-in)

Range 0.1 millivolts to 1000 volts  
Accuracy  $\pm 0.1\%$  FS,  $\pm 0.1\%$  of reading  
True integrating voltmeter design  
10 megohms input impedance at all times

#### AS A DIGITAL 1 MC COUNTER (DP150 Plug-in)

$\pm 0.005\%$  accuracy: Resolution 1 part in  $10^7$   
(Overrange capability with sector read-out permits 3-digit display to be equivalent of a 7-digit instrument)

Frequency measurement range 0.1 cps to 1 mc  
Period measurement range 0.1 ms to 999 seconds

#### AS A DIGITAL OHMMETER (DP170 Plug-in)

Range 0.01 ohm to 1,000 megohms  
Accuracy  $\pm 0.1\%$  FS,  $\pm 0.2\%$  of reading

#### AS A DIGITAL CAPACITY METER (DP200 Plug-in)

Range 1.0 picofarad to 10,000 microfarads  
Accuracy  $\pm 0.1\%$  FS,  $\pm 0.2\%$  of reading

#### AS AN EVENT COUNTER AND SLAVE (DP140 Plug-in)

Event counting speed: 1,000,000 pps  
Alternate use as slave to DP-150 to provide 6-digit display

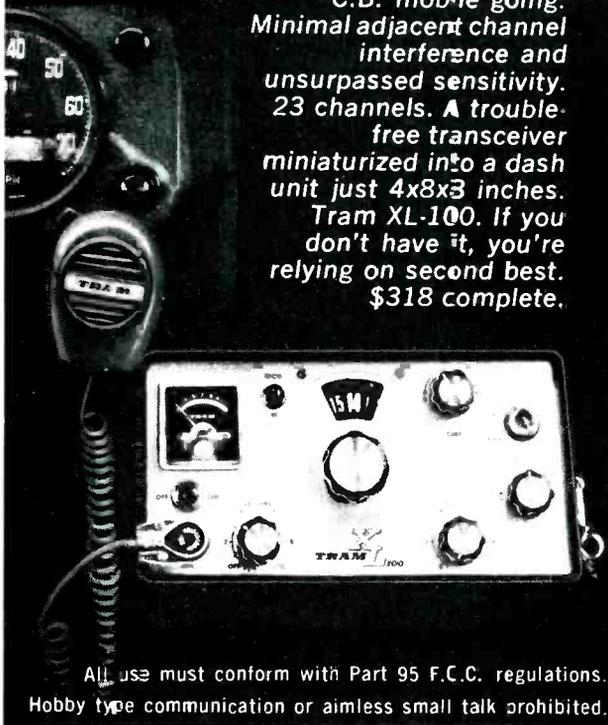
The DMS-3200 is designed for rugged industrial and laboratory applications. By utilizing a design which has the optimum combination of accuracy capability and number of digit display, the DMS-3200 meets the general purpose measurement needs of industry for reliable, precision digital measurement equipment in the \$400-\$500 price range.

XL-100 Now approved by  
D.O.T. for use in Canada



## Tram by-the -sea

Showing up everywhere.  
XL-100. The sharpest  
C.B. mobile going.  
Minimal adjacent channel  
interference and  
unsurpassed sensitivity.  
23 channels. A trouble-  
free transceiver  
miniaturized into a dash  
unit just 4x8x3 inches.  
Tram XL-100. If you  
don't have it, you're  
relying on second best.  
\$318 complete.



All use must conform with Part 95 F.C.C. regulations.  
Hobby type communication or aimless small talk prohibited.

### Tram Electronics, Inc.

Dept. No. C-1 Lower Bay Road, P.O. Box 187,  
Winnisquam, N.H. Phone 603-524-0622.

... for more details write directly to advertiser

## NEWS OF THE INDUSTRY

### More Tv Commercials Feature Antennas

Jerrold Electronics has had a massive spot radio-TV ad campaign this fall which was run in 125 key cities from coast to coast. According to Sandy Berlin, manager of the distributor sales division, local distributors increased antenna sales up to 6 times in test markets where spot TV and radio campaigns had been used last spring. "Floor salesmen who used our special customized sales book find that they can easily sell antennas to 30 and up to 50 percent of their customers who have bought color sets."

A series of TV commercials was announced by Gavin Instruments, Inc. The commercial captures Gavin the Wizard as he shows just how easy it is for the average homeowner to capture true TV color and lock in signals that may otherwise be lost. The commercial is for nation-wide release and contains a time allowance for names of dealers who carry the Gavin line of TV antennas.

Television retailers and antenna installation specialists in the greater Connecticut area attended a series of meetings sponsored by the American Institute for Better Television Reception to prepare for a better TV reception campaign launched by Channel 8 in New Haven and other cities in the area. In addition to TV announcements prepared by the station to educate viewers to the need for adequate outdoor antennas, the station also includes educational spots prepared by the institute for the same purpose. Institute manufacturer-members include Channel Master Corp., The Finney Co., JFD Electronics Co., S & A Electronics and Winegard Co.

### All-Electric Home of Tomorrow Displayed

Among the displays at the 1966 Los Angeles Home Show was an All-Electronic Home of Tomorrow. This home combined a traditional Spanish architecture with a myriad of ultra-modern devices. An electronic distribution system was used to combine these devices into a unified whole. It supplied antenna signals to TV and FM outlets in every room of the house and tied together a closed circuit TV camera and tape recorder system. Prewired into the home, the system not only accommodated all the electronic devices presently shown in the home, but provides for future developments as well.

Among the units featured in the home were: closed circuit TV/telephone systems, electronically controlled windows and lawn sprinklers, video and audio tape recorders, an electronic cooking center and a wide variety of home entertainment devices.

The All-Electronic Home of Tomorrow was built by Felger Construction Co. and the electronic system was supplied by Jerrold Electronics Corp.

### Motorola Begins Nationwide Technical Training Program

A nationwide program to support home electronics service companies and service-dealers with a large contingent of "technical training representatives" has been set in operation by Motorola Consumer Products.

A training force of 50 men is now strategically located across the nation to train Motorola service-dealers for better customer service. The territorial assignments are

based on population density with an additional task force of four men operating out of Chicago.

The training representatives will offer personalized upgrading training sessions for consumer electronic service technicians in their place of business. These sessions will be scheduled for one full day or more. A formal, classroom style session of about two hours will be devoted to a specific product, while informal training during the remainder of the day will be spent working on products either on the bench or in the consumer's home.

During their visits the training force will cover such subjects as ways to speed-up parts orders and delivery, appearance of work areas, current warranty policy, customer handling techniques and, in general, the merchandising of service.

### Demand for Integrated Circuits Expected to Multiply

The industrial demands for integrated circuits is expected to increase 15-fold to 400 million units annually by 1971. This prediction was made by Ben A. Jacoby, marketing manager of RCA integrated circuits, when speaking before members of the Instrument Society of America. The current expansion in the number of lines of integrated circuits produced is evidence of the growing market. Mr. Jacoby said that RCA's current commercial line of 15 general-purpose linear circuits will be enlarged to 40 circuits by the end of 1967.

He predicts that five years from now general-purpose integrated circuits will sell for \$1 to \$3. At that time, a specific integrated circuit for consumer applications, produced in quantities of two million per year, will probably be sold to equipment manufacturers for 50 cents each.

### Maryland County Awards Contract for \$500,000 Communication Systems

The police, fire and utility departments of Anne Arundel County, Md., are each slated to receive new communication systems under a \$500,000 contract awarded to Motorola, Inc.

Under the terms of a five-year lease, the three departments will receive 308 two-way radios for the various vehicles, 38 portable units and related base station equipment. Emergency standby base stations will also be provided for the police and fire systems.

The communications control consoles will be designed to provide 42-hour logging of police and fire calls, monitoring of neighboring public safety agencies, audio and alarm alert of all fire stations and county-wide status maps for police and fire vehicular location.

### Congress to Study Engineering Fee Restrictions

The National Society of Professional Engineers, plus two other engineering groups, have jointly filed a brief with the U.S. Comptroller General requesting the repeal of five Federal statutes that limit the fees of engineers and architects to six percent when they are working for the government.

The brief asserts that the statutes penalize the government as well as architect-engineer firms, since many of the best qualified firms are unable to undertake these public service jobs within the limitations imposed.

The General Accounting Office has been instructed by a Senate-House committee to investigate the administration of the five fee-limitations statutes by the various Federal agencies involved and to report its recommendations to the Congress by January for possible incorporation into remedial legislation.

## For a top job in Radio-TV ... get a FIRST CLASS FCC LICENSE ... or your money back!



**Y**OUR key to future success in electronics is a First-Class FCC License. It will permit you to operate and maintain transmitting equipment used in aviation, broadcasting, marine, microwave, mobile communications, or Citizens-Band. Cleveland Institute home study is the ideal way to get your FCC License. Here's why:

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### NEWS FOR VETERANS

New G. I. Bill may entitle you to Government-paid tuition for CIE courses if you had active duty in the Armed Forces after Jan. 31, 1955. Check box in coupon for complete information.

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Please send me your FREE book, "How To Get A Commercial FCC License."

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City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Occupation \_\_\_\_\_ Age \_\_\_\_\_

Veterans check here for GI Bill information

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A Leader in Electronics Training . . . since 1934 ET-27

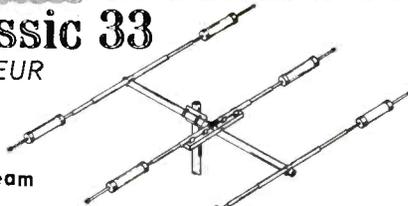
# PROFIT!

## Stock New Mosley Ham and CB Antennas

### The Classic 33

TRAP AMATEUR  
MASTER BEAM

a Tri-Band Beam



A 'Classic' Full Power rated addition to the Trap-Master family. Features a new matching system for added gain . . . 8 db. over reference dipole; 10.1 db. compared to isotropic source. Mosley advertising reinforces your selling efforts. \* (Pat. Pend.)

### LANCER 1000

AMATEUR MOBILE  
ANTENNA

for 10, 15,  
20, 40 and  
75/80 meters



This mobile antenna gives full 2 KW punch where it's needed the most. Rated for 1 KW AM/2 KW P.E.P. SSB input to the final on 5 bands. Minimum SWR. Be ready to cash in on Lancer 1000 sales. Stock up now!

### CADET

CITIZENS BAND  
MOBILE ANTENNA

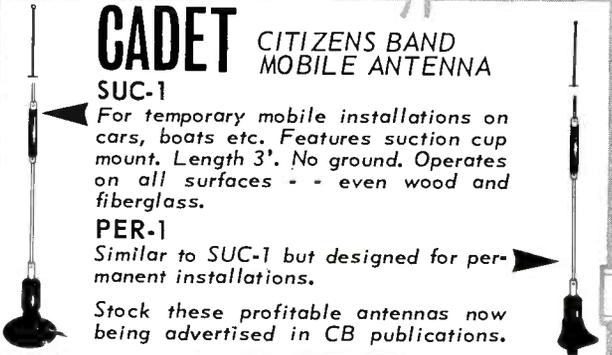
SUC-1

For temporary mobile installations on cars, boats etc. Features suction cup mount. Length 3'. No ground. Operates on all surfaces - - even wood and fiberglass.

PER-1

Similar to SUC-1 but designed for permanent installations.

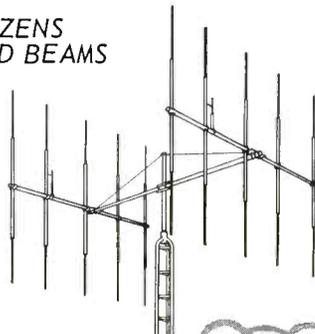
Stock these profitable antennas now being advertised in CB publications.



### STACK'IT

CITIZENS  
BAND BEAMS

STACK'IT 3 (3 el.);  
STACK'IT 4 (4 el.);  
STACK'IT 5 (5 el.);  
These are new Mosley stacked beams now being announced to CB'ers. Beams and all parts - - - even coax, boom and hardware included. Be ready for CB Stack'it beam requests.



For more information write Ad no. 117

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

. . . for more details circle 123 on postcard

## NEWS OF THE INDUSTRY

### ABC Will Have New Radio Network Center in New York

The American Broadcasting Co. has signed a contract with Visual Electronics Corp. for complete technical facilities in its new network center in New York City.

This contract, amounting to over \$500,000 will provide the network center with seven radio studio control rooms, two tape rooms, two tape edit rooms and a complete transmission-recording room facility. An extensive house monitoring system with switching facilities, as well as a modern maintenance facility, are also included.

These new ABC radio facilities are to be installed at 1926 Broadway, New York City, and are scheduled to be completed by the fall of 1967.

### Admiral Opens Plant in Mexico

The new manufacturing facility of Admiral de Mexico, a subsidiary of the Chicago-headquartered Admiral Corp., was officially inaugurated before 300 guests by Octaviano Campos Salos, Mexican minister of commerce and industry, and Ross D. Siragusa, Admiral board chairman.

The new plant employs more than 650, of whom only one is a North American. Their principal products will be B/W TV receivers, stereo phonos and radios.

### ITT Acquires Howard W. Sams & Co.

The International Telephone and Telegraph Corp. has announced the acquisition of the business and assets of Howard W. Sams & Co. The Sams Co. will be operated under the same name by a new ITT subsidiary.

### Malco Patent Held Valid and Infringed

A patent relating to self-locking terminal connectors, jointly owned by Malco Manufacturing Co., of Chicago, Ill., and Amphenol Corp. of Broadview, Ill., has been declared valid and infringed by the United States Eighth Circuit District Court, in a suit by the owners against National Connector Corp. of Minneapolis, Minn. Judge Nordbye said in his written opinion that this patent "amply fulfills the requirements of novelty, utility and nonobviousness."

A counterclaim by National Connector Corp. for alleged anti-trust violations by Malco and Amphenol was denied.

### IRC Plans \$1,230,000 Resistor Plant Expansion

IRC announces the start of a five-year, multi-million-dollar expansion of its resistor and other electronic component production facilities at Boone, N.C.

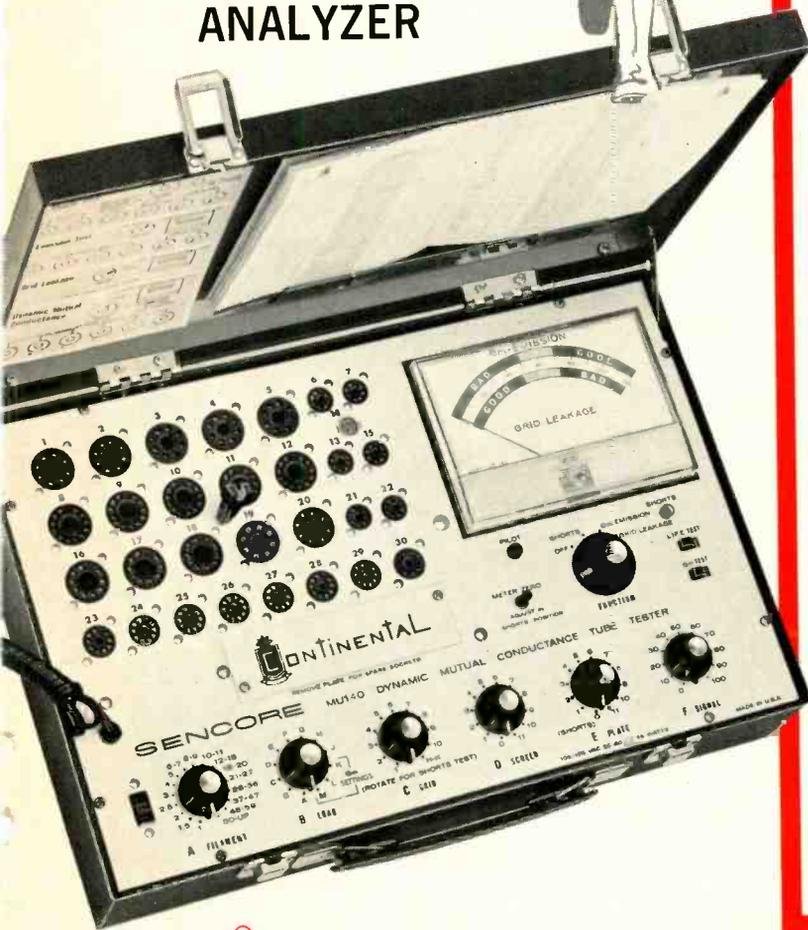
About half of the initial appropriation will go for new equipment and the balance for a 31,000 sq ft addition to be completed late next Spring.

By 1971 the company expects to more than double its present employment of about 650 at Boone. The Boone Div. manufactures resistors, selenium rectifiers and diodes, and resistance specialties.

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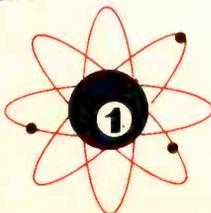
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**\$179.50**



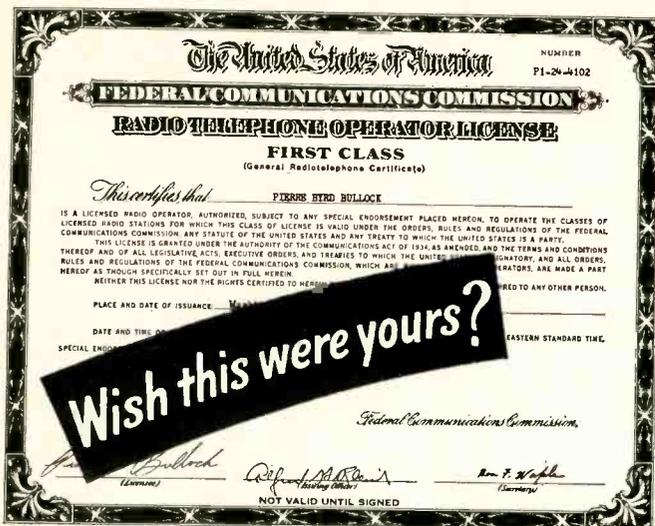
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Speed collection of over-  
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■ Collecting overdue accounts is a sensitive problem in any business. Working capital is tied up, collection letters are sometimes misunderstood and personal visits are time-consuming and costly.

According to the Bell Telephone System, experience has shown that the use of the phone is most effective when collection calls are strategically integrated with present collection procedures. The actual timing of collection calls will vary with many factors, such as the past record of the account in question. In some cases, it may be best to use a telephone call after sending your first letter. Or, the call can follow the second or third letter. In other cases, a phone call may replace the sending of any letters.

Before embarking on any collection call, it is important to develop a definite plan of what you are going to say. Also, have all pertinent facts about each customer at hand. You should know exactly how much he owes, what his past credit history is, how long he has been your customer, how much he has spent with you and what payment plans are available to him.

When you make your call, be sure to talk with the right party. Your call will be wasted unless you reach the person who is authorized to send payment. Of course, it always makes good sense to be tactful for your customer may have some valid reason for not having paid. In addition, your tactful handling of his particular situation will help insure that you get your money and also keep a customer.

If possible, work out a definite payment plan before your initial conversation. Ask the customer what payment arrangements will be convenient for him. If his suggestion does not meet your minimum requirements you can always insist on your terms. In any case, be sure the payment arrangements are definite and clearly understood.

Advance planning is necessary to achieve maximum



The integration of telephone calls with regular collection procedures is providing an effective and economical way to speed the collection of overdue accounts. An over-all goal is to obtain payment and keep a customer.

results from your telephone collection program. It is especially important to plan your approach. To help you with this, here are seven recommended steps for making a successful collection call:

- Identify yourself and your company. You will also make a better impression if you call your customer by name. Since your customer probably has already received a collection reminder from you, he will know why you are calling.
- Pause to give the customer an opportunity to offer payment or to mention any problems that have prevented him from paying his bill.
- State the facts, including the date that payment was due.
- Listen and give your customer a chance to volunteer his reason for not paying. Let him talk it out. You may uncover his reason for not paying sooner.
- Sometimes slow payments are due to some dissatisfaction. If the customer raises this issue, listen courteously to his side of the story.
- Ask your customer what payment arrangements he planned to follow. His suggestions may meet your requirements. If not, outline your plan—this is *the* reason for the call.
- Thank your customer for the anticipated payment. Remember—you are interested in getting the money and keeping a customer.

For many firms, the integration of telephone calls with regular collection procedures is providing an effective and economical way to speed the collection of overdue accounts. To help you apply these principles to your special needs, Bell Telephone companies across the country are now making available, without charge, communications consultants who are experienced in setting up and implementing telephone collection programs. ■



## TEST TRANSISTORS IN SECONDS in circuit

TR139  
89<sup>50</sup>



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and Icbo leakage.

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Sencore has developed a new, dynamic in-circuit transistor tester that really works—the TR139—that lets you check any transistor or diode in-circuit without disconnecting a single lead. Nothing could be simpler, quicker or more accurate. Also checks all transistors, diodes and rectifiers out of circuit.

**BETA MEASUREMENTS**—Beta is the all-important gain factor of a transistor; compares to the gm of a tube. The Sencore TR139 actually measures the ratio of signal on the base to that on the collector. This ratio of signal in to signal out is true AC beta.

**ICBO MEASUREMENTS**—The TR139 also gives you the leakage current (Icbo) of any transistor in microamps directly on the meter.

**DIODE TESTS**—Checks both rectifiers and diodes either in or out of the circuit. Measures the actual front to back conduction in micro-amps.

**COMPLETE PROTECTION**—A special circuit protects even the most delicate transistors and diodes, even if the leads are accidentally hooked up to the wrong terminals.

**NO SET-UP BOOK**—Just hook up any unknown transistor to the TR139 and it will read true AC beta and Icbo leakage. Determines PNP or NPN types at the flick of a switch. Compare to laboratory testers costing much more. . . \$89.50

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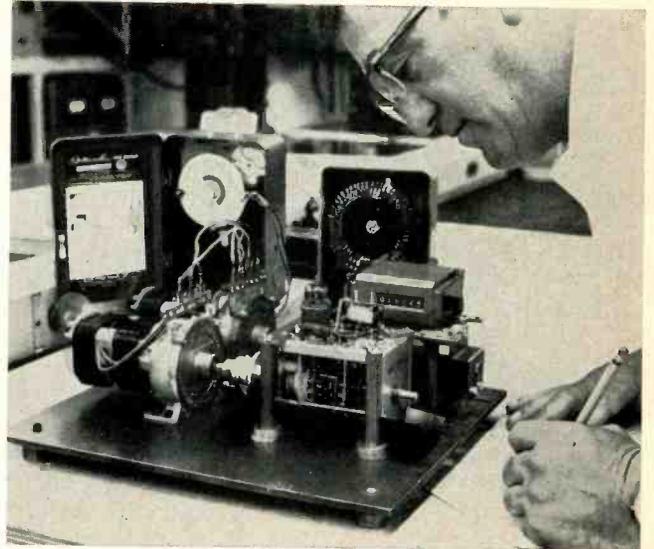
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Tuner testers are designed to produce 10 years' wear on TV tuners by twisting them 100,000 times in 30 days.

## TV Channels Changed 100,000 Times

■ There is probably no part of the family TV set that takes as much abuse as the channel selector fine tuning assembly, which must withstand the angry twists of adults and the forever curious fingers of five-year-olds interested in any moving image.

To make sure that television tuners can take this kind of daily abuse, Oak Manufacturing Co., Div. of Oak Electro/Netics Corp., reportedly puts tuners selected at random from stocks headed for major TV set makers through the mechanical equivalent of 10 years' life in an average U.S. living room. This figures out, Oak says, to 100,000 tuner twists, which are accomplished on the tuner-tester in just 30 days.

Driven by an electric motor and gear train, the tested tuner is snapped through all 13 channels, slammed against a stop, and reversed. The tuner is periodically stopped and inspected for signs of wear or deterioration, which might cause poor pictures or difficult tuning. ■

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## SEMICONDUCTORS . . .

*continued from page 61*

no problem when MOS devices are used with high-impedance transistors or other high impedance signal sources, they must be considered when the input impedance is 1K or less.

Laboratory models have been developed with a transconductance

$$(g_m = \frac{\Delta I_D}{\Delta V_G})$$

in excess of 10,000  $\mu\text{mho}$  and power gain bandwidths approaching 1GHz.

A forthcoming article will discuss tunnel diodes and their related circuits. ■

s/n ratios, improved noise limiters, squelch circuits and AGC systems.

Silicon mesa transistors and zener diodes are being used more widely to improve various sections of CB transceivers.

Noise-blanking circuits have been designed to reduce ignition noises.

But what does this technical progress mean to the legitimate user of CB equipment if he finds available channels "jammed" with ham-type hobby-talk? Considering the number of rule violations occurring today, will the field facilities of the FCC be adequate to enforce the regulations? If the service continues to degenerate it most certainly cannot continue to be an ever-growing market in the area of two-way communications. ■

## GROWING PAINS . . .

*continued from page 49*

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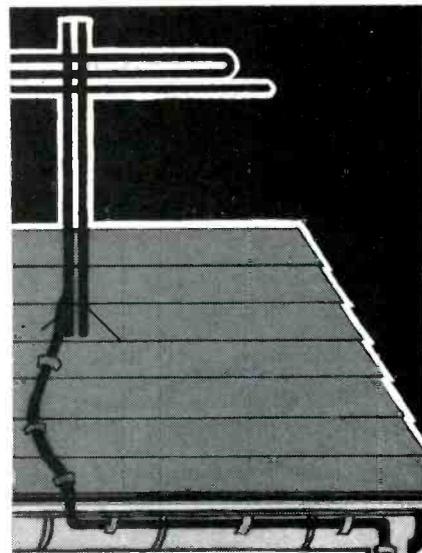


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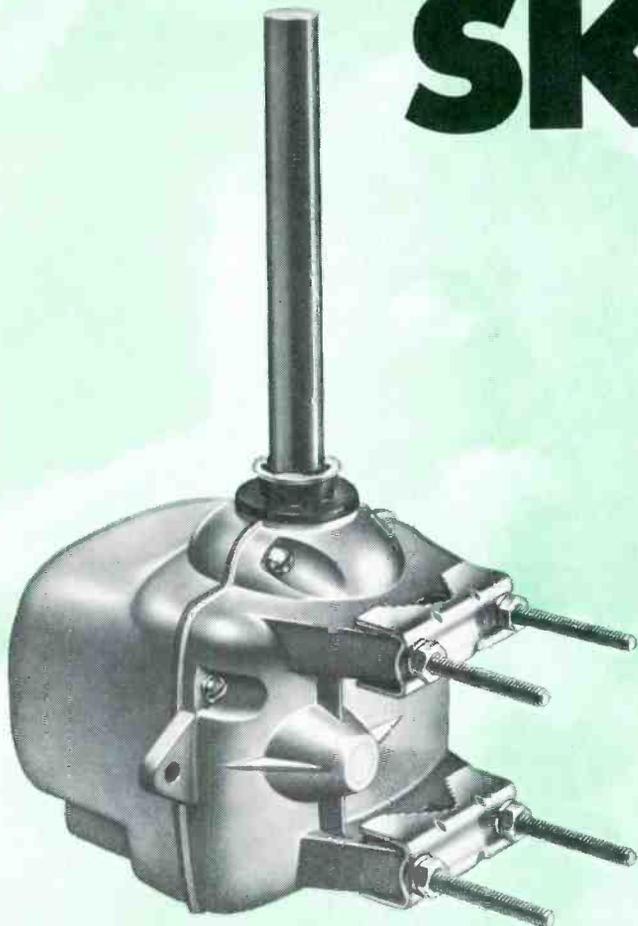
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