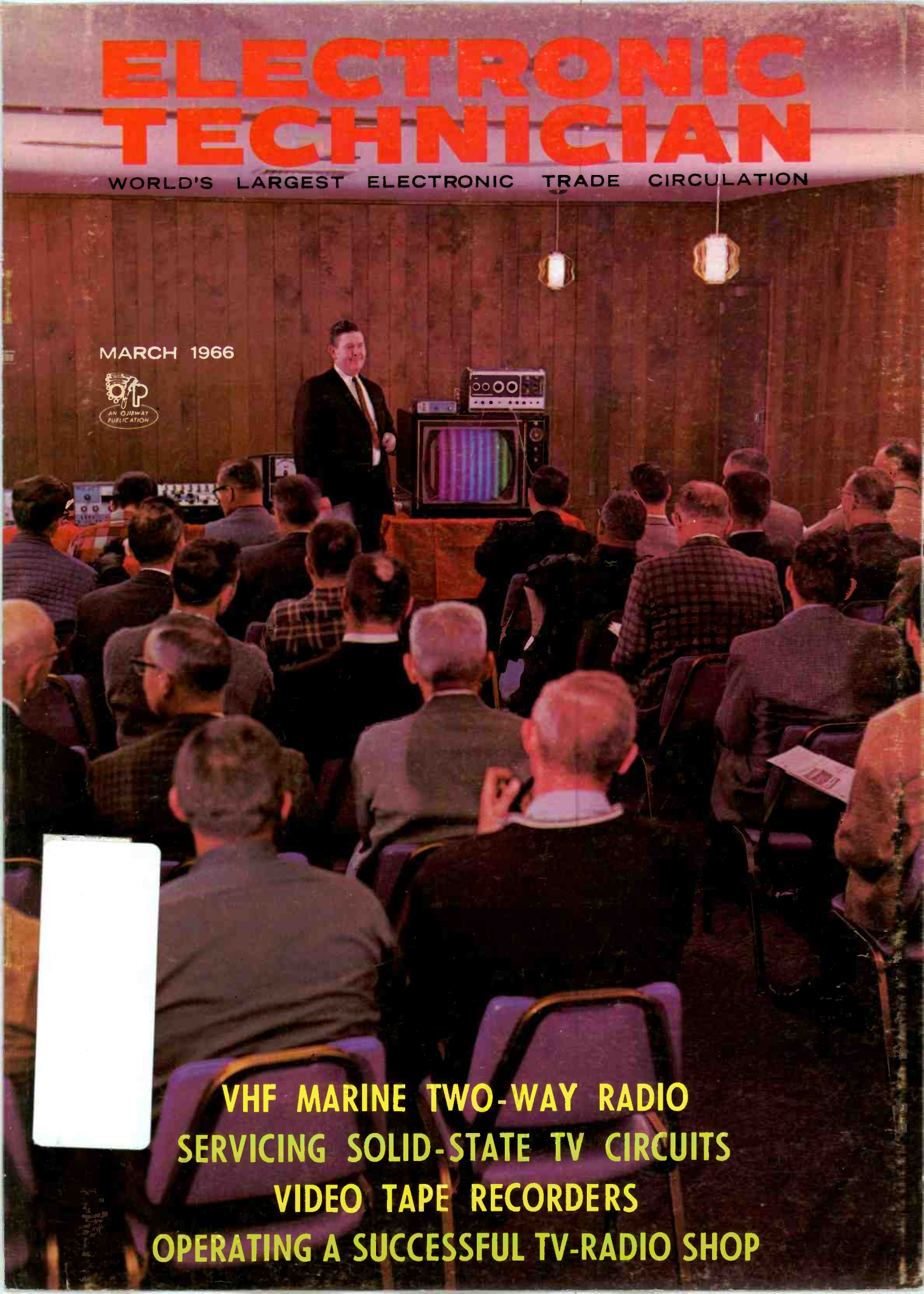
ELECTRONIC TECHNICIAN

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION



MARCH 1966

AN OJIBWAY PUBLICATION

VHF MARINE TWO-WAY RADIO

SERVICING SOLID-STATE TV CIRCUITS

VIDEO TAPE RECORDERS

OPERATING A SUCCESSFUL TV-RADIO SHOP

The mighty Ultradynes!

(Now that we've filled in the empty spaces, how can you even mention any other antenna line in the same breath)

And that goes for COLOR and black-and-white on all 82 channels . . . or UHF only . . . and FM and FM Stereo.

This line (with four brand-new models added) is complete. And the concept completely new. The result, in the Ultradyne Crossfires and Ultradyne Coloray, is the most powerful 82-channel color antenna series yet achieved. A model for every area, pocketbook, and performance need.

Each with the highest gain. Higher than any log periodic type of antenna. In fact, here is the first high-gain FM and FM Stereo performance ever developed in VHF/UHF antennas. Truly amazing front-to-back ratios, too. Over 15:1 across the entire UHF band. How did we do it? Not with mirrors.

World's best selling! The Ultradyne Crossfires are based on the same VHF principle which has made the Channel Master Crossfires the best-selling antennas in TV history. But with the remarkable new UHF antenna design added.

As for UHF only, Ultradyne UHF antennas are the first in history to provide automatic impedance match with any 300 ohm VHF antenna. No coupler is required when Ultradyne is used in conjunction with any 300 ohm VHF antenna such as the Color Crossfire.

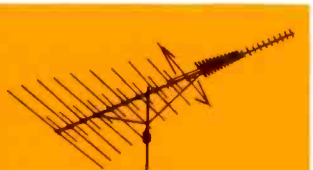
Extras? Uniquely constructed. All antennas feature our famous EPC "Golden Overcoat". And each 82-channel model comes with a U-V band-splitter (model 0032).

Mighty! That's the word.

CHANNEL MASTER Ellenville, New York

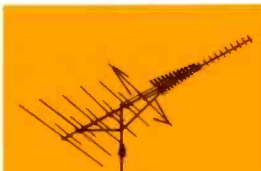
Good Housekeeping GUARANTEES

. . . for more details circle 20 on postcard



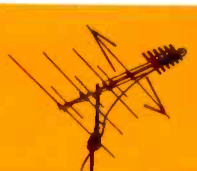
UHF/VHF Ultradyne Crossfire. New Model 3632G for deeper fringe. Sug. List: $69.95.

UHF/VHF Ultradyne Crossfire. New Model 3633G for fringe. Sug. List: $59.95.



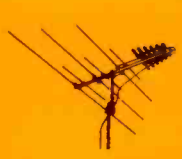
UHF/VHF Ultradyne Crossfire. New Model 3634G for near fringe. Sug. List: $49.95.

UHF/VHF Ultradyne Crossfire. New Model 3638 near fringe. Same VHF gain as 3634G, less UHF gain. Sug. List: $39.95.

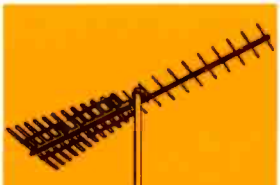


UHF/VHF Ultradyne Crossfire. New Model 3639G for near suburban to metropolitan. Same VHF gain as Color Crossfire, same UHF gain as 3638G. Sug. List: $29.95.

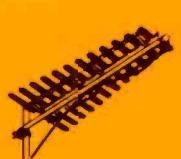
UHF/VHF Ultradyne Coloray. New Model 3637G. Famous Ghost-Killer. Sug. List: $29.95.



UHF/VHF Ultradyne Crossfire. New Model 3640G metropolitan. Slightly less VHF gain than 3639G, same UHF gain. Sug. List: $22.95.



UHF Ultradyne. New Model 4314G for near fringe to fringe. Sug. List: $24.95.



UHF Ultradyne. New Model 4313G for suburban to near fringe. Sug. List: $17.95.

UHF Ultradyne. New Model 4315G for metropolitan to suburban. Sug. List: $11.50.

GE TUBES

STOP & GO

Sweepstakes and Go Premiums

Win one of these 141 prizes:

- 1 FORD MUSTANG HARDTOP
- 10 G-E TUBE CADDIES WITH 160 TUBES
- 25 G-E PORTACOLOR TV SETS
- 25 G-E AM/FM RADIOS
- 30 G-E SLICING KNIVES
- 50 G-E VIDEO CLOCKS

Look for your Sweepstakes number and instructions inside

EARN FREE PETROLEUM PRODUCTS WITH YOUR G-E TUBE PURCHASES.

GENERAL ELECTRIC

STOP

You may already be a winner in G. E.'s Stop and Go Sweepstakes

Here's Your Sweepstakes Number

№ 203229

Open to Radio, TV and HiFi Service Dealers only. If you're a winner, fill in the information below and send this coupon by registered mail to: G-E Sweepstakes, Suite 102 — 2100 Gard ner Lane, Louisville, Kentucky 40205.

Name_____

Address_____

City_____

State_____ Zip Code_____

Distributor's Name_____

FIRST PRIZE–1966 Ford Mustang Hardtop

10 SECOND PRIZES
Tube Caddies with 160 G-E Tubes

25 THIRD PRIZES
G-E PortaColor TV Sets

25 FOURTH PRIZES
G-E AM/FM Sterec Radios

30 FIFTH PRIZES
G-E Slicing Knives

50 SIXTH PRIZES
G-E VideoClocks

GO

with free Shell or Sunoco products available with G-E Tube purchases

Check today to see if you're a Sweepstakes winner at your G-E Distributor. Match your number against the list of winners. There's a good chance one of these 141 prizes may be yours. As a bonus you will find a different number in both the March and April issues of ELECTRONIC TECHNICIAN.

On top of this you will be able to earn quality Shell or Sunoco products with all your regular purchases of General Electric Entertainment Receiving Tubes. Depending on your location, either Shell or Sunoco product certificates will be provided.* There's no limit on the number you can earn, so start collecting your premium points now.

Your G-E Distributor** is the man to contact for details on both the Stop and Go Sweepstakes and Go Premiums. Stop in and see him today.

Distributor Sales, Owensboro, Kentucky

**Gasoline and petroleum product certificates will be redeemable at Conoco stations in North Dakota, South Dakota, Montana, Oklahoma, Kansas, Nebraska, Arkansas, Wyoming, Colorado and Utah.*

***Premiums and Sweepstakes participation available at the option of your local G-E Distributor.*

OFFICIAL SWEEPSTAKES RULES

1. No purchases are required. If your number (provided in this ad) matches one of the winning numbers posted at your participating G-E Distributor, you're a winner.

2. If you are a winner, send your Sweepstakes coupon along with your name and address and the name of your G-E Distributor by registered mail to: G-E Sweepstakes, Suite 102 – 2100 Gardiner Lane, Louisville, Kentucky.

3. Sweepstakes are open to Radio, TV and HiFi Service Dealers only. An individual may win only once. Employees of General Electric or its Distributors are not eligible.

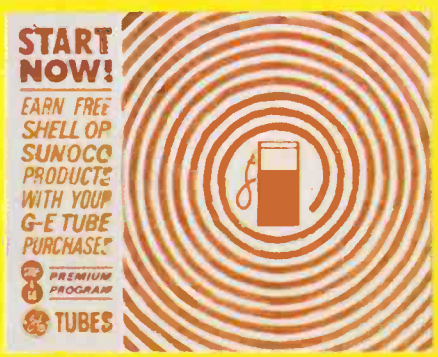
4. Sweepstakes closes May 30. All winning claims must be postmarked by that date and received by June 9. All decisions concerning winners will be made by General Electric Company and such decisions are final.

5. This Sweepstakes is void in Nebraska, Florida or wherever prohibited by law, and is subject to all Federal, State and local laws and regulations.

GE TUBES

LOOK for the G-E Distributor displaying these signs

STOP & GO



The signs and displays at your participating G-E Distributor will help determine if you're a Sweepstakes winner. They will also serve as a reminder to you of the big Shell and Sunoco deals General Electric is offering. Stop in today to see if you're a winner and start collecting premium points with your G-E tube purchases.

GENERAL ELECTRIC

288-01

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VOL. 83 NO. 3

ELECTRONIC TECHNICIAN

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION

AN OJIBWAY PUBLICATION

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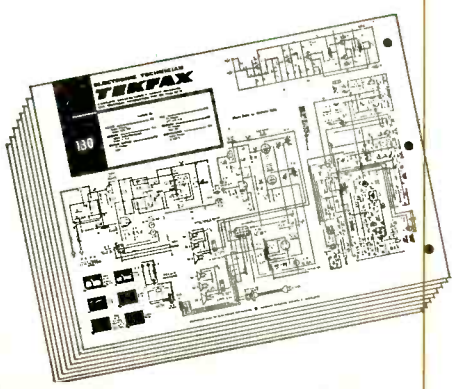
Cover

Service-dealers and technicians throughout the nation take advantage of manufacturers seminars to keep abreast of fast-moving events in color TV and solid-state technology.

FEATURES

DEPARTMENTS

TEKFAX ..... 16 PAGES OF THE LATEST SCHEMATICS



ADMIRAL: TV Chassis G2

GENERAL ELECTRIC: TV Chassis DC

MAGNAVOX: TV Chassis T908 Series

OLYMPIC, TV Model 6P28, 6P29, 6P30

SEARS-SILVERTONE: TV Model 6150, 6151, 6152, 6154, 6155, 6156, 6157

SONORA: TV Model S64K236M

ZENITH: Color TV Chassis 24NC31

EDITOR'S MEMO

Beyond 'Tomorrow'

Before the expression "rapid change" became a cliche, before the words "imagineer," "moondoggle" and a score of other space-age terms were coined and before the top business magazines of the nation discovered the "boundless age of the computer," we wrote about Boolean algebra, electronic logic circuits and how digital computers were subverting the status quo, turning the business and educational world topsy-turvy and enabling man to see through the locked doors of tomorrow—into the future.

But we couldn't really believe, even as we imagined it, how fast space-age change could take place.

Microelectronic circuitry in household consumer products, for example, was something beyond the horizon, on a new frontier, existing in "tomorrow"—strictly for exotic military gear, astronauts and space-birds. And then, in a flash, tomorrow was here—and we were projected even beyond tomorrow—deep into the future . . .

More than a month ago the Radio Corporation of America announced that it would place integrated circuits in 1966 TV sets.

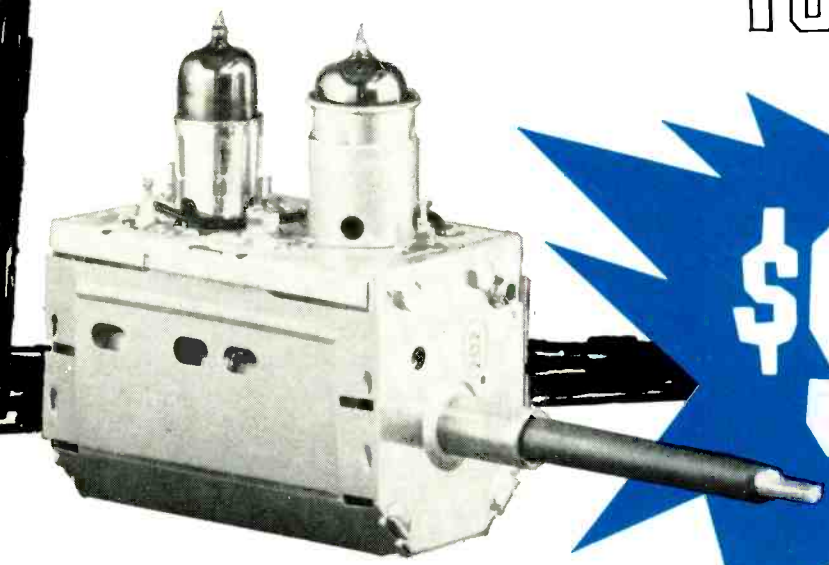
The paper-thin silicon circuits, about the size of a match head, are too small to be manipulated by human fingers. And they can perform the functions of 26 old-style components. The circuits will, of course, make pocket-sized TV sets possible. It was also announced that future plans call for applications of integrated circuits in other home entertainment products, radios and stereo phonographs—to replace tubes, transistors, diodes, resistors and capacitors.

Now Dick Tracy's bulky wrist radio is finally obsolete and can be replaced with a small lapel button or tie pin. And "007" can easily swallow his two-way radio without ill effect if he gets caught with his push-to-talk button down.

Problems that would take man a thousand years to solve are being done in a few hours today on high speed computers by using the "Monte Carlo" system. This destroys the conventional concept of "yesterday," "today," and "tomorrow" more effectively than Einstein's relativity theories did.

Actually, we are projecting ourselves into the future at a rapid rate—well beyond "tomorrow."

Complete TUNER REPAIR for only $9.50



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

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

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

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

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537 S. Walnut Street, Bloomington, Indiana
Tel: 812-332-6055

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MANUFACTURERS OF TUNERS, SEMICONDUCTORS, AIR TRIMMERS, FM RADIOS, AM-FM RADIOS, AUDIO TAPE and BROADCAST EQUIPMENT

LETTERS TO THE EDITOR

Grounding Spring Missing

Here's some info that may help other readers. If horizontal phasing diodes fail repeatedly in Zenith models M-N 2000, -01, -02 and 2003, look for missing aquadag grounding spring on CRT. We have serviced several that had this strap missing. High voltage from ungrounded coating jumps to terminal strip where AFC diodes are connected. Install a grounding strap and new diodes to complete the repair.

FRANK BARBATO

Stoughton, Mass.

Le Coq A Hero

This is one of those spur-of-the-moment letters that you feel you must write to make a day complete. After nine house- and ten color-TV-calls later, I am enjoying my dinner and thumbing through the pages of ELECTRONIC TECHNICIAN. I just came across "A Toast To the Designers" by Willy Le Coq. You can't imagine what a good down to earth belly laugh I enjoyed as I read the article — and the more I read, the more I laughed. I was laughing on the outside and crying on the inside because I so sympathized with Le Coq. For a moment I thought it was I speaking subconsciously. Why can't we have "A Toast to the Designers" each month? I'm sure you could get fresh raw material by the car load from technicians all over the country. . . . I think it's about time that technicians speak up about the "goof-ups" in equipment design — from the servicing viewpoint. . . .

STEVE KOSAK

Reseda, Calif.

. . . Let's all tip our hats to our brother technician, Willy Le Coq for his article "A Toast to the Designers." He hit the nail squarely on the head. Why did you bury this article in the back pages of ET? It is front page stuff. At least to the long suffering service industry. When a customer complains about the high price of repair, can we get the designers to foot the bill — because it took longer than it should have because they disregarded the service factor? . . . Some of the worst problems today are short yoke leads, soldered-in fuses, or fuse wires. Having to remove the chassis to replace defective speakers; having to remove a tuner to realign the oscillator slugs after oscillator tube is replaced — the designer forgot to provide a hole in front of the cabinet to poke the alignment tool through . . . Using a 16 in. long HV lead to reach from right hand side of chassis to enable it to be plugged into the CRT anode which is on left side, etc., etc. . . .

C. R. WILLIAMS

Baltimore, Md.

. . . Hurrah to Willy Le Coq for "A Toast to the Designers" in the January issue. I have wanted to write that article for years, but you know, I didn't think anyone would have the guts to print it!

DENNIS CRISP

Howard, Kansas

. . . I just finished enjoying Willy Le Coq's fine article on "A Toast to the Designers" in the January 1966 issue. Although it is called a "spoof" to the screwballs who design modern fiascos, 'taint' really funny, Magee. . .

M. WITTNER

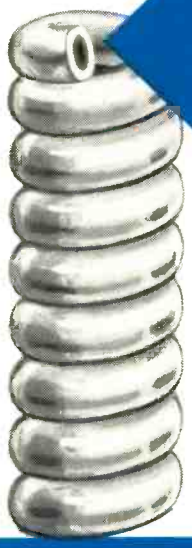
Long Beach, N.Y.

KWIKETTE* SOLDERING AIDS...

the revolutionary new connectors that make QUICK work of parts replacement!

WIRE + FLUX + SOLDER, ALL in One!

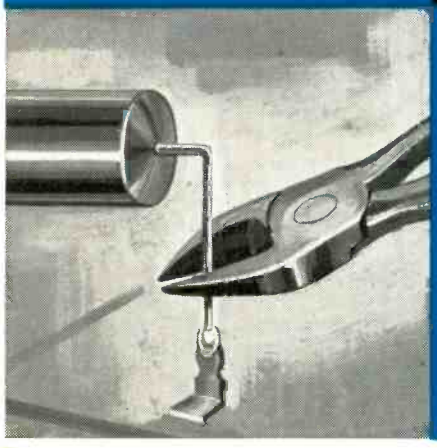
The 3-in-1 KWIKETTE is *not just another wire spring connector* . . . Copperweld wire inner core, an intermediate layer of flux, and an outer jacket of solder . . . ALL YOU NEED IS HEAT!



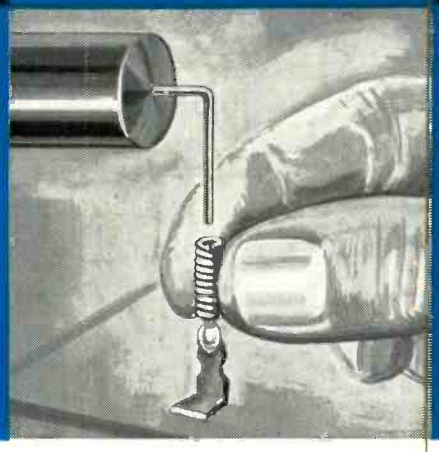
Nine times actual size

Once again, Sprague helps the TV-radio service industry by solving difficult servicing problems . . . parts replacement on printed wiring boards, in "inaccessible" chassis nooks, and on crowded terminal lugs. Mechanically sturdy and electrically reliable, the KWIKETTE provides *quick*, expert, "one-handed" soldered connections as easy as A-B-C!

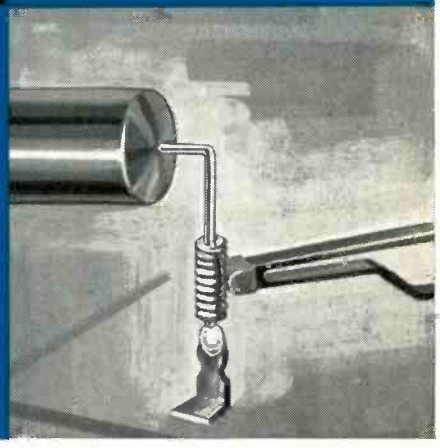
A SNIP LEAD... it's quick!



B SLIP ON KWIKETTE... it's quick!



C APPLY HEAT... it's quick!



NOBODY ELSE HAS KWIKETTE CONNECTORS . . . YOU GET 'EM ONLY FROM SPRAGUE PRODUCTS!

KWIKETTES are now being packed with Sprague Atom® Capacitors *at no extra cost to you!* Whenever you need tubular electrolytics, insist on pre-packaged Sprague Atoms from your parts distributor and you'll automatically get your KWIKETTE component connectors . . . the biggest boon to the service technician since the soldering gun!

*Trademark

SPRAGUE®
THE MARK OF RELIABILITY

WORLD'S LARGEST MANUFACTURER OF CAPACITORS

. . . for more details circle 47 on postcard

LETTERS TO THE EDITOR

'Drivel' He Says

For a bit of constructive criticism — regarding "Adventures of A Color Expert," in the December 1965 issue. I consider the bit on 'Doodlers' a sad piece of drivel, well below the standard I expect from ET. I benefit very little by reading a full page of mumbling about others.

One more comment. I believe the author of the article should have learned one additional lesson during his bout with the fouled up color bar/dot generator. When it is necessary to make a set-up during no color reception periods, *use the green stripe.*

JACK PRUDEN

Monroe, La.

We Goofed Too

You forgot to include our name and address on the car desk item you published in the Sync On Business column in the November 1965 issue.

MISHEK SUPPLY CO.

821 East Elm Avenue

Waseca, Minn.

Scoped Us

What happened to the scope articles you ran in September and October 1965 issues? Haven't seen one since.

WALTER HOBART

Los Angeles, Calif.

. . . Your scope series is fabulous. This is something I have been waiting for. Keep the articles coming every month. If I may throw in my two cents, I've always maintained that no scope manufacturer gives more value for a dollar than any other scope manufacturer. If one company produced a $300-value scope and sold it for $250, he would have all the other manufacturers on their knees (and looking to buy can-opener or mouse-trap factories) within a few months. Like the man says, you get what you pay for.

B. KILEY

New York, N.Y.

. . . Your scope articles are fine but kind of slim. Let's have more meat and potatoes with the bones.

LES WATSON

Chicago, Ill.

• *Our scope man has advised that he has been too busy on other matters but he's back in action again.—Ed.*

They Goofed

Part II of "Noise Figure Measurement Fundamentals," November 1965 ET, has an error in Fig. 6. The filament and B+ leads to the noise "head" are reversed. The mistake was in the original drawing.

H. T. HOWARD

Stanford, Calif.

Needs Recording Head

Can any reader (via ET) tell me where I can get a recording head for a Webster-Chicago Model 288 Electronic Memory wire recorder? I understand it's no longer made.

JOSEPH PETERSON

LaCrosse, Wis.

Needs Capacitor Analyzer Schematic

I've been trying for three years to locate someone with the schematic of a Solar Capacitor Analyzer, model CF. Can anyone help me? Write via ET.

LEO SMITH

Sandy, Utah

Engineered for Professional Quality
and savings up to 50%

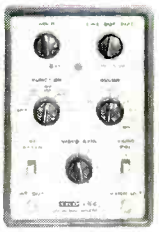
Whether you want the creative pleasure and thrift of build-it-yourself, or factory-assembled professional quality equipment ready-to-use—you save up to 50% with EICO

no-compromise engineering. Be super-critical. Compare EICO with anybody else. The more critically you judge, the more you'll see for yourself that your best buy is EICO.

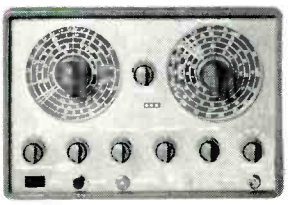
EICO
KITS & WIRED

COLOR TV LAB

Three compact portable instruments for shop or home Color TV servicing. Add one more and you're set for FM-MPX stereo.



New Model 380 Solid State NTSC Color Generator generates exact NTSC color signals individually and all required dot-bar patterns. Super-compact, 4 pounds light, instant operation. **$159.95 wired only.**



Model 369 Sweep/Marker Generator for 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 2-225mc. Crystal marker oscillator. Post injection of markers. **$89.95 kit, $139.95 wired.**

New Model 435 Direct-Coupled Wideband Scope. Top-quality DC-4.5mc scope with 3" flat-face CRT. Zener calibrator: Outperforms 5" scopes three times its size, facilitates on-location color TV and other servicing. **$99.95 kit, $149.95 wired.**

New Model 342 FM Multiplex Signal Generator. Design lab quality. Both composite audio and FM RF outputs. Inputs for stereo audio source for store demonstrations, critical A/B listening tests. **$149.95 wired.**

New Model 1030 Regulated Power Supply. Speeds troubleshooting, design work, production line testing, electronics teaching. Variable bias and plate sources regulated to ⅓ of 1%: 0-150V @ 2ma; 0-400V @ up to 150ma. Ripple less than 3mv rms. Unregulated fil. volts of 6.3V & 12.6V, @3A. Switchable, monitoring milliammeter and voltmeter. **$59.95 kit, $99.95 wired.**

New Model 378 Audio Generator. Near-distortionless sine wave generator (<0.1% 20-20,000c) providing fast, convenient switch-selection of frequencies from 1c to 110kc (1c steps 1c-100c, 10c steps 100c-1kc, 100c steps 1kc-10kc, 1kc steps 10kc-110kc), 8-pos. 10db/step output attenuator & fine attenuator. Output meter (4½" 200ua) with 8 voltage ranges & db scale. **$49.95 kit, $69.95 wired.**

New Model 965 FaradOhm Bridge/Analyzer. "Unusually versatile"—Electronics World. 9-range, low-voltage capacitance-resistance bridge safely measures even 1-volt electrolytics. Metered bridge balance. leakage test voltage (6 DC VTVM ranges 1.5-500V), leakage current (11 DC VTAM ranges 0.15ua-15ma). DC VTVM & VTAM externally usable. **$129.95 wired.**

Model 460 Wideband Direct-Coupled 5" Oscilloscope. DC-4.5mc for color and B&W TV service and lab use. Push-pull DC vertical amp., bal. or unbal. input. Automatic sync limiter and amp. **$89.95 kit, $129.50 wired.**

Model 232 Peak-to-Peak VTVM. A must for color or B&W TV and industrial use. 7-non-skip ranges on all 4 functions. With Uni-Probe.® **$29.95 kit, $49.95 wired.**

New Model 779 Sentinel 23 CB Transceiver. 23-channel frequency synthesizer provides crystal-controlled transmit and receive on all 23 channels. No additional crystals to buy ever! Features include dual conversion, illuminated S/RF meter, adjustable squelch and noise limiter, TVI filter, 117VAC and 12VDC transistorized dual power supply. Also serves as 3.5 watt P.A. system. **$169.95 wired.**

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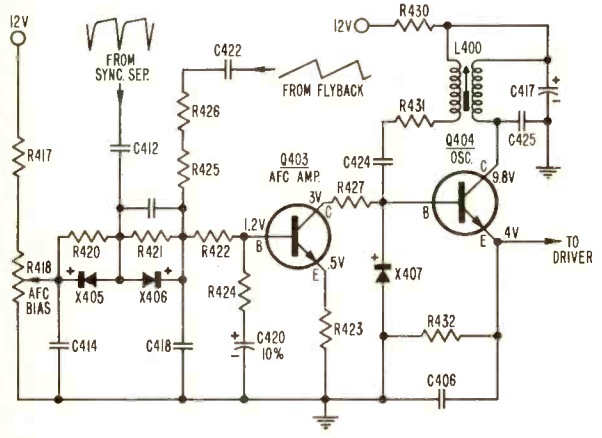
WESTINGHOUSE

TV Chassis V-2483—Horizontal Sweep Circuit Operation

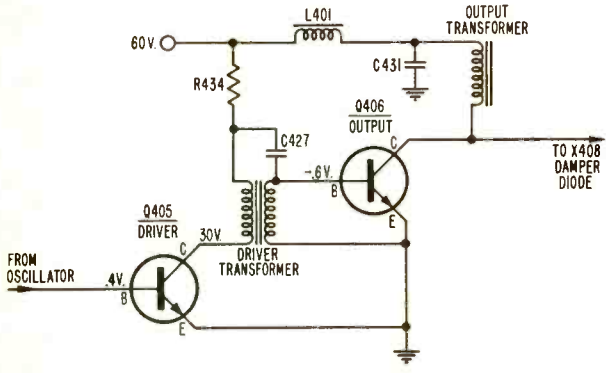
The horizontal sweep section consists of an AFC circuit (a dual-diode network and AFC amplifier), an oscillator, a driver, a power amplifier, a diode damper and a tube-type high voltage rectifier. Even though four transistors are required, very few other components are used as compared to a multivibrator in a monochrome receiver.

The dual-diode requires two pulses to produce a correction voltage; the horizontal sync pulse from the sync separator and a sawtooth from the flyback. These two pulses combine in the diode network to produce a correction



voltage which is direct-coupled to the base of AFC amplifier, Q403. The network of C422, R426 and R425 reshape the sawtooth waveform being fed back from the flyback for use by the AFC network.

The AFC amplifier is a simple dc amplifier. Any small change in the correction voltage at the base is amplified and appears at the collector as a larger voltage change. This is coupled to the base of the oscillator, Q404, through

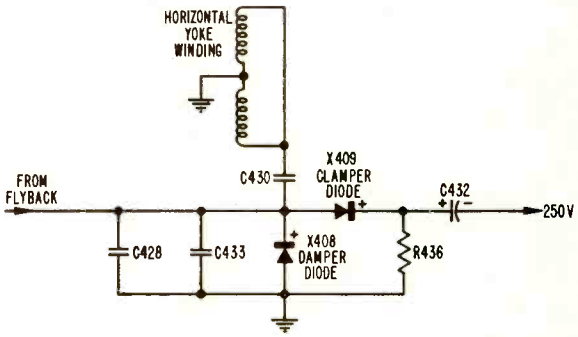


R427 and serves as a reference voltage that C424 discharges to during the oscillator cycle. The oscillator frequency is controlled by this reference voltage.

The oscillator is a blocking oscillator type. Feedback is from collector to base through L400, R431 and C424. Assume that the transistor is conducting. The waveform in the primary of L400 has a maximum value of approximately 12v when the transistor conducts. The induced voltage in the secondary of L400 is the opposite; it begins at zero and has a maximum value of 12v. Whereas the waveform in the primary is negative going, the waveform in the secondary is positive going. After the waveform reaches its maximum positive value, it decays slowly to zero. The waveform coupled to the base of the oscillator by C424 tries to follow the waveform across the secondary of L400, but is modified slightly by the capacitor to produce a gradual rolloff. A charge is formed on C424. When it leaks off, the base voltage goes to a positive 0.6v (approximately), through the cutoff level of the transistor, and cuts the transistor off.

The conduction time of the oscillator and therefore its frequency, is determined by the value of C424, by the value of dc voltage at the junction of R427-X407, and by the presence of X407. The diode is connected in a reverse bias position so that the voltage at the base of the oscillator is clamped at a more positive value. Its removal or its change in conduction characteristics would change the frequency of the oscillator, possibly to the extent that horizontal sweep and high voltage would be cut off. Diode X407 also protects the base-emitter junction of Q404 from becoming dangerously back biased.

The output waveform which is taken from the emitter is basically square in shape, but with a high initial peak lasting a few microseconds that rises and drops off quickly.



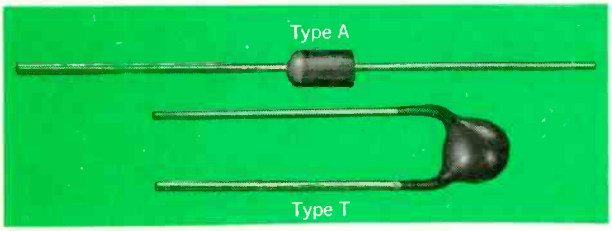
The entire pulse lasts for about 22μsec of the total horizontal scan time of 63μsec. This time, then, represents the "on" time of the oscillator.

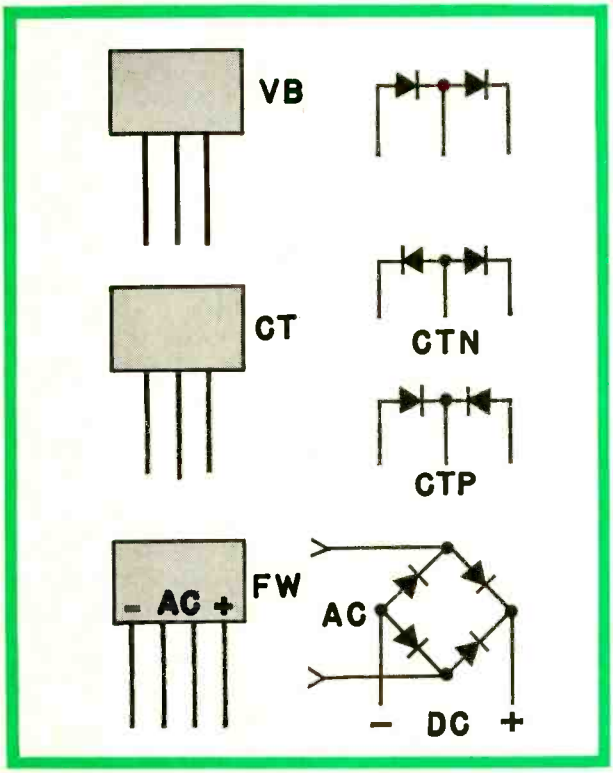
The 22μsec positive-going pulse from the oscillator turns on the NPN driver transistor, Q405. Ordinarily, a square wave pulse would appear at the base of the output transistor, Q406, but with addition of C427 across the driver transformer, the result is a sawtooth waveform produced at the base of the output transistor, Q406. The driver, Q405, has a push-off radial heat sink. Caution should be observed when probing around this circuit since the heat sink has collector voltage on it. No other parts should be allowed to touch the heat sink.

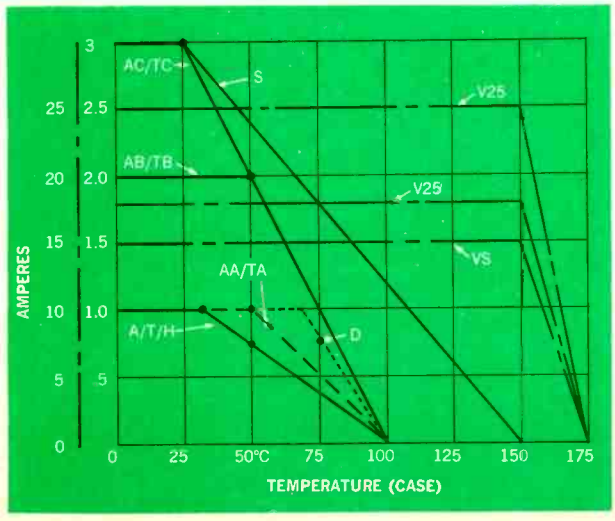
The horizontal output transistor, Q406, is also mounted on a heat sink at the right side of the chassis. Caution must be observed when probing around his area. Although there is no voltage on the heat sink, collector voltage appears on the transistor case and its two mounting screws. Basically, this transistor is a high-power switch which conducts for about 10μsec and is then cut off. This is sufficient to

MALLORY **Tips for Technicians**

How to save trouble and money in replacing silicon rectifiers







When you need to replace silicon rectifiers, it will pay you to take a look at what's available from your Mallory distributor —at new low price tags.

Suppose you need to replace a single rectifier. Some service technicians have followed an ancient adage that the only kind to use "to be sure" is a MIL top hat style. This may have been true in the pre-historic days of semiconductors (eight years or so back). But not today. Plastic-case Mallory rectifiers —Type A and Type T—are every bit as good for entertainment equipment. And they cost less, fit anywhere, are easy to mount. If you insist on a top hat, you can't get a better one than the Mallory Type H; but you don't really need it unless ambient temperatures reach the egg-frying point.

Doublers. When one leg of a doubler goes out, better check the filter capacitors first. A leaky filter or a sudden current surge could be the reason the rectifier failed. Our tip: replace the whole doubler—to make sure you won't get a call-back if the other half had been pushed beyond its limit and was ready to fail. Easiest way to do the job is to install a Mallory VB doubler package. These encapsulated units consist of a pair of factory-connected, matched rectifiers in series. Just three leads to connect instead of four. And the cost is less than that of two separate rectifiers.

The same deal goes for center-tap rectifiers. Our CT packages, in either positive or negative center tap configurations, give you the assurance of matched rectifier characteristics. Savings are identical with what you get on doubler packages.

How about full-wave bridges? You'll find a lot of these in sound equipment, so all the more reason to make sure that you deliver a top quality replacement job. It's a cinch to replace four separate rectifiers with a Mallory Type FW package—a neat encapsulated unit with only four leads to worry about instead of eight, and with four matched rectifiers factory-connected inside. And the cost is substantially less than four separate rectifiers.

And best of all, when you use Mallory packaged circuits you're sure of getting the best OEM quality. Ask your Mallory distributor . . . for silicon rectifiers in ratings up to 25 amps, for zener diodes, for dual trigger diodes and for new Amp-Gate* diodes for battery-charging circuits. Mallory Distributor Products Company, a division of P. R. Mallory & Co. Inc., Indianapolis, Indiana 46206.

50th ANNIVERSARY

*P. R. Mallory & Co. Inc. trademark

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TECHNICAL DIGEST

provide full scan because the energy stored in the yoke (an RL circuit) decays slowly.

The damper diode X408 minimizes any ringing that might occur in the yoke current during trace time. Damping action is similar to familiar tube type circuits except that a damper tube is not used. The job is done by a semiconductor device.

The clamper diode, X409, protects the horizontal output transistor from damage caused by momentary arc-over in the high voltage section.

MAGNAVOX

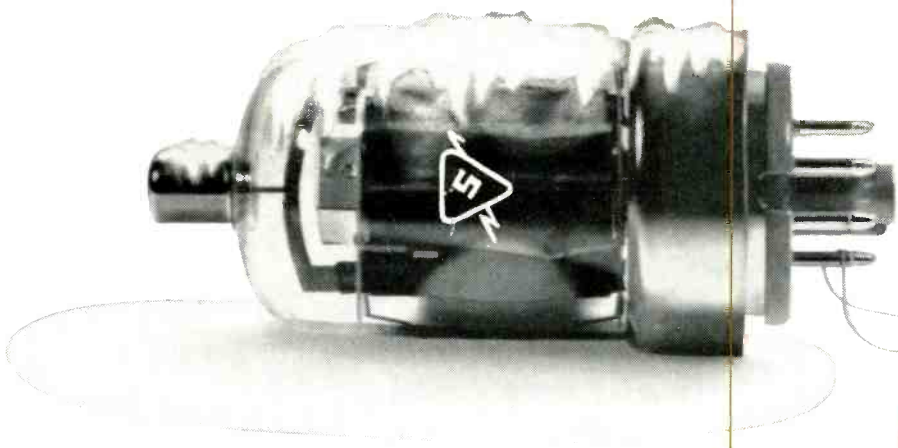
TV Chassis T908/T915—Production Changes

Intermittent Sound: Some reports have been received of intermittent sound accompanied by a "popping" sound in the audio. The sound IF stage uses a 2.2pf capacitor (C303) as a neutralizing capacitor and under certain circumstances this stage may tend to oscillate at a frequency around 20MHz. If this is the case, removing C303 will eliminate the "popping" and intermittent sound, however, it may be necessary to re-tune the sound input transformer, L301, as outlined in the service manual. In later production C303 will be a 1.5pf capacitor and R304 will be changed from 1K to 1.2K.

Horizontal Hold Range: If improvement in the horizontal hold range is desired, this can be achieved by shorting R603 (with a jumper wire) and removing the 390pf capacitor connected across the varicap, D602. On the T908 chassis this capacitor is C614 and on the T915 chassis it is C606. In later productions R603 will be changed from 47K to 1K and the 390pf capacitor is omitted.

Addition of AGC Control: R236 in the AGC circuit was changed from a fixed resistor (680Ω) to a variable pot to provide adjustment of AGC to compensate for variables in VHF tuner and IF characteristics. This control is mounted on the printed board in the same location as the fixed resistor. This is a 1500Ω pot, part No. 220182-2. In some chassis a 10K pot was used, but it was shunted with a fixed resistor to provide an equivalent value of approximately 1500Ω. This control is accurately set at the factory to provide 1.7v AGC voltage at the RF AGC point with a 2000μv signal at the antenna input. The control will not normally require adjustment in the field unless it is suspected that the factory setting has been changed or in the event that the VHF tuner or the 1st or 2nd video IF transistors are replaced. If adjustment is required: (1) Connect an ohm meter from ground to the junction of the control (R236) and D204 and adjust the control to provide a resistance of approximately 550Ω. (2) Turn the receiver on and check reception on all available channels. The control may be adjusted very slightly from this pre-set position to minimize snow on channels you normally receive snow free or to eliminate overloading on very strong signals. In most cases, however, the correct setting will be at the pre-set resistance as in step 1.

Our 6146B has a cooling system inside.



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And because it does, it has a higher dissipation safety factor and stays in power longer than conventional amplifier tubes.

The heart of the system is Sylvania's cool-running Hi-Con plate. It's iron that's copper-plated and then nickel-plated.

This combination keeps the tube cool, prevents hot spots, assures greater uniformity in heat reduction and efficient heat radiation.

The Sylvania 6146B also has increased heat transfer at a lower operating temperature because a heavy oxide insulating coating isolates the heater from the cathode. Rated power output is maintained even at reduced heater voltage.

The cathode is cold-rolled from a blend of powdered metals to eliminate peeling and flaking of the emissive coating. Emissive materials are progressively reactivated and this reduces "gm slump."

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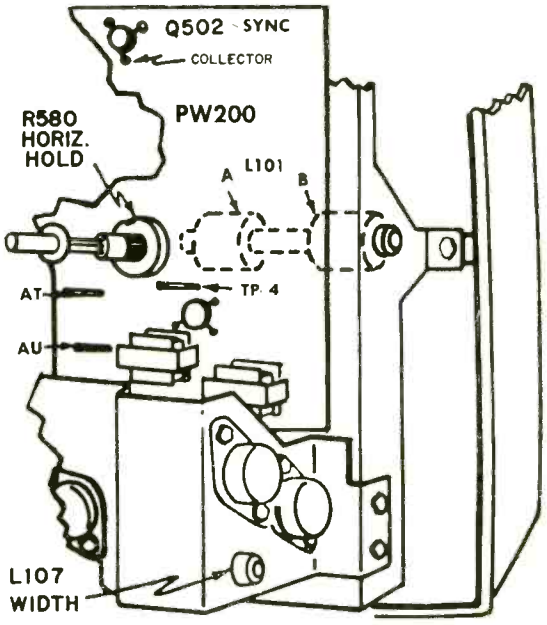
TECHNICAL DIGEST

RCA VICTOR

TV Chassis KCS153—Horizontal Oscillator Adjustments

The horizontal oscillator originates the 15,750Hz waveform for use in developing a sweep waveform in the horizontal output stage. This stage uses an NPN transistor in the grounded emitter circuit; it is a blocking oscillator with refinements to obtain high operating stability. Within certain limits the frequency is automatically corrected by an AFC correction voltage. The output of the oscillator



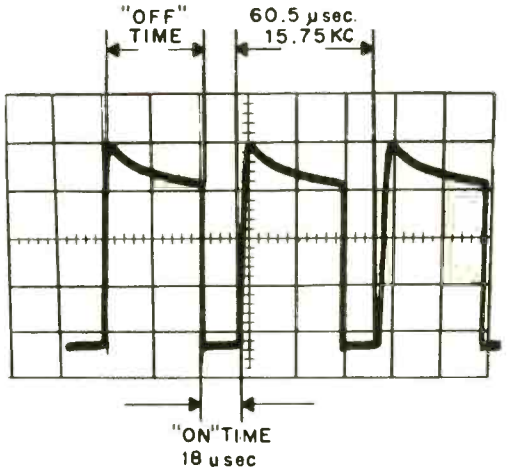
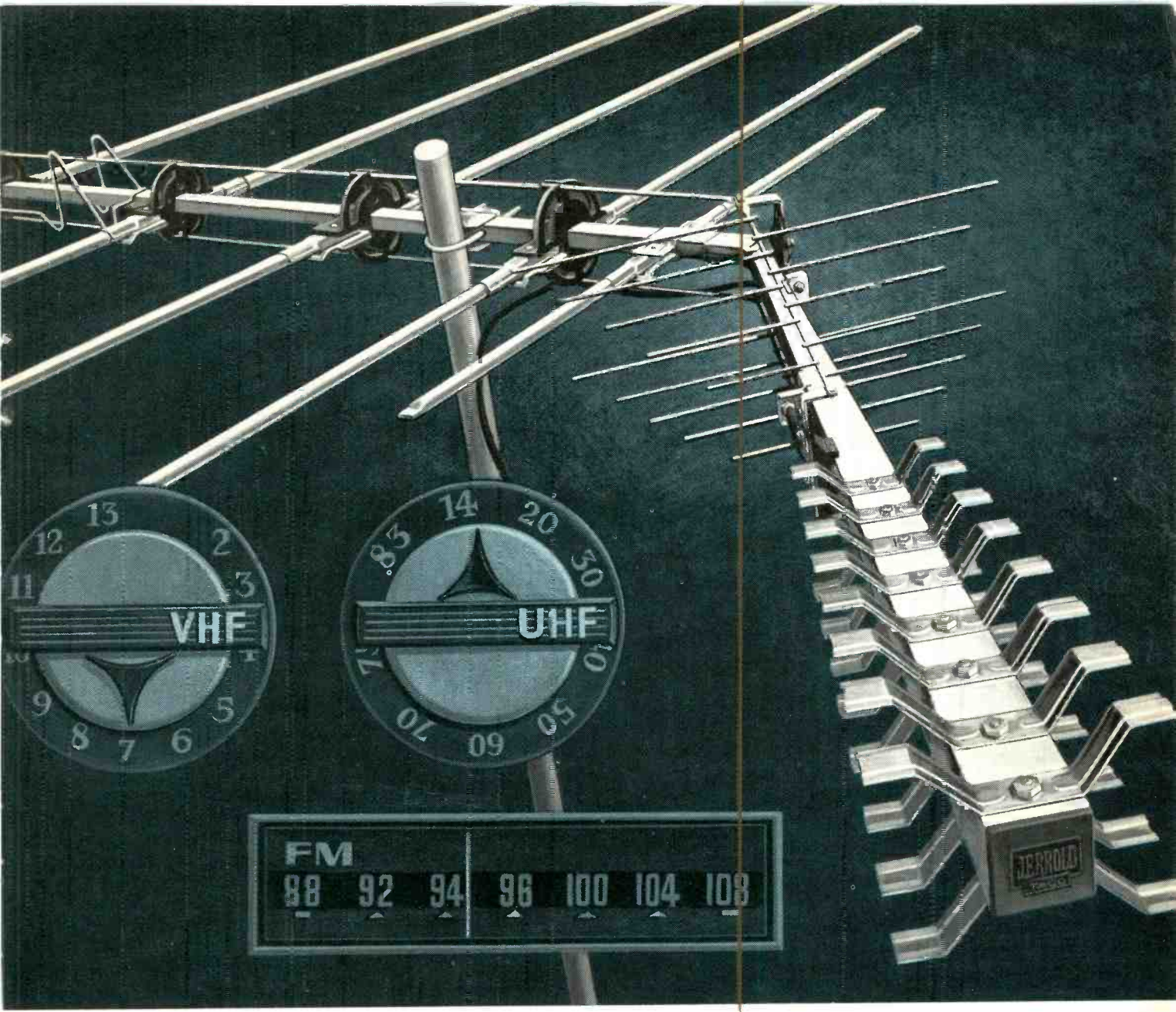


Figure 6—Waveform at TP4

is a squarewave which is applied to the horizontal driver for further processing.

Stability is achieved by using two stabilizing coils. One coil, L101A is the familiar "sinewave" coil which stabilizes the oscillator OFF time. The other coil, L101B, is used to introduce a higher frequency "ringing" (approximately 40kHz); this stabilizes the ON time of the oscillator.

Field Procedure: (1) Connect a jumper from Q502



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TECHNICAL DIGEST

(collector) to ground. (2) Connect a jumper from terminals AT to AU. (3) Adjust horiz hold (R580) for least sideway drift of picture. (4) Remove jumper from terminals at AT and AU. (5) Adjust L101A for least sideway drift of picture. (6) Remove jumper from Q502 (collector) to ground.

Adjustment of L101B is not a normal field service adjustment. The following "shop procedure" should be used when adjusting L101B.

Shop Procedure: (1) Perform steps 1 through 5 of field procedure. (2) Connect scope to TP4. (3) Adjust L101B so ON time is about ½ the width of the OFF time. (4) Remove scope from TP4. (5) Readjust L101A to lock picture. (6) Remove jumper from Q205 (collector) to ground.

Width Coil Adjustment: At an ac input line voltage of 108v, adjust L107 (width coil) to fill screen with not more than ¼ in. overscan on both sides of the picture.

MOTOROLA

TV Chassis TS-454A — Production Changes

To reduce barkhausen oscillation: The 0.005μf capacitor, C512, removed from screen circuit of horizontal output tube. **To eliminate silicon diode radiation:** The gray ac lead feeding power rectifier diode, E801, was removed from wiring harness and re-dressed. **To increase brightness range:** The 180K resistor, R201, in brightness control circuit changed to 150K. **To improve reliability of electrolytic filter capacitor, C802:** Filter capacitor, C802, relocated beneath VHF tuner. It is recommended that if the filter capacitor is being replaced and is located under the top chassis, that it be re-located. The Motorola replacement capacitor Part No. 23P65133A22, includes the mounting bracket. Add approximately 5 in. of lead to the filter choke leads to facilitate possible future servicing of upper chassis. **To increase 47.25Mc attenuation:** The 16K resistor, R101, changed to 10K, 5%. **To improve reliability of 4BZ6, 1st IF amplifier, V-3:** The 220Ω resistor, R104, in plate circuit changed to 1000Ω. **Design change:** The main chassis board (etched panel) has been revised slightly to improve insulation area adjacent to horizontal output tube, to provide filtered B+ voltage to plate of audio output tube and to provide space for an RC (R620-C610) filter network located in the feed-back network between the grid of horizontal output tube and vertical linearity control.

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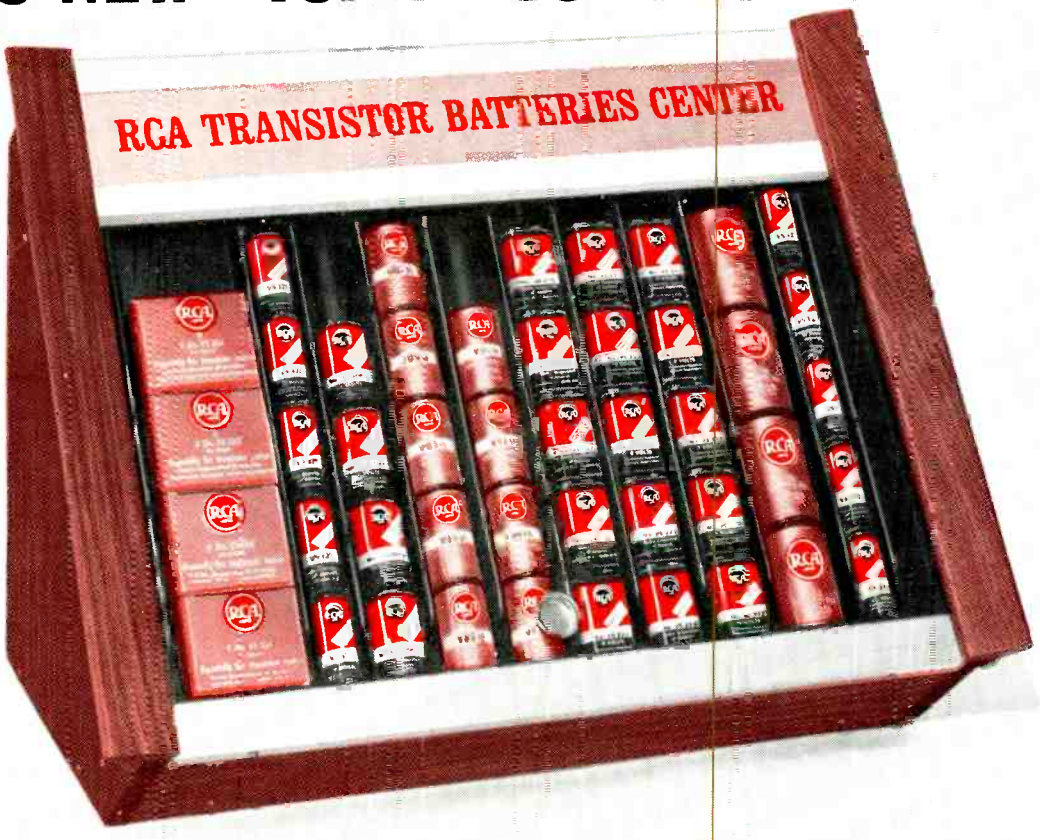
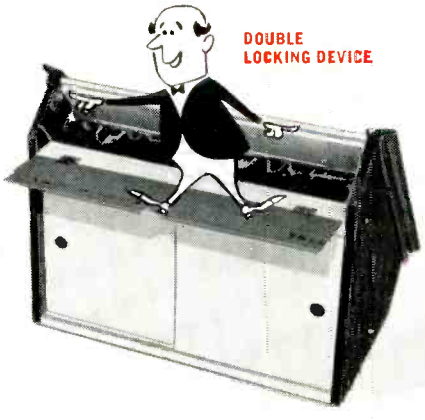
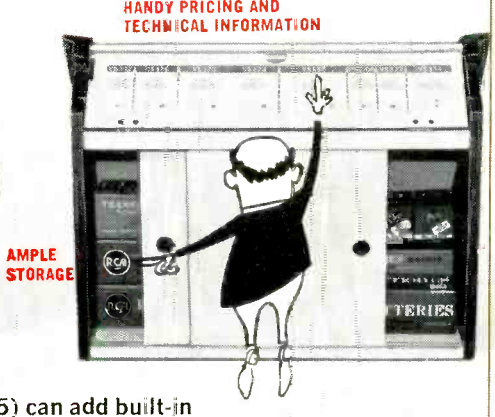
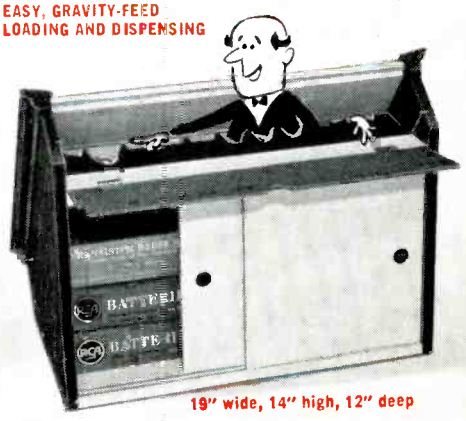


Quality and convenience... inside and out. Its gold anodized aluminum header and genuine walnut trim reflect the smart styling, top quality, and durable construction of this RCA Battery Showcase. Underneath... there's a real inside story of selling convenience.







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• • •

The nation-wide "Sell Service" campaign has been expanded by the Distributor Products Div. of the Electronic Industries Assn. (EIA). The campaign is designed to increase parts sales of producers and distributors by encouraging service technicians to seek additional repair jobs. It is expected that the campaign will be scheduled at the EIA Spring Conference at Washington this month. Technicians will be urged to "Sell Service" by reminding customers that radios, TV sets, phonos and other electronic entertainment equipment lying unused in the home can be restored to working order by repair. The theme of the "Sell Service" program is "What Else Needs Fixing?"

• • •

Digital measuring equipment in the $400-$500 price range is now being manufactured by Hickok. The equipment is expandable and the line begins with a dc voltmeter, a 1MHz counter, ohmmeter and capacity meter plug-in units. Additional plug-ins will be made available periodically. The equipment will be sold exclusively through the company's existing distributor organization. If you do lab or industrial type work requiring this equipment write on your letterhead for detailed information to Hickok Electrical Instrument Co., 10514 Dupont Ave., Cleveland, Ohio 44108.

• • •

The increasing demand for microphones should be taken advantage of by those service-dealers and technicians who are prepared to do so. Mike manufacturers are stepping up their promotion efforts. Sonotone, for example, has redesigned its packaging line for tape recorder, PA system, CB transceiver and professional types and matched mikes for stereo taping. The packaging is printed in two colors, an attention-getting red-orange and black. As tape recorder, audio communications and two-way radio communications equipment sales continue to rise, so will microphone sales.

• • •

How to adjust and maintain relays is described in a 20-page pocket size booklet available from P. K. Neuses, Inc., 511 N. Dwyer St., Arlington Heights, Ill. It covers adjustment of armature assemblies, tensioning, gaging and explains current values and timing for all types of relays.

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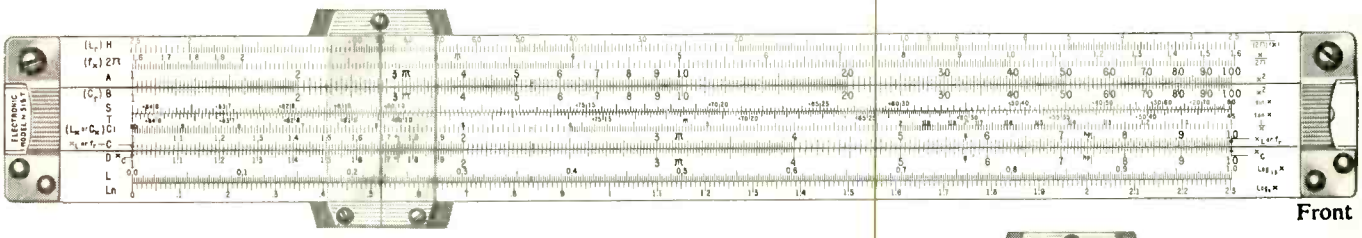
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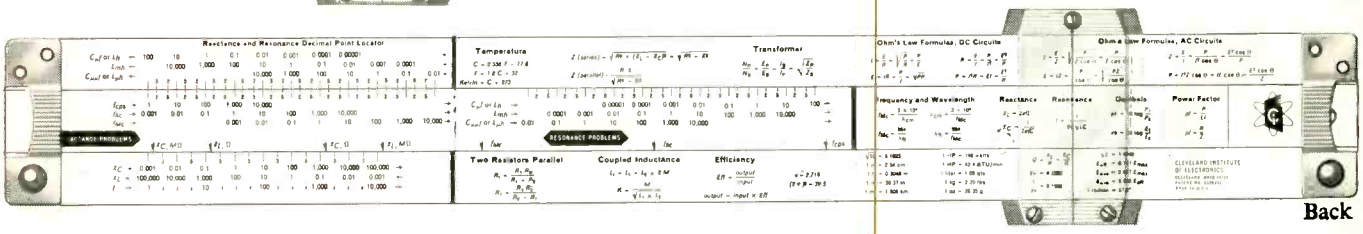
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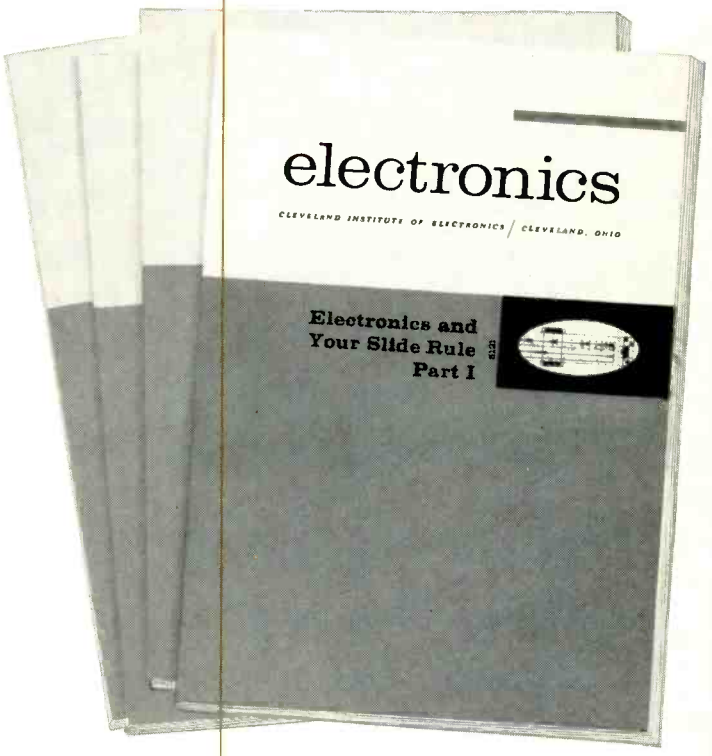

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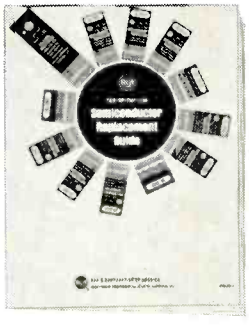
RCA's new Top-of-the-Line Replacement Guide SPG-202A is an absolute necessity if you are servicing solid-state entertainment-type equipment. It lists the 18 RCA types and the more than 5,000 types which they replace. Ask your RCA Distributor for your copy or write: Commercial Engineering, Section C 46SD RCA Electronic Components and Devices, Harrison, New Jersey.



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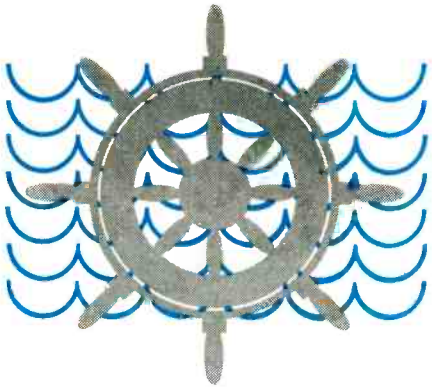

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A business opportunity for two-way communications service-dealers and technicians

■ The Coast Guard, the FCC and the Radio Technical Commission for Marine Services are urging small boat owners to use VHF marine radiotelephones so the congestion on 2182kHz can be alleviated.

In many respects, the 18-channel VHF/FM marine band—available to both pleasure craft and commercial vessels—is far better for many communications purposes than the 2-3MHz marine band.

The VHF marine band has been ignored by most service-dealers mainly because they know so little about it. Now, however, the move to the VHF marine band is under way—stimulated by expansion of the Coast Guard network of VHF stations and by the introduction of new, low-cost VHF marine equipment.

VHF equipment is now widely used by Great Lakes vessels and by tug boats operating on salt water and by tow boats operating on the Mississippi, Ohio and Missouri Rivers. The St. Lawrence Seaway is already being served by VHF shore stations.

VHF vs Medium Frequency

For the majority of service-dealers and technicians who are in the small-boat two-way communications business, VHF equipment offers some advantages that 2 to 3 MHz equipment does not offer. Some of the reasons are as follows:

The 2-3MHz band is almost useless on inland waters—except on major waterways frequented by commercial vessels — because no shore stations are presently available. So it appears logical to assume that inland lake and river two-way communications operations will find their most profitable future in the VHF band.

Yacht clubs and marinas can install limited coast stations for their customers.

Boat owners will find the VHF band easy to use and will enjoy almost complete freedom from static and ignition noise. They will also experience no skip-distance interference from distant stations as frequently occurs by day on CB channels and at night in the 2-3MHz band.

A hull ground is not required on VHF marine band equipment. A ground plane, coaxial or colinear antenna can be mounted as high above the water as the height of the boat's mast. The installation is essentially the same as a land mobile system base station except that a battery power supply is used in most cases.

No license waiting period exists for VHF at the present time. A boat owner can walk into any FCC field office and submit an application for a station license and be issued an interim license the same day.

Communicating range in the VHF band is somewhat greater over water than over land. Boats on the Great Lakes are usually able to maintain contact with at least one coast station at all times. The ship-to-ship range in the VHF band is from 15 to 35 miles—depending on antenna height. The ship-to-shore range varies from 20 to 75 miles—depending primarily on the shore station antenna height and the effectiveness of the boat's antenna.

Although some boat owners will argue that they can't use VHF because of its shorter range and insist on 2-3MHz equipment, they overlook off-shore distress message situations where they will seldom be more than 35 miles from another boat. They can relay a message to the Coast Guard. And, in the VHF band, they will have a better chance of getting the message through than in the very much over-crowded and abused 2-3MHz band — particularly on 2182kHz, the safety and calling channel.

Equipment and Standards

The VHF marine band extends

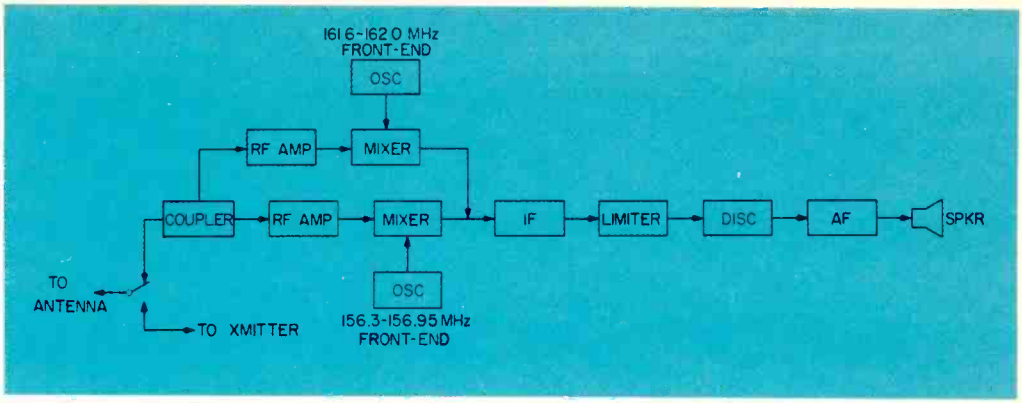


Fig. 1—Some VHF receivers have two front ends.

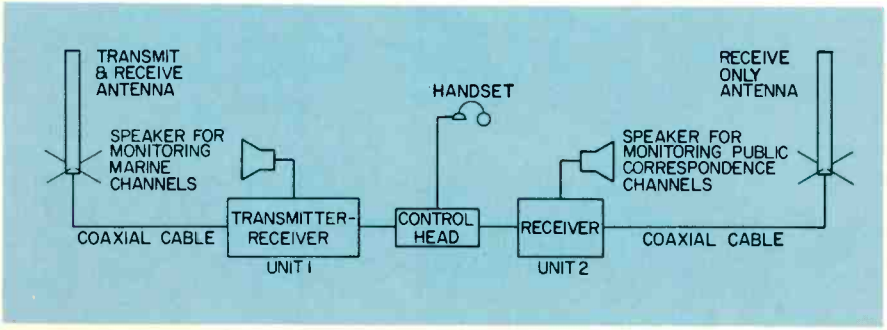
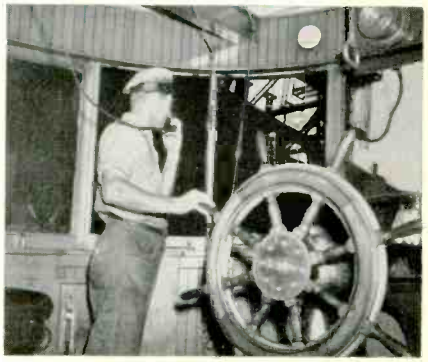
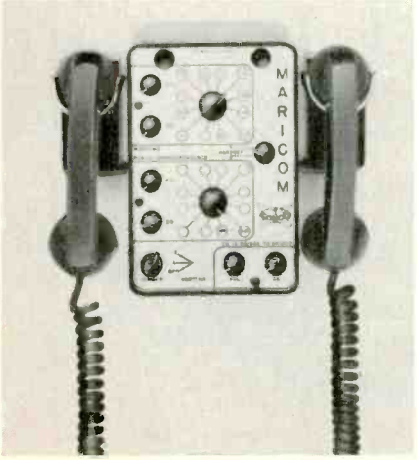


Fig. 2—Combination simplex and duplex marine radio system.



Tug boat captain uses VHF/FM radio for ship-to-shore and ship-to-ship communications.

A wide band FM mobile unit by Hammarlund.



Control unit for multi-channel VHF/FM marine radiotelephone by Comco.

VHF Developments at National Boat Show

New York—Electronic equipment manufacturers meeting with representatives of the Federal Communications Commission and the U. S. Coast Guard at the recent National Boat Show here mapped a three phase program to implement the Coast Guard's request that more marine communications be conducted on VHF instead of the congested 2-3MHz channels.

The program includes:

1. An effort by individual manufacturers and the Coast Guard to educate the boatman to the many advantages of VHF/FM communications.

2. Press for installation of additional land stations that boatmen may call for connections to telephone company lines.

3. Continue technological progress to build VHF two-way radios at prices that will eventually be in the same range as today's ship-to-shore sets.

A representative from Canada, where VHF radios have been in widespread use for several years, noted that power levels were not a significant factor in successful VHF communications from boats. He said that power levels of less than 20w, a requirement in Europe, were very satisfactory even in areas of intervening land and high ground.

The technical personnel attending the meeting predicted that the VHF mode of radio communications will continue for an indefinite period to be secure from interference and overcrowding because of its technically superior characteristics. It already offers a calling and distress frequency (156.8MHz) plus ship-to-ship and marine operator channels.

It was observed that private corporations are showing increasing interest in setting up land stations. A new breed of marine operator was predicted—the telephone answering service in a coastal community that teams up with an electronics firm to apply

from 156.3 to 162.0MHz—a span of 5.7MHz. Multi-channel transmitters are required to operate only between 156.3 and 157.4MHz—a span of only 1.1MHz, making it relatively easy to use crystal switching. Receivers used on marine operational channels and public correspondence channels must be operable over the entire 5.7MHz span—presenting some receiver design problems.

Wide-band FM (±15kHz deviation) is used on the VHF marine channels. The frequency stability requirement is only ±0.001 percent. Mobile radio manufacturers offer wide band equipment for VHF marine band use. Because of the less stringent technical requirements, used VHF/FM mobile equipment which no longer meets land mobile technical standards, can be used if it meets the technical standards of FCC's Part 83.

In some VHF marine radiotelephones, the receiver has two front-ends, as shown in Fig. 1. One of the front ends employs crystal switching and covers the 156.3 to 156.95MHz (650kHz span) end of the band. The other also employs crystal switching and covers the 161.6 to 162.0MHz (400kHz span) end of the band for receiving public coast stations.

A single-channel set equipped for two-frequency simplex can be used on a boat requiring maritime telephone service only. All communications with other boats and shore points are via a public coast station.

Otherwise, at least a two-channel set is required, equipped to transmit and receive on both 156.3MHz (ship-to-ship) and 156.8MHz (safety and calling). Sets with more channels enable communications with limited and public coast stations.

In at least one brand of equipment, the problem has been solved without providing a second receiver front-end by "double humping" the RF amplifier and mixer circuits. The RF amplifier is tuned for optimum performance on the channels at one end of the band, and the mixer for the other end of the band.

Used wideband VHF/FM land mobile radio equipment can be readily modified for marine use by adding crystal switching or separate oscillators for multi-channel operation and by using double-hump tuning or an extra receiver front-end. For single-frequency simplex operation when only maritime telephone service is required, no modifications may be needed except for installation of transmit and receive crystals for the desired public correspondence channel. Since the transmitter and receiver front-end circuits are independent of each other, the receiver can be peaked to the higher receive frequency and the transmitter to its frequency, which is 4.6MHz lower.

Narrow band VHF/FM mobile equipment can be converted to wide band operation by the manufacturer or dealer by increasing transmitter FM deviation and by using a wide-band IF filter in the receiver. The transmitter-receiver unit, whether a modified, new or used unit or one designed specifically for marine use, must be FCC type accepted under Part 83. Procedures for getting type

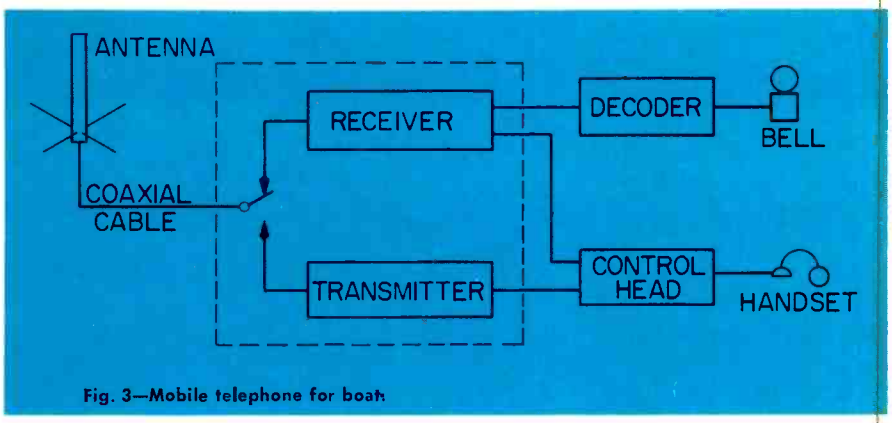


Fig. 3—Mobile telephone for boat

for an FCC license to set up around-the-clock service and offer interconnections between boats underway and any telephone ashore.

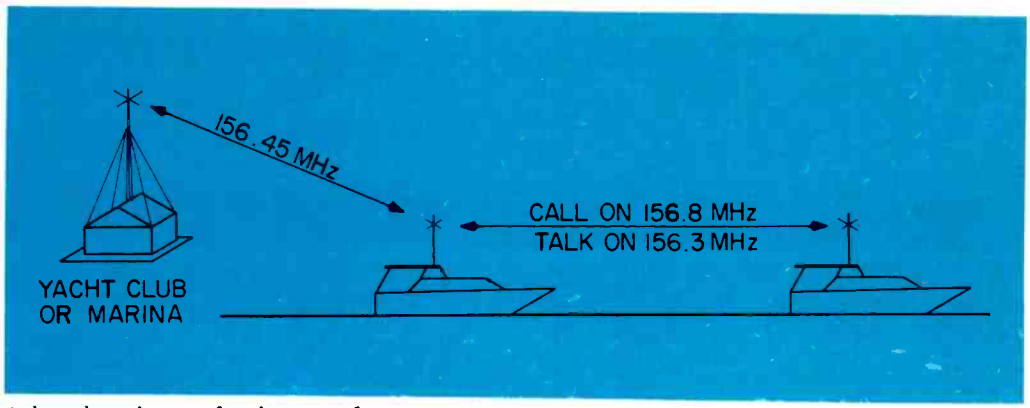
The conferees agreed that many additional stations would be necessary because of the 50 to 60 mile inherent maximum range of VHF equipment.

Joseph Shehan, a dealer from Miami, told the group that he is planning to fill the void in the Florida area and is prepared to set up five coast stations as soon as his permit is approved.

Commander H. J. LaBlanc, operational communications officer for the U. S. Coast Guard's Eastern Area, said that all Coast Guard vessels and shore stations are now VHF-equipped and are guarding 156.8MHz day and night. To relieve congestion on 2-3MHz frequencies, the Coast Guard is adopting a group concept. Commander LeBlanc said only selected stations in each group would guard 2182kHz but that these had been carefully selected to insure full coverage in each area.

A Weather Bureau representative described a new service for VHF set owners. Detailed five-minute weather forecasts and situation reports are tape recorded hourly and broadcast continuously on a VHF channel, 196.55MHz. These broadcasts are now being heard in New York, Chicago and Kansas City. By next June, 15 more stations will take to the air. These are scheduled for Tampa, Miami and Jacksonville, Fla.; Charleston, S. C.; Wilmington, N. C.; New Orleans and Lake Charles, La.; Brownsville, Galveston and Corpus Christi, Texas; Norfolk; Washington; Boston and Atlantic City.

Manufacturers attending the meeting included Raytheon, Apelco, RCA, Walco, Bendix, Kelvin Hughes, Pearce-Simpson, Hartman, Kaar, Canadian Marconi and Konel.



A three-channel system for pleasure craft.

acceptance are specified in Part 2 of the rules.

It is also feasible to provide a transmitter-receiver unit for transmission on all channels and reception on channels 6 through 19A, and a separate receiver for reception on channels 20 through 28, as shown in Fig. 2. This enables the user to have full duplex telephone service on public correspondence channels 24 through 28. At present, only channels 26 and 28 are in wide use. The receiver can be either single-channel (set to channel 26 or 28) or a multi-channel crystal switching type.

Services

Boats may use mobile telephone service (MTS) in many areas through MTS stations which ordinarily serve mobile telephones in cars and trucks. To use MTS, a separate radio unit, equipped with a selective ringing decoder, as shown in Fig. 3, must be used since marine stations are licensed under Part 83, FCC Rules and Regulations, and MTS mobile units are licensed under Part 21. The same transmitter may not be licensed in two different services.

Public coast stations, operating in the VHF marine band, provide maritime telephone service in many parts of the country and new stations are being installed. Limited coast stations, also operating in the VHF marine band, are in service at locks, dams, bridges, yacht clubs, marinas and by tug and tow boat operators.

The VHF marine band channels, listed in Table 1, include a safety and calling channel (156.8MHz) and a ship-to-ship channel (156.3-MHz) and several channels for communications between ships and between ships and limited and public coast stations. One channel, 156.65MHz, reserved for direct bridge-to-bridge communications except in the Great Lakes area, and is used extensively in the Port of Philadelphia. A channel, 156.45-MHz, has been reserved for yacht clubs and marinas for communicating with boats they serve.

Opportunities

Opportunities for two-way service-dealers and technicians to increase sales and service in the VHF marine radio field appear obvious. Almost any manufacturer can furnish a wideband version of a land mobile unit for boat use. Additionally, used wideband FM mobile equipment is available from surplus dealers, much of which will meet the type-acceptance standards of Part 83. As previously mentioned, single channel sets can be used when a boat owner requires maritime telephone service (MTS) only. Or a single-channel narrow band set (±5kHz deviation) can be used, together with ringing decoder, if the boat owner wants land mobile telephone service.

Some manufacturers offer multi-channel sets specifically designed for the VHF marine band. Other sets can, of course, be modified for multi-channel use. As the demand continues to grow, more VHF marine band equipment will become available.

A continued market for medium frequency marine radiotelephones will certainly continue—especially in coastal areas. Even in such areas, however, VHF equipment can be much more useful because of the lack of congestion and freedom from static and skip interference. And VHF marine radio will boom in the inland-waterway areas.

The U. S. Weather Bureau is helping by operating weather news broadcasting stations on 162.55MHz at a number of inland cities, including St. Louis and Kansas City, in addition to major ports like Chicago, New York and Los Angeles. This also presents a golden opportunity to sell VHF/FM monitor receivers to boats, marinas and at the homes of boat owners. Soon, there will be many more VHF Coast Guard stations, giving the VHF marine band another shot in the arm. ■

TABLE 1
VHF MARINE BAND CHANNELS

Channel	Frequency MHz Transmit	Receiver	Purpose
6	156.3	156.3	Ship-to-Ship only
7A	156.35	156.35	Ship-to-Ship-to-Shore
8	156.4	156.4	Ship-to-Ship only
9	156.45	156.45	Ship-to-Ship-to-Shore
10	156.5	156.5	Ship-to-Ship-to-Shore
11	156.55	156.55	Ship-to-Ship-to-Shore
12	156.6	156.6	Ship-to-Ship-to-Shore
13	156.65	156.65	Bridge-to-Bridge only*
14	156.7	156.7	Ship-to-Ship-to-Shore
16	156.8	156.8	Ship-to-Ship-to-Shore
18A	156.9	156.9	Ship-to-Ship-to-Shore
19A	156.95	156.95	Ship-to-Ship-to-Shore
20	157.0	161.6	Ship-to-Shore
24	157.2	161.8	Maritime Phone Service
25	157.25	161.85	Maritime Phone Service
26	157.3	161.9	Maritime Phone Service
27	157.35	161.95	Maritime Phone Service
28	157.4	162.0	Maritime Phone Service
Weather		162.55	Weather Bureau Broadcasts

*Except on Great Lakes

711 HOWARD STREET:

There's No Room for Lady Luck

Brown's takes advantage of new street address with new 711 trade-mark—a pair of dice on the door.

Middle-sized shop in middle-sized community proves you can get big-time results with small-town tactics

■ "Want to see something unusual?" Marty Brown asked an ELECTRONIC TECHNICIAN field reporter recently. He pulled open a desk drawer and showed a thick stack of envelopes addressed to Brown's Evanston, Illinois, TV shop. "Ever see so many?"

"What are they, bills?"

"They're Christmas cards!"

"So what?" the reporter asked.

"These aren't from suppliers, they're from customers!" Mr. Brown said proudly. "This is the best indication I know of that we have built a list of satisfied customers. When a man walks in as a customer, he walks out as a friend—and we keep him as both.

It seemed unusual for a TV-radio service-dealer to be judging success by the number of Christmas cards, fruit cakes and home-made cookies received from his customers. But further checking into this shop's operating methods showed these things actually reflect the sound grass-roots business philosophy that motivates the operation's growth. Marty Brown and his partner, Larry Fullett, have proven this by building Brown's TV & Electronic Service business to the point where its volume is rapidly approaching $100,000 a year.

Growth and Competition

Mr. Brown started as a "loner" in 1958. He had few assets except the conviction that word would get around fast about a TV technician whose customers could trust him with "blind" repair jobs. Mr. Fullett came in as a partner in 1960, and they entered retailing with a concerted advertising program. In August 1965 they moved into larger quarters and now have a 2000-sq ft combination shop and display room on one of the town's main traffic arteries.

Brown's is located in a suburban community of 80,000 people, north of Chicago. Competition is stiff, with 20 other service-dealers in the area—not counting three major department stores and a half dozen jewelers competing for equipment sales. Thirty drug stores also help cut the replacement tube business on a do-it-yourself basis.

"With this kind of competition, we can't afford to make many mistakes," Larry Fullett says. "The way we picked our new location is a good example of how careful you must be when you make a major move.

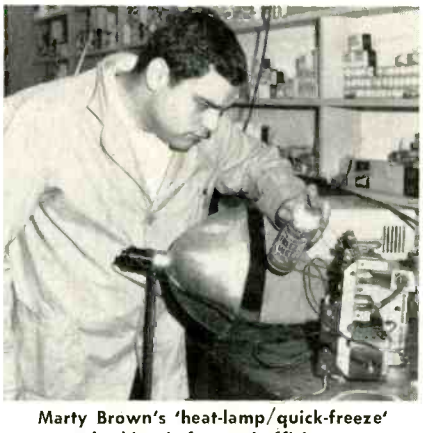
"We needed to double our existing space. A year before our old lease ran out, we were clocking street traffic all over the neighborhood with a scientific technique borrowed from the restaurant industry. One reason why we picked this location is the big super market directly across the street. We got a lot of new customers almost automatically.

"By the end of 1965," Mr. Fullett continued, "the shop had sold $50,000 worth of TV sets, radios, record players, tape recorders—plus air conditioning equipment which is used to fill out the traditionally slow third quarter. Repair business for the year topped $30,000. Volume was $10,000 more than in 1964."

711 HOWARD STREET:

Radio repair bench averages $10 an hour for labor.

'Assembly-line' type operation minimizes time spent on each job.



Marty Brown's 'heat-lamp/quick-freeze' checking is fast and efficient.

Draw drapes provide darkened demonstration space for color TV sales by specialist Larry Fullett (right).

Shop work has expanded and two outside men handle most of the house-calls. These average 40 to 50 a week with a minimum charge of $5. Average parts mark-up is about 40 percent. Bench charges average $10 an hour. This includes work on TVs, record players, tape recorders and radios.

Overhead — Advertising — Capital Investments

"Basically, we use our sales from the floor to cover overhead." Mr. Fullett says. "Although we stay away from 'footballed' lines when possible, our margin is between 15 and 20 percent. And our floor stock investment was turned over better than ten times in 1965.

"With that kind of turnover, you don't need a lot of margin," Mr. Fullett admits. "Because we are within a 24-hour delivery distance from our largest set supplier we can avoid major inventory problems. In fact, the factory serves as our warehouse. Even at the peak Christmas season, floor stock values seldom rose above $5,000 in merchandise."

Aside from the $300-a-month rent, which is on an escalating lease that peaks out at $350 per month by 1970, the biggest overhead item is for classified advertising in the local phone book. The $300-per-month telephone bill includes $50 for telephone calls; the balance covers 20 separate listings in the phone book.

Brown's does not run a display ad. Listings are carried under numerous classifications, however, including air conditioning, phonograph and radio headings plus several TV headings (sales, service, antenna systems, etc.). Alphabetical listings are augmented with columnar listings by brand names, with part of the costs for the latter covered by co-op advertising agreements with manufacturers. But much of their advertising is by word-of-mouth.

The largest stable capital investment is in test instruments and parts inventory, representing a $6000 to $9000 investment at any given time. The company is also edging into more investment in fixtures.

Sales and Service Techniques

One of Marty Brown's most successful ideas is a viewing area he constructed for promoting color TV sales. An alcove fronted with draw drapes provides a darkened environment where color sets can be demonstrated under the most favorable conditions. Including paneling from the attractive set-up total cost was under $200. Profit from the first three color sets sold paid for the project.

"Because most of our products are sold to customers who have been coming in for repair work," Mr. Brown says, "and because of the large amount of referral business we get, we have to sell sets as conscientiously as we make shop repairs."

As previously mentioned, Brown handles air-conditioners. At peak season he orders out from 20 to 30 for installation. This area of the business is primarily the job of Bob Tolzien, a recognized expert in the field with the ability to promote air-conditioning business over a wider market.

Bob Tolzien is an advocate of promotional telephoning

Tolzien specializes in emergency air conditioning service.

This is strictly seasonal work, though, and Mr. Tolzien doubles in brass during the rest of the year handling outside service work on routine house-calls, along with Al Scott who works on TV and sound equipment exclusively. Both are full-time on salary and commission.

"The only way we can come near the $10-an-hour we shoot for on the bench," Mr. Brown points out, "is by ganging the small jobs."

This is a unique "production line" method of operation which Mr. Brown has developed for servicing radios, tape recorders and phonos. A minimum of eight jobs are lined up for servicing at one time, with tube testers, other test equipment, etc., rigged for all in a single work period.

Each piece of equipment is given identical checks, and each check is progressively more critical as troubles are spotted down the line. Average time spent on each repair job with this gang method: 15 minutes. Actually, Mr. Brown has repaired as many as 18 radios in a three-hour stint.

"This technique has enabled us to post a $1.50 minimum charge for radio repairs," he says. "In 1965, the average job ticket was $4.50 including parts. If we used our old method — handling these little jobs one at a time — we could never get the average price that low. With the production line our customers may have to wait a day or two, but it's the only way they can get a reasonable charge for labor costs."

When troubleshooting equipment, especially TVs, Mr. Brown uses the well-known heat-cold treatment for intermittent components. The chassis of course, is upended in front of a heat lamp, the components heated, and then each component suspected of being defective or border-line is sprayed from a "fast-freeze" Aerosol can — while watching the TV screen. Defective or marginal components will show up quickly — saving much troubleshooting time.

All needed parts are kept within direct reach on tiered shelves above the work benches. Parts inventory is controlled with a simple system: double bins. As the front of each bin is emptied out, its permanent ticket is spindled for ordering as technicians begin to use "reserve" stock. Distributors are only called twice a month.

In Action — A Dynamic Philosophy

"Our work areas are out in the open," Mr. Brown says. "Customers are welcome to come in and watch if they feel like it. A lot of them expect to see complexes of exotic equipment when they bring in their new solid-state equipment for repairs, and they are almost always favorably impressed when we explain that 'solid-state' generally means 'transistorized.'

"This is the kind of reputation for frankness we like to build. When new technical terminology comes up it gives new opportunities for the 'gougers.' We want our customers to know exactly what they are paying for."

The operation maintains a do-it-yourself tube tester for the walk-in trade. "It pays for itself even more in good will than in profit," Mr. Brown says. "Let's face it — if a set owner can find the trouble and fix the set himself, he doesn't *need* a professional technician."

As a result of this philosophy, many of the test-'em-yourself tube buyers are now buying their big-ticket equipment from Brown's, and floor volume grew to the point in 1965 where arrangements had to be made to finance the paper. Added profit comes from accommodating installment buyers, too.

"We do plenty of service work which is little more than an accommodation for our customers. Repairing transistor radios, for example is sometimes a losing proposition. Regular radio repair work is often only a break-even deal. And that's why we use our 'assembly-line' system for these items.

"When a customer buys merchandise from us, we don't want him to have trouble with it. If people do have trouble, they seldom relate it to the prices they paid originally. We would sooner spend the extra time convincing a prospect that he will be better off buying top quality merchandise instead of cheaper equipment," Mr. Brown says.

Brown's makes the most of opportunities, no matter how small, to boost its image — even to the street address. The new address — 711 Howard Street — has prompted adoption of a trademark; with that "7-11" what else — a pair of dice.

This is strictly ironic. There is almost no element of luck in the continuing growth of this modern progressive shop. ■

Keeping Up With Space-Age Terminology

Nano, Pico, Femto and Hertz

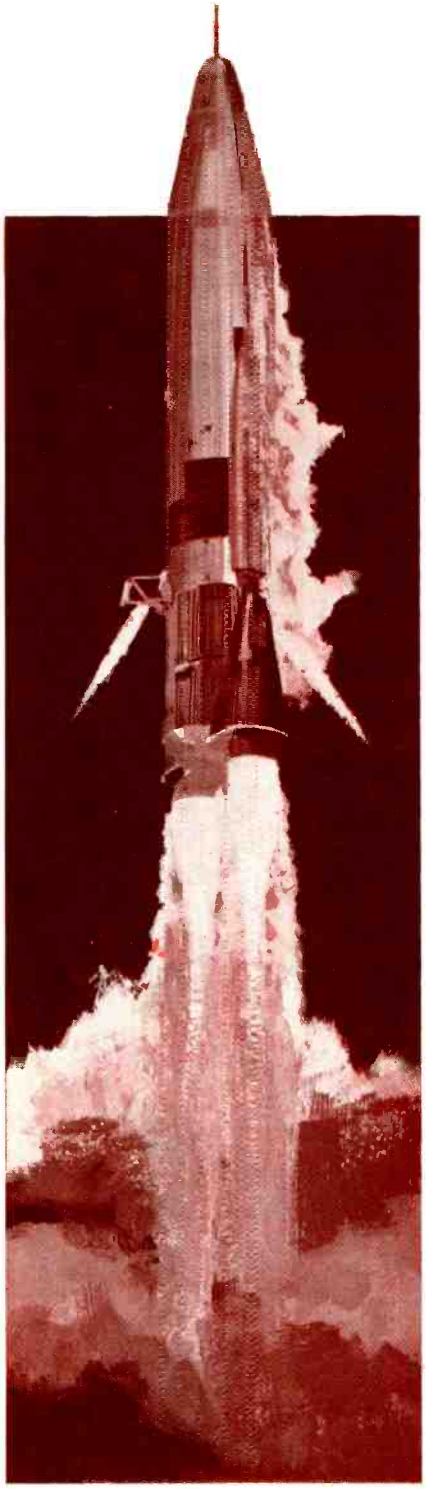


Fig. 1—Femto-ammeter, capable of measuring full-scale range of 0-3 femto-amps (fa). Victoreen dynamic-capacitor electrometer, model 475.

Modern electronic measuring instruments have reached new highs in sensitivity and we are confronted with new and strange-looking prefixes.

In the past, we have become well-accustomed to making the accepted transition to a new prefix when the sensitivity advances by three orders of magnitude—when the quantities became smaller by a factor of 1/1000th (or 10^{-3}). For example, from the familiar 0-1 milli-amp (ma) range to the more-sensitive 0-1 micro-amp (μa) range. Having thus gone from milli to micro (10^{-6}), we now find that we must extend our vocabulary still further, each time the sensitivity advances by another factor of 10^{-3}, or 1/1000th.

This brings us into the range of nano-seconds (nsec) which is 10^{-9}sec, to pico-farads (pf) which is 10^{-12}f and all the way down to fempto-amps (fa), or 10^{-15}amp. An example of an instrument having this extreme sensitivity is shown in Fig. 1. The instrument can measure currents to 1/1000th of a "micro-microamp," or 1fa—a quantity representing a millionth of a billionth of an amp, or 10^{-15}amp (which is 1 in the 15th place after the decimal point).

The reasoning behind choice of terms may be explained by noting that "nano" comes from the Latin for nine (thus 10^{-9}); "pico" from the Italian for very small (as in piccolino—the very small flute) (thus 10^{-12}); and "femto" from the Swedish for fifteen (thus 10^{-15}).

The National Bureau of Standards has also recently adopted "Hertz" (Hz) to replace cycles per second (cps). This is more in line with other similar terminology like ohms, volts, watts, etc.

In the formal table, the prefixes of the decreasingly smaller quantities (for current, in this case) are listed and defined as follows:

ABBREV.	UNIT
ma = milli-amp	(1/1000 amp, or 10^{-3}a);
μa = micro-amp	(1/1000 milliamp, or 10^{-6}a);
na = nano-amp	(mili-microamp, or 10^{-9}a);
pa = pico-amp	(micro-micro-amp, or 10^{-12}a);
fa = femto-amp	(milli-micro-micro-amp, or 10^{-15}a).

It is also interesting to note that "atto" (10^{-18}) is another official prefix but, for the moment, is regarded as "ultra-special."

For the increasingly larger units, each new prefix increases by a factor of 1,000 (or 10^3 times) over the previous one. For frequency, this gives us the giga-hertz (GHz) for 1000 mega-hertz (MHz) or 10^9Hz. Giga comes from the English for gigantic, pronounced with a hard "g" and tera-hertz (THz) for 1000 GHz, or 10^{12}Hz. Tera comes from the Latin prefix for monster. In table form:

ABBREV.	UNIT
KHz = kilohertz	(1000Hz), or 10^3Hz;
MHz = megahertz	(1000kHz), or 10^6Hz;
GHz = gigahertz	(1 kilo-megahertz, or 10^9Hz;
THz = terahertz	(1000 kilo-megahertz), or 10^{12}Hz.

Instrument Circuitry

While discussing the terminology of the newer prefixes—particularly

Fig. 2—Fast risetime preamp plug-in unit for scope vertical amplifier. Has risetime of 6 nsec. Tektronix, type L.

Fig. 3—Pico-ammeter and micro-voltmeter has a full-scale dc current range of 10pa. The current of 10pa is measured as a voltage-drop of 10μv across an internal 1M resistor. Hewlett-Packard model 425A.

for the smaller and smaller quantities—it is profitable also to take a quick look at the circuitry involved in instruments capable of making highly delicate measurements. Reverting, then, to the descending order of the nano, the pico and the femto areas, a typical example of the nano-sec range can be found in the fast-rise time specified for the vertical amplifier of various laboratory scopes.

The type shown in Fig. 2 is illustrative of an amplifier that has an extremely wide bandwidth, since it is a general characteristic of amplifiers that the rise-time becomes shorter, as we increase the bandwidth. Two main circuit methods are used for accomplishing the desired wide-band feature.

One method involves peaking coils, which give a rising output as frequency increases, to compensate for the opposite effect of shunt capacity, which causes the output to decrease at the higher frequencies. The other method trades-off a greater band-width against a loss in gain, since the product of the two (the gain times band-width product) tends to remain constant for a given amplifier design. Thus, it can be noted that the fast-rise-time calibrated pre-amp plug-in unit shown in Fig. 2 is specified as having a rise time of 10nsec, when used at its highest gain setting of 5mv/cm, but it has a still faster rise-time of 6nsec when it is used at reduced gain setting of 50mv/cm.

The circuit method employed in measuring very small dc currents in the pa range uses chopper-modulation to change the dc input signal to a squarewave ac signal. This expedient is necessary to overcome the inherent drift tendency of dc amplifiers, which cannot distinguish a small undesired change in the dc operating point from a correspondingly small change in the dc input signal.

The chopped squarewave, however, can be amplified in a high gain ac amplifier that has practically no drift, since a small shift in dc operating point of an ac amplifier does not appreciably affect its gain. The ac amplifier output is then rectified back to dc to actuate the dc indicating meter. The resulting instrument is essentially classified as a highly sensitive chopper-type VTVM, where the pamp current measurements are made by indicating the voltage drop produced by the dc input current across an accurately-known internal resistor.

The chopping action in the micro-volt ammeter, shown in Fig. 3, is produced by photo-conductive cells actuated by ac operated neon lamps, rather than by mechanical chopping action.

In the previously mentioned femto-meter (Fig. 1), this next higher order of sensitivity (10^{-15a} is obtained by using a vibrating (or dynamic) capacity arrangement, which modulates the dc input. In this method, the modulation results in a varying charge on the capacitor, rather than a squarewave. To amplify the minute amount of power represented by this varying charge, it is necessary to use an electrometer tube to avoid excessive amplifier loading. The dynamic-capacitor and electrometer combination in the first stage of amplification enables an input impedance as high as 1000T (10^{15}ohms) to be attained. As in the previous case of the pico-ammeter, current measurements are based on the voltage drops across internal resistors. ■

Common Designations of Frequency Bands

P-band—225-390MHz (133.3-76.9cm)
L-band—390MHz-1.55GHz (76.9-19.3cm)
S-band—1.55-5.2GHz (19.3-5.77cm)
X-band—5.2-10.9GHz (5.77-2.75cm)
K-band—10.9-36GHz (2.75-0.834cm)
Q-band—36-46GHz (0.834-0.652cm)
V-band—46-56GHz (0.652-0.536cm)

VLF to 30kHz
LF 30-300kHz
MF 300kHz-3MHz
HF 3-30MHz
VHF 30-300MHz
UHF 300MHz-3GHz
SHF 3-30GHz
EHF 30-300GHz

Units of Length

1 meter = 3.281 ft
1 in. = 2.54 centimeters
1 cm = 10^8 angstroms (A)

Low-cost solid-state units may follow color

VIDEO TAPE RECORDERS

A REPORT

Fig. 1—This Dage-Bell video tape recorder uses a half-helical recording head with one-inch wide tape and records at a speed of 5.9lips.

■ Since "instant playback" telecasts of sports highlights became something less than a novelty, we have been waiting to see what further astounding developments would take place in video tape recording. In a fast-moving space-age technology, almost anything can happen in video tape recorder developments — and probably will at frequent intervals for the next few years.

In a recently published book on "Video Tape Recording," prepared by Chris H. Schaefer, Cedric L. Suzman & Associates, it was pointed out that lower priced video tape recorder model- and specification-changes have been so rapid that revisions and additions to the manuscript had to be made almost weekly. Considering this trend, it would be futile to attempt an up-to-the-minute technical report on specific video tape recorders — or a round-up of manufacturers and models — at this time. The data would probably be obsolete within a month or two. Hence, we will sketch a few significant developments which have taken place during recent times and call attention to some factors which most concern service-dealers and technicians — including present and possible future trends in tape recording and recorders.

Historical Sketch

The first video tape recorder was used in telecasting less than 10 years ago. It was a heavy, elaborate and expensive electro-mechanical package. Within five years, new, smaller and less expensive commercial-type units were being used in commercial telecasting, closed-circuit TV work in medical research, educational TV, national defense and other areas.

Late in 1963 a low-cost video tape recorder made its appearance in Great Britain. Shortly thereafter, in 1964, a number of Japanese and American manufacturers began talking about a "home-type" video tape recorder which would sell for $1500 and less.

In the meantime, comparable commercial-quality video tape recorders that once weighed close to a ton and cost up to $50,000 or more, have dropped in weight to 275-300 lb and sell for less than $20,000.

Lower priced commercial-quality video tape recorders that sold for around $12,000 only a few months ago are now going for less than $8,000.

The latest information (at this writing) is that home-type video tape recorders will soon be on the market with prices ranging from $300 to $1500. Cinerama, Inc., reported owners of the Western Hemisphere home TV tape recorder rights to manufacture the British "Telcan" system have claimed that the recorder can be retailed in the U.S. for $200 or less.

Fairchild Camera officials have demonstrated a prototype which they say can be retailed for less than $500.

The Illinois Institute of Technology Research Institute has developed a low-cost tape recorder which has been licensed to one or more manufacturers.

About one year ago a video tape recorder, developed and manufactured by Wesgrove Electrics, Ltd., Worcester, England, was being quoted in this country at $492 assembled, $392 in kit form. The company announced that a playback unit for pre-recorded tapes would be available for $150 early in 1966. They also stated that 5-minute "pop" tapes would retail at $1.50.

In the autumn of 1965 the Wesgrove tape recorder was being quoted by one west-coast source at $550 assembled and $450 in kit form.

An official of Ampex Corp., manufacturer of commercial- and home-grade video tape recorders, announced in late 1965 that the company was producing a recorder to sell for $1500 and believed quality home-type recorders could be manufactured for $500. The official also stated a belief that the video tape recorder would eventually become a "mass volume consumer item."

At least one industry official has voiced the belief that the video tape recorder will obsolete both the phonograph and audio tape recorder within the next decade. So much for historical fact, industry speculation and "crystal-balling."

Some Technical Aspects

A video tape recorder is essentially similar (with outstanding exceptions which will be mentioned later) to a regular audio tape recorder except it records "vision" as well. Hence, it is an audio-visual tape recorder. Recording on tape may be done direct (with composite video taken from a regular TV receiver) or from a low-cost TV camera's output. The future home-type will probably use both recording methods so the user can make and record "home-hatched" movies and record sports events and other programs from a TV receiver in the home. Most home-type recorders will probably use the regular ¼-in. audio-type recording tape with two, four or more tracks for recording B/W pictures and audio. Color video tape recorders for home-use will not be too far behind. In fact, a Japanese manufacturer is reported to be working on a color home-type recorder now. Video recordings, of course, can be erased the same as audio recordings and a new recording made on the same tape.

One outstanding difference exists between audio- and audio-visual type tape recorders. The audio tape recorder is required to record a relatively narrow-band of low frequencies while the video tape recorder must handle a very wide band of frequencies ranging from the very low to high. Hence, the design of video recording equipment is considerably different; design and manufacturing costs are higher. A number of compromises and trade-offs have been made to satisfactorily solve many problems, however.

One problem, for example, was the frequency response limitations imposed by the gap-width of magnetic recording heads. The smallest practical gap-width of magnetic heads (about 75 to 100μin.) normally limits frequency response to about 50 to 75kHz. To record higher frequencies it was necessary to draw the tape past the recording head at very high speed. But even at 1000ips (an impractical speed and useless waste of tape) it was difficult to record the higher video frequencies. The problem was first solved by rotating the head *transversely* across the tape (since relative speed between head and tape is the important consideration). If a given head is rotated at approximately 15,000rpm, the tape can be pulled at a relatively slow speed. A number of additional approaches including multi-track recording, FM signal hetrodyning in recorder video circuits, helical type rotating heads, etc., have combined to partly solve these problems.

Rotating head, transverse scan type video recorders will probably be limited to heavier and more elaborate type commercial equipment. Half- and full-helical rotating type

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Wesgrove video tape recorder uses ¼in. tape at speeds from 90 to 150ips.

You and Your

When you buy a new scope, spend as

■ Two previous articles in ELECTRONIC TECHNICIAN (September and October 1965) briefly reviewed the basic scope, its circuitry and detailed some minimum scope specifications required for troubleshooting and aligning color TV circuitry. One area of particular importance was the vertical deflection system and its various requirements. It was pointed out that the scope's bandwidth (bandpass, or frequency response) and "gain" (sensitivity, sometimes called "sensibility" and frequently specified as deflection factor), were two very important specifications to be considered. The scope's risetime was also mentioned as being important. But not all service-type scope manufacturers list risetime on spec sheets.

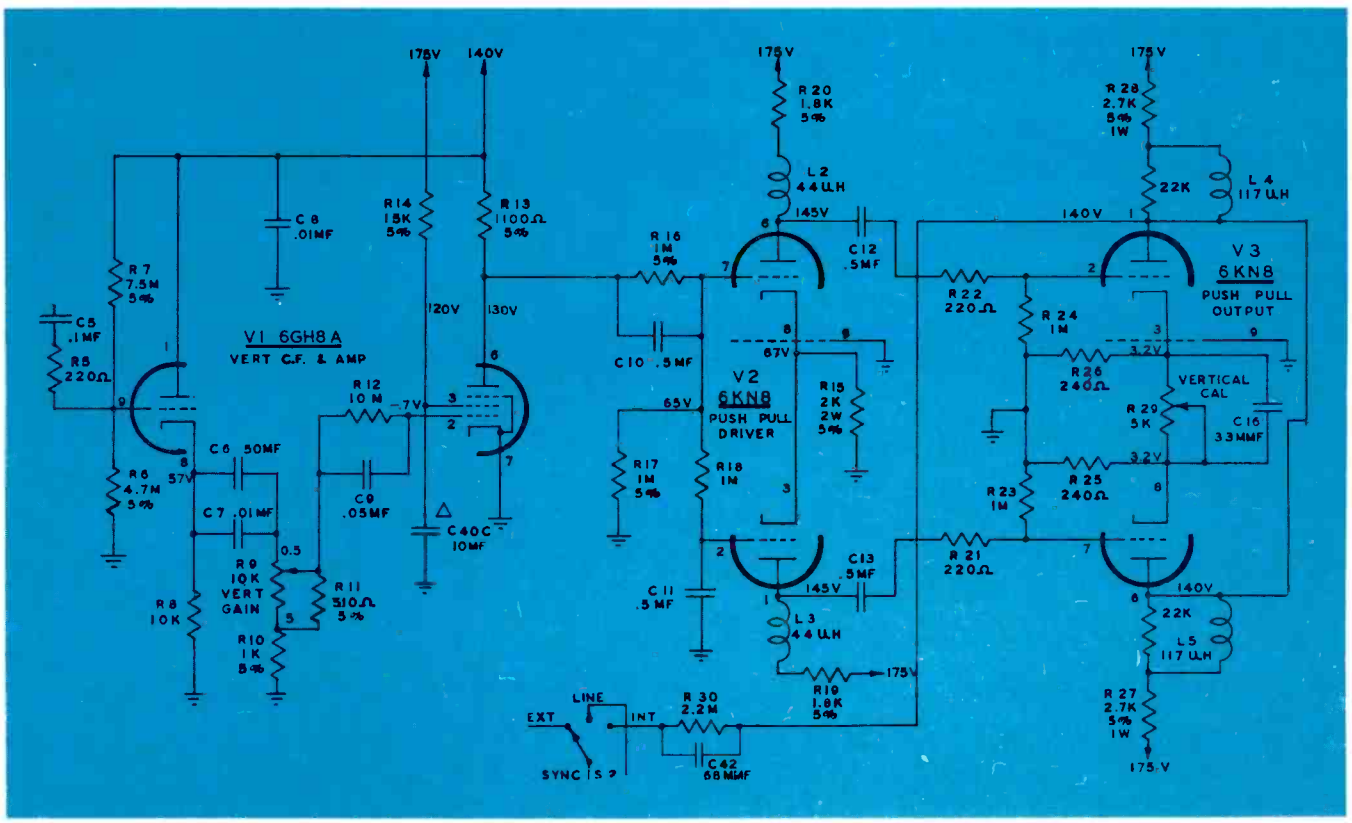
Vertical Amplifier Specifications

For medium priced service-type scopes the risetime will usually be around 0.05 to 0.08μsec. Medium priced lab scopes (in the $1000 to $1500 area) sometimes have risetimes specified in nanoseconds.

Additionally, scope design engineers do not always agree on what is "adequate" bandwidth, sensitivity and risetime for TV-service work. One thing is certain, as emphasized previously, small amplitude and complex waveforms (similar to those frequently found in B/W and color TV sets), cannot be observed in their true form unless the scope's vertical amplifier is a little better than "good."

Some engineers have said — assuming all other factors to be equal —that the risetime of a vertical amplifier should be at least as rapid as the step signal (squarewave or rectangular pulse), being observed. Others say it should be twice or even four or five times faster. Be this as it may, if the amplifier cannot pass a squarewave with reasonable fidelity, the scope screen won't show a horizontal sync pulse, for example, in its true form—not to mention the true shape and amplitude of a 3.58MHz color-burst signal. You cannot tell, without checking the scope's amplifier, whether a pulse or the scope is at fault in an amplifier that does not come up to "snuff." You can't do effective troubleshooting and alignment with a marginal scope. If over-

Fig. 1—Vertical amplifier section schematic of the Sencore Model 127 scope.



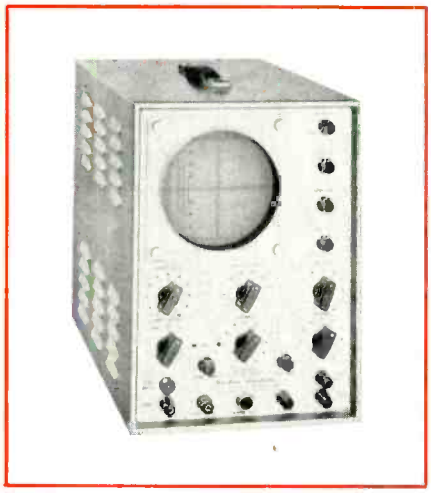
Oscilloscope

much for it as you can afford

Fig. 2—Heath model 10-12 scope.

Fig. 3—RCA WO-91A scope.

Fig. 4—Hickok model 677 scope.



shoot, ringing, sag or other distortions appear on a squarewave test signal, the vertical amplifier is not doing an effective job.

The schematic in Fig. 1 shows the vertical amplifier of a scope which sells in the lower area of the medium price range. The manufacturer specifies a frequency response from 10Hz to 4.7MHz; risetime as 0.07μsec; deflection sensitivity as 0.017 ($\pm$5 percent) volts RMS/in. with direct probe and 0.17 ($\pm$5 percent) volts RMS/in. with low capacity input. Sensitivity of the horizontal amplifier is specified as 0.9v RMS/in. It is noted that the amplifier has the traditional cathode follower input which most service-type scopes now have, a balanced push-pull driver and balanced push-pull output.

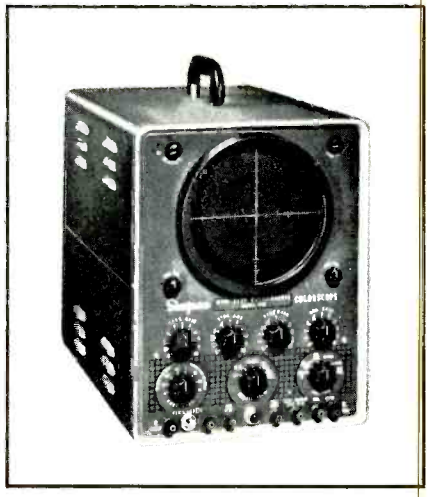
Specifications listed on the scope shown in Fig. 2 are: sensitivity, 0.025v RMS/in. at 1kHz; frequency response $\pm$1db from 8Hz to 2.5MHz, $\pm$1.5 to $-$5 db from 3Hz to 5 MHz; risetime 0.08μsec; horizontal sensitivity 0.3v RMS/in. at 1kHz.

The scope shown in Fig. 3 specifies a wideband response within $\pm$1db from 10Hz to 4.5MHz with sensitivity specified as 0.053v RMS/in. on the wideband position and 0.018v RMS/in. when the switch is in the more sensitive narrow band position. Risetime is stated to be 0.1μsec when the passband switch is in the 4.5MHz position and 0.5μsec when the passband switch is in the 1.5MHz position.

Another wideband TV-radio scope is shown in Fig. 4. Specs on this scope are: response flat within 3db from 5Hz to 4.5MHz; sensitivity 40mv RMS/in.; risetime, 0.08μsec; horizontal response within 3db, 5Hz to 350kHz.

Still another scope, Fig. 5, has a frequency response specification as $\pm$1db to 4.5MHz on wideband operation and $\pm$2db from 10Hz to 300kHz with sensitivity greater than 15mv RMS/in. on this position. Horizontal sweep to 250kHz.

Fig. 5—Simpson model 458 scope.



Design Problems

We must digress momentarily at this point and sympathize with scope designers. As previously mentioned, no purpose would be served here by getting involved in the spider-web of video amplifier design considerations, but we should recognize that the problems involved in video amplifier design necessitate compromises: gain is traded off for bandwidth and vice versa, in medium-priced scopes. This is a general statement and avoids necessary qualifications. But we can say that gain and over-all bandwidth has a tendency to vary inversely. Hence, design and construction costs go up when extremely flat frequency response and high gain is attempted.

Most modern TV-radio service-type scopes have both narrow band and wideband facilities (within certain limits) which are selected at will from the scope's front panel—usually a two position switch. High

continued on page 92

YOU AND COLOR TV

■ Previous articles in this series have concentrated primarily on the basic principles of color TV circuitry. This article zeros in on specific circuitry, how it functions and how to service it properly.

A number of present color sets, for example, use the 6LE8 tube as a color demodulator. The circuit shown in Fig. 1 shows a 6LE8 circuit which performs a number of functions. It generates its own 3.58MHz signal, mixes this signal with the incoming chroma information, amplifies the result and feeds the detected color signal to the proper CRT grid. In most color sets, demodulation is performed by mixing the chroma signal with two 3.58MHz signals which are 90deg out of phase. In this circuit, a single 3.58MHz signal is mixed with two different phases of the chroma signal. The chroma signal is split into two phases, 90deg apart, and each is mixed with the same 3.58MHz — resulting in the proper R-Y and B-Y color information which appears at the tube plates.

The Oscillator

If point "A" (Fig. 1) is grounded and you consider the cathode, control grid and grid No. 2, you see a fairly conventional crystal oscillator. Feedback is provided by cathode coil L2, and G2 acts as the oscillator plate. Notice that the crystal is not actually grounded but is connected to ground through the secondary of T2. Addition of this impedance lowers the Q of the crystal somewhat so the circuit frequency can be varied by applying an external locking signal. Besides varying the oscillator frequency, adjustment of T2 also affects the amplitude of the 3.58MHz signal.

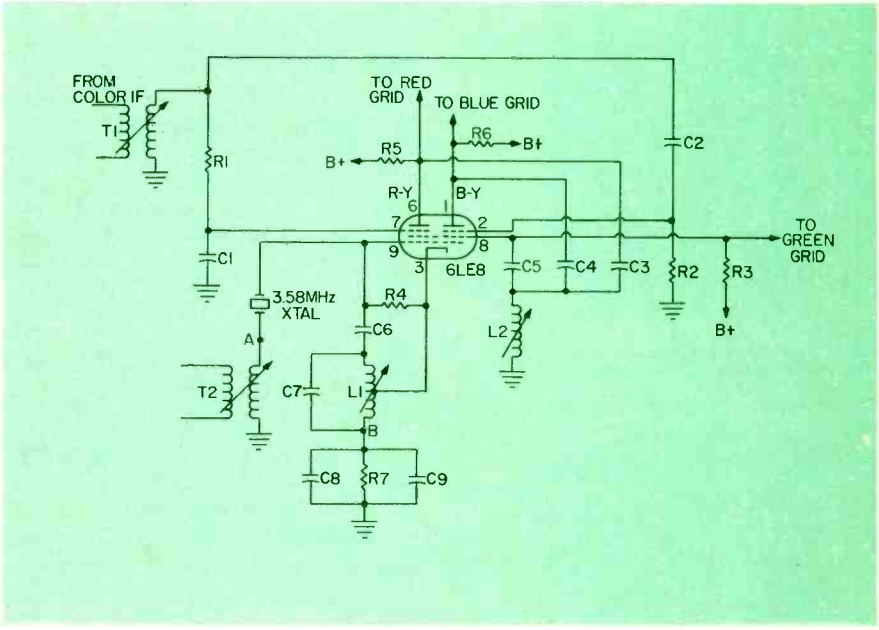


Fig. 1 — Oscillator-demodulator circuit employing 6LE8

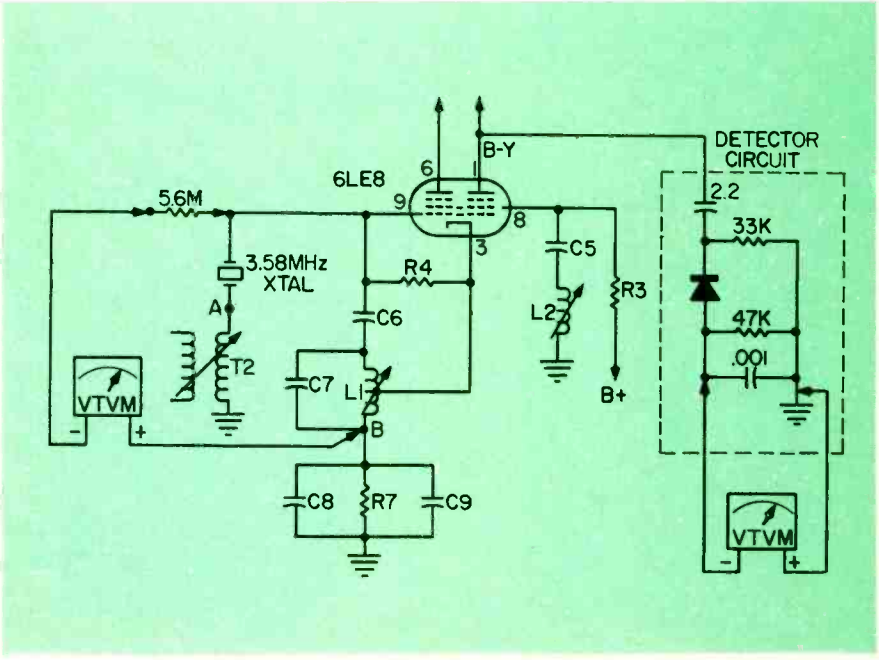


Fig. 2—Detector circuit used for aligning 3.58MHz trap in demodulator outputs

TEKLAB REPORT

Understand the new circuit innovations now being employed in modern color sets

The burst signal, removed from the composite chroma information by either a sync gate or burst amplifier, is applied at the primary of T2. This signal causes a ringing effect in the crystal and forms a continuous ac signal at the control grid. Even if we were to disable the oscillator by grounding the cathode (pin 3 Fig. 1), the ringing caused by the burst signal would be visible on a scope connected to the control grid, pin 9. The oscillator is locked on frequency by this burst signal.

Chroma Signal

The chroma signal is fed to the network of R1, C1, R2 and C2. R1 and C1 cause the signal to lag by 45deg and this lagging signal is applied to grid 3 of the R-Y section of the tube. R2 and C2 cause a 45deg leading signal to be applied to grid 3 of the B-Y section. We then have two chroma signals separated by 90deg and mixed with a single 3.58MHz signal. Demodulation is accomplished with R-Y information appearing at one plate and B-Y information appearing at the other. This information is then fed to the respective CRT control grids. Variation in plate current in the two sections of the 6LE8 causes the screen current to vary at a rate dependent on both the R-Y and B-Y voltages — which results in a screen grid voltage variation at the G-Y rate. This output is applied to the green grid of the CRT.

The presence of a 3.58MHz signal at the grids of the CRT will cause objectionable interference on the screen. Hence, the 3.58MHz component must be removed from the demodulator plates. Capacitors C3, C4, C5 and L2 form a filter which traps the unwanted 3.58MHz signal from the three color outputs. L2 is adjusted to trap the maximum amount of 3.58MHz energy.

Alignment

Alignment of this type of demodulator is fairly simple. T2 and L2 both affect the frequency of the oscillator and the adjustment of T2 also varies the amplitude of the 3.58MHz signal. A detector circuit recommended by one manufacturer is shown in Fig. 2. This detector is connected from the B-Y plate to ground as shown. The procedure described here will vary for the different circuits of this type used by the various manufacturers.

A very important adjustment, done first because of its effect on the other steps, is the alignment of L2, the 3.58MHz trap. With the detector connected to the B-Y plate and a color signal (either off the air or from a generator) being fed to the antenna terminals, the color intensity set at minimum and the color killer control set at maximum (clockwise), L2 is adjusted for minimum reading on a VTVM. This adjustment is made with the oscillator disabled by shorting the cathode, pin 3 of the 6LE8, to ground. With the oscillator out of operation the color burst continues to ring the crystal circuit and a 3.58MHz signal appears at pin 1 — plate of the B-Y section.

Next remove the short from the cathode and short test point A (Fig. 2) to ground. Connect the VTVM negative lead through a 5.6M decoupling resistor to pin 9, the control grid, and the positive lead to test point "B." With the color signal applied and the controls set as in the previous step, adjust L1 for a maximum negative reading on the VTVM. Grounding out point "A" increases the strength of the oscillator output and removes the effect of the burst pulse. This enables you to adjust L1 properly.

Remove the short from point "A" and then kill the color sync by shorting out the control grid of one of the color sync stages. The VTVM is left connected as in the previous step and T2 is adjusted for a —3vdc reading. This is called the oscillator injection voltage. As adjustment of L1 and T2 will interact, the procedure should be repeated several times to be sure that the oscillator is functioning properly.

Troubleshooting Procedures

With proper application of the color generator, scope and VTVM in localizing the trouble, this type of oscillator-demodulator circuit should not present too many service problems.

To establish test points, we will simulate some possible troubles that may arise in the demodulator or adjacent circuitry of a Motorola TS-914 chassis, which employs a 6LE8 combination type demodulator.

First, a series of key waveforms of a normally operating set should be viewed. All waveforms should be measured with a wideband scope and a low capacity probe. A keyed rainbow modulated RF signal from a generator is fed in at the antenna terminals. The output of the generator is set so that 2v P-P of chroma information appear at the grid of the first video amplifier (Fig. 3). The chroma signal at the cathode of the first color IF is shown in Fig. 4. The output of this stage, a cathode follower, measures approximately 1.1v P-P (Fig. 5).

YOU AND COLOR TV...

The two chroma inputs to the demodulator tube, phased 90deg apart, are shown in Fig. 6 and 7. The waveform in Fig. 6 is taken at pin 2 of the 6LE8 and Fig. 7 appears at pin 7 of the same tube. Waveforms for a normally operating oscillator are illustrated in Fig. 8. With Fig. 8A showing the 3.58-MHz signal at the cathode of the 6LE8 and 8B illustrating the same signal at the control gird.

The burst pulse which is used to ring the crystal circuit is shown in Fig. 9. This signal locks the oscillator on a frequency which is at a phase of 270deg compared to the sync signal.

The next waveforms shown are very important as they show the demodulator outputs as viewed at the CRT grids. The B-Y output is shown in Fig. 10A, G-Y in 10B with 10C illustrating R-Y. You will notice that in a normally operating set the sixth bar is at a null point on the red grid, the seventh bar at the green grid and the 3rd and 9th bars at the blue grid.

One should study and learn the waveform representations of a normally operating set. When trouble does exist you will be better able to analyze a distorted waveform.

In localizing troubles in the oscillator-demodulator section of this set we want to establish some reference points. First, as in any TV set, we have the CRT indication.

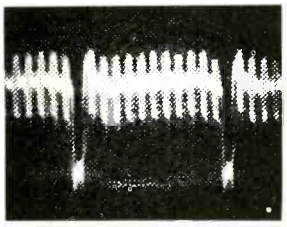
Lack of color sync, no color with green background, no color with normal background and inability to tune flesh tones are some of the common problems caused by a defective demodulator.

Let's disable the oscillator by shorting out pin 3 of the 6LE8 and make some observations. First we notice that the screen lost its color and also has a green background.

A scope check of the CRT reveals no demodulator ouput at any of the grids. If we measure the chroma signal on pin 7 or pin 2 we find that it is absent. The reason why no chroma appears here is because the color killer is dependent on the additional negative voltage generated by the oscillator on a color transmission. Therefore, when the oscillator is disabled the color killer tube begins conducting and cuts off the second color IF tube.

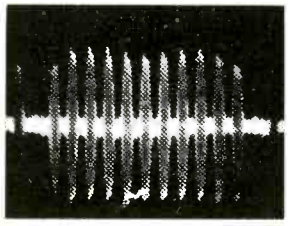
A normal chroma signal is found at pin 8 of the 2nd color IF and the burst pulse at the secondary of T2 is also normal. These checks localize the trouble to the oscillator-demodulator stage. The next step is to measure the injection voltage described earlier. This negative voltage is measured from pin 9 of the 6LE8 to point "B" (Fig. 2).

continued on page 93



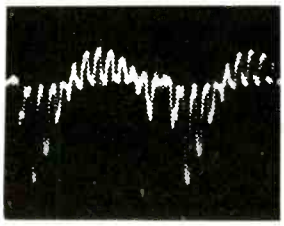
2V PP CHROMA
4V PP H

Fig. 3 — Chroma information at grid of first video amplifier



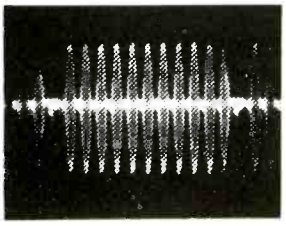
14V PP
H

Fig. 7 — Chroma input to R-Y section



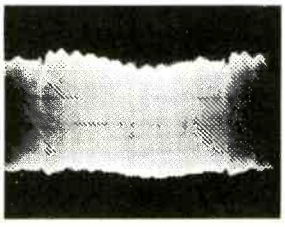
85 V PP
H

Fig. 10 — (A) — B-Y output at blue CRT grid



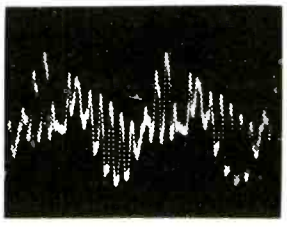
12V PP
H

Fig. 4 — Chroma signal at cathode of first color IF

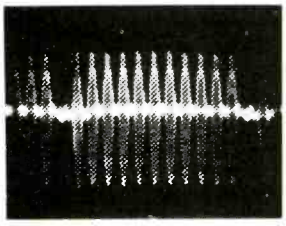


10V PP
H

Fig. 8 (A) — Oscillator signal at cathode of 6LE5 (B) — 3.58 MHz signal at control grid

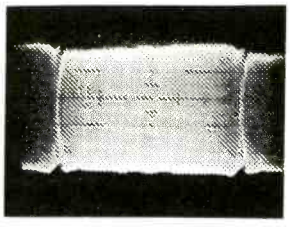


18V PP
H
(B) — G-Y signal at green grid

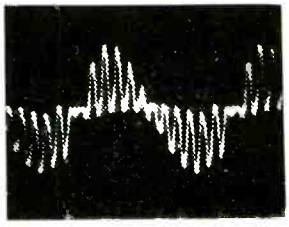


1.1V PP
H

Fig. 5 — Cathode follower output



14V PP
H



155V PP
H
(C) — R-Y waveform appearing at red grid

Fig. 6 — Chroma input to B-Y section of demodulator

20V PP
H

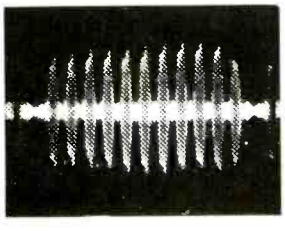
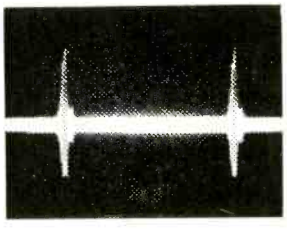


Fig. 9 — Burst pulse used to ring oscillator circuit

105V PP
H



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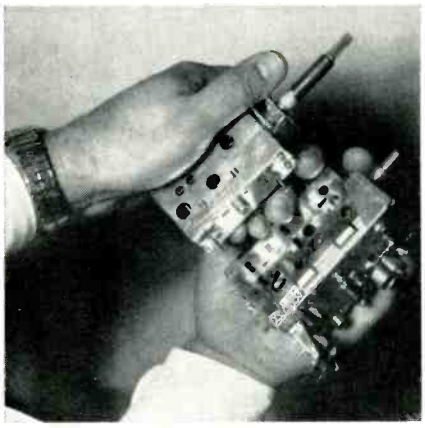


Transistorized UHF and VHF tuners. Strange looking units compared to their electron tube counterparts.

■ Like color, the influx of transistor TVs into service shops was predicted long before it became a fact. But now that it is a fact, many technicians are still holding the bag — unprepared to render proper services.

Fortunately, learning what is required to service transistor sets is not so tough as learning to service color sets. Even though the transistor may be an exotic new component to you, the circuit functions in transistorized equipment are identical to those in electron tube equipment. To make sure technicians are on familiar ground, one manufacturer has used an electron tube type chassis and laid out each transistor stage where it would be found if the set had tubes. Such convenient aids won't last long, however. If you don't dig in now, you may find yourself losing your "tube" customers to the guy down the street who "fixes" the transistor portables.

Similarities

Although the market hasn't felt the full impact of transistors, there are presently many transistor chassis driving large screen console models. The fact that a transistor chassis can be made very small does not limit its capabilities.

You will find yourself on familiar gounds when you see 1st, 2nd and 3rd video IF stages, video detectors, and two video amplifiers, for example. The sound section is generally similar using similar take off circuits.

"Support" circuits: AGC, sync separator, vertical oscillator and output, AFC and high voltage generation are also present. There's nothing unusual about controls either; most of them are also common: the normal user-controls plus AGC, height, linearity and width adjustments.

Differences

Obviously, everything is not the same. The transistor gives off very little heat and the transistor chassis is consequently much cooler. This is true because no filaments exist. Because of no filaments, considerable wiring is eliminated from the transistor set. Also, since the transistor is a three element component, connections to screen grids suppressor grids, etc. are eliminated.

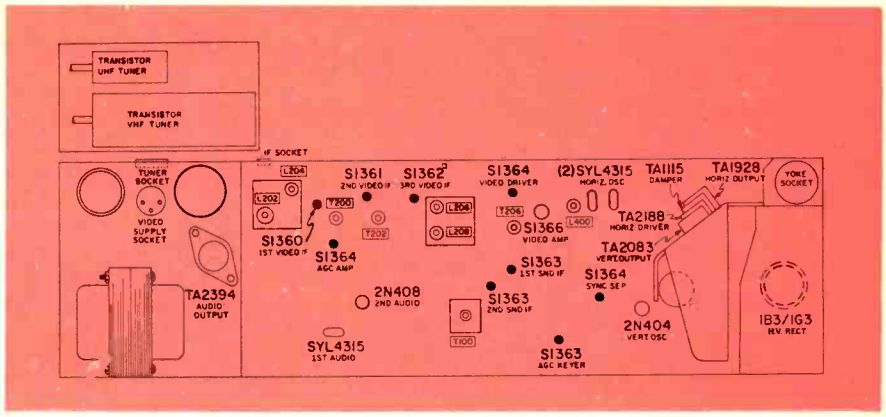
But the transistor is a relatively low impedance component, it takes more current to drive each stage. Consequently, other component values are quite different. This is probably one of the biggest hurdles technicians will have to jump.

Since the transistor is a low voltage component too, B+, in most cases, is less than 50v. The usual exception is the higher voltage required for video output transistors. Since the CRT requires considerable voltage drive, higher B+ is necessary at this point. Usually, this voltage is derived from a separate winding on the flyback system.

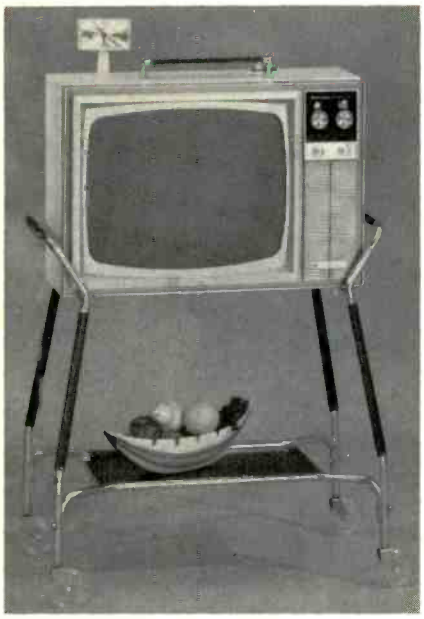
Common Trouble

Since both transistor and tube-type TVs have circuits that perform similar functions, circuit malfunctions will be evidenced in a similar fashion — trouble symptoms will be the same. That is, if the tuner or IF strip is faulty, there'll be no sound or picture but the raster will probably be visible.

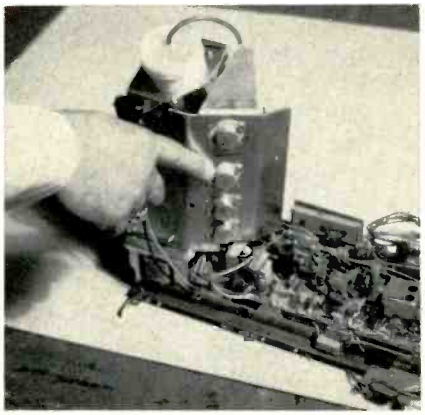
SERVICING SOLID-STATE TV CIRCUITS



Chassis layout from one manufacturer follows tube layout of a preceding model. The goal is to achieve technician-familiarity.



Transistorized set (top) and tube type set (bottom). You can't tell from the front which is which.



Power transistors are often mounted together on a common heat sink. Some are insulated from the sink.

Trouble in the horizontal section will kill the raster but sound will still be present.

Such common problems rarely cause technicians any great difficulty, however. But difficult problems encountered in tube sets are not reserved for the tube sets. Troublesome problems will also be present with transistorized TV.

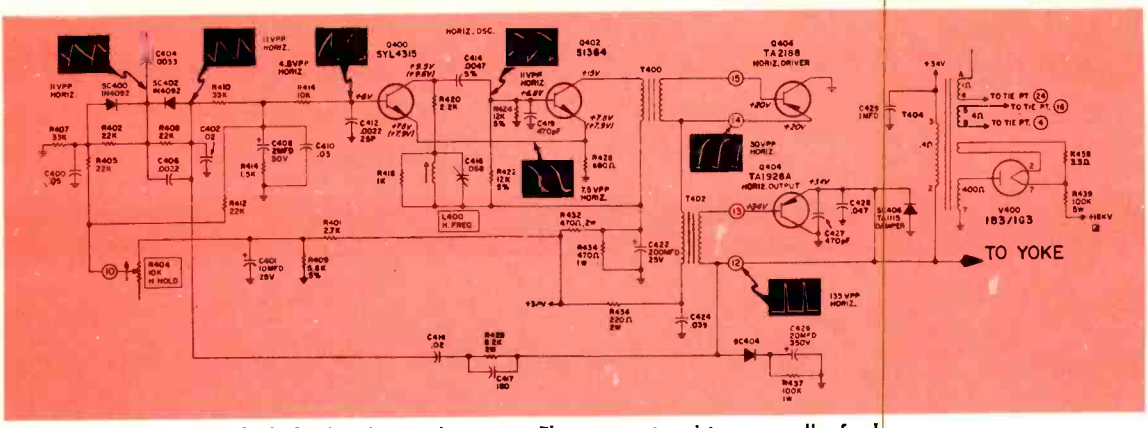
We recently encountered a transistor TV which had a normal picture but considerable hum and no audio from the speaker. After considerable lost time troubleshooting, the problem was pinned to the first video IF stage transistor. This problem can be particularly difficult to solve in transistor TVs since the voltage levels are exteremely low. Also, since the sound is even lower than the video in the first IF, troubleshooting time can be multiplied.

You have all undoubtedly heard of the long life expected from transistorized equipment. Too many of you, however, have probably already experienced transistor failure in a relatively new set. These statements appear contradictory or paradoxical. But once again, like tube sets, or other electronic gear (and even some mechanical gear), failures frequently appear most often in relatively new equipment. Once the set is "broken in," an indefinite life can be expected from solid-state components.

Troubleshooting

The best troubleshooting method with any TV set is the isolation-by-reasoning method. In other words, we first deduce what could be wrong with the set by observing the picture or the absence of a picture; absence of audio or a combination of both. A completely dead set leads us to the power supply and no raster would lead us to the horizontal or high voltage section or picture tube (and sometimes the video amplifiers). Using this procedure, it is frequently possible to go directly to the stage at fault. Then, by using logical troubleshooting procedures, which usually require a VOM or scope, the defective component can be isolated. Most technicians know that the grid and cathode of an electron tube are normally operated with a small bias. If fact, this can be the key to a problem in a tube stage.

When troubleshooting transistor circuitry, however, technicians often become confused as to what bias to expect on an amplifier stage. Let's clear the air on this: The base, like the grid of a tube, is always in the middle of the schematic symbol. Therefore in a PNP transistor



Some horizontal systems look foreign in transistor sets. The output transistor generally feeds the yoke directly.

(arrow pointing in), the "N" element represents the base. On an NPN unit the "P" element represents the base.

Since the base and the emitter junction is *always forward biased* in PNP or NPN circuits, we can expect to find a negative voltage on the base with respect to the emitter in PNP transistors. And we can expect a positive voltage on the base with respect to the emitter in NPN transistors. This can easily be remembered since the base (being a "P" in an NPN transistor) takes the positive lead and the emitter (N) takes the negative lead. The opposite is true for PNP transistors.

The next question would logically be "how much voltage would I expect on an NPN transistor if I put the negative lead on the emitter and the positive lead on the base?" Being a little "smart" we might say "the same amount of voltage as you expect on a PNP transistor." And, in fact, this is true. Regardless of whether the unit is a PNP or NPN transistor, the bias is generally the same. The major difference is that germanium transistors (the largest type now in use) generally have about 0.2v bias. The bias may be slightly less or as high as 0.5v, but wider variation should be cause for immediate investigation. Silicon type transistors generally have about 0.8v bias. Again, this may vary from less than 0.5v to as much as 1v.

Most schematics indicate the bias voltage only by showing the voltage on the emitter and the base. For example, the emitter voltage may be 6.3v and the base 6.5v, or 0.2v bias. Simple enough! To determine the bias, however, it is necessary to make two measurements, subtract one from the other, and then decide if the voltage is the proper polarity. Additionally, it is sometimes difficult to read a small bias difference on one of the higher meter scales. There's no doubt about it: Putting the meter probes directly between the base and emitter is the easiest and most fool-proof way to check bias.

Signal amplifying transistors — those used in transistorized TVs — generally draw about 1ma of current. This gives us a convenient reference to find out how much current a transistor is drawing. For example, if the emitter resistor in a transistor circuit is 1.5K, then we expect to measure 1.5v across the resistor. Since the base current is a small fraction of the total current drawn, the same theory may be applied to resistors in the collector circuit if the emitter section is grounded.

Although it is common to find transistors drawing both more and less than 1ma current, it is not common to find them drawing considerably more or considerably less than 1ma. The logic, then, is simple: whatever the value of the resistor in the emitted or collector is in KΩ, the value should be about the same in volts across the resistor. If, for any reason, the base voltage is driven closer to the emitter voltage the transistor will be cut off. Conversely, if the base voltage is driven closer to the collector voltage the transistor will be driven into saturation and will perhaps be destroyed.

More Oddities

If you look over the schematics for some of the transistor sets now on the market, you may be surprised. For example, the horizontal oscillator-output circuitry in place of the tube-and-a-half used in electron tube sets. A typical circuit is shown above. Here, two transistors are employed as the oscillator which feeds a driver transformer. The driver transformer, in turn, feeds a driver transistor, which drives the final horizontal output transistor through another transformer.

Even though the procedure is not much like a tube set, the functions are still the same. Interestingly enough, to simplify matters, the flyback's dual function of impedance matching and generating a pulse for the high voltage is partially shattered too. The flyback in the circuit shown is used only to generate a high pulse voltage for the 1B3 and the familiar AGC and blanking voltages. Since the impedance of the transistor is quite low, it can drive the yoke directly.

Noise immunity circuits are not often found in transistor TV because the transistor is relatively noise immune by virtue of its sharp cutoff characteristics. The sharp cutoff of the transistor is frequently employed to clip the sync and thereby rid the sync circuits of noise problems.

Forthcoming articles will dig deeper into the practical problems involved in understanding, troubleshooting and repairing solid-state TV circuits. ■

The 'Beeps'

Learn how to eliminate radar interference

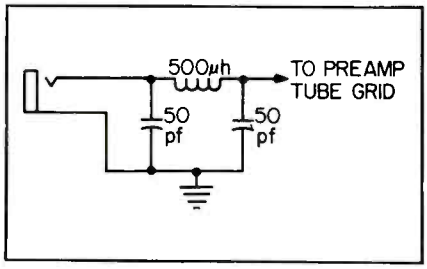


Fig. 4—Pi-trap inserted between mike cable jack and 1st preamp grid.

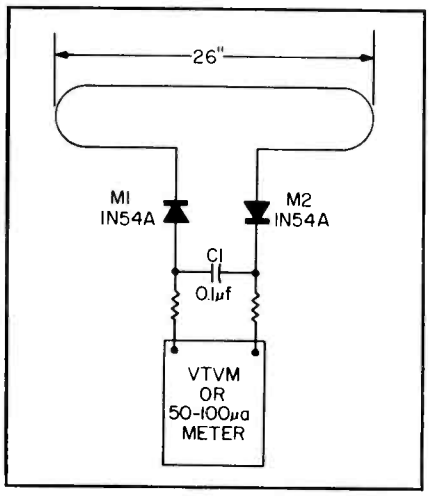


Fig. 5—Simple strength meter for measuring intensity of radar signal.

■ New, sophisticated military radar equipment piercing our skies presents new forms of technical difficulties for service-dealers and technicians in a number of locations across the country.

Land-based radar systems are monstrous in both physical size and radiated RF power and some installations will, of necessity, be close to populated areas. Radiation from this equipment may cause interference within a saturated area (up to 8 miles, depending on climatic conditions). But the interference can be eliminated in most cases.

Radar radiation may cause interference to radios, both AM and FM, TV receivers, tape recorders, electronic organs, record players, regular and stereo, various kinds of audio communications equipment, dictaphone and movie projectors. Each piece of equipment has one thing in common — audio amplifiers.

The Problem

Since most of the technical information is classified, we'll use a hypothetical radar system. Say, it's emitting a half million watts of power on a certain high frequency, with pulse-repeated frequency of around 400Hz and the "sail" (antenna reflector) is rotating at one revolution every 12sec. This goes on 24 hours a day, serving not only the military but in many cases, the Federal Aviation Agency (FAA), too.

The radar "beep," a sound that closely resembles the amplified zooming of a mosquito, does not normally pass through the RF circuits of most electronic equipment. In stereo units, both channels may be equally affected, or one channel may respond at a different intensity.

Elementary electronic principles tell us that detection can occur between the grid and cathode of an audio tube. This is what we must prevent.

In audio amplifiers, tone and gain will be affected if we use capacitors indiscriminately. And we can't remove parts which the design engineers find essential to proper functioning of the equipment. This makes it necessary to use suppressing components that do not cause loss of reproduction quality or amplification. We must use small coils and capacitor combinations.

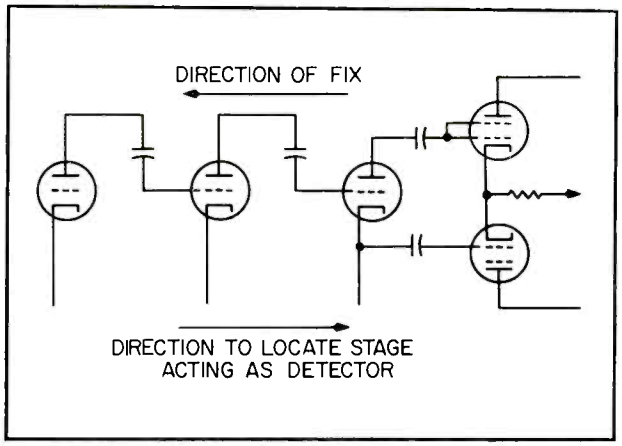
Solving the Problem

In any amplifier — radio, TV, stereo, etc. — remove the first amplifier or sound limiter tube. If the beep is still there, leave the tube out and proceed to the next stage. Keep doing this — *moving always toward the output* — until the stage is located where RF detection is taking place. This is the area where we begin making the "fix."

In series-string circuits, removing tubes is not practical unless dummy tubes are used. An alternative is to shunt a 0.1μf capacitor from plate to ground of each succeeding stage until the beep disappears or is radically reduced.

Since the last stage from which the beep is removed has been acting

Fig. 6—Directions of locating trouble and proceeding with 'fix.'



Are Here!

if you work in an affected area

as a detector, so have the previous stages. Beginning with the last affected stage then, we have to apply suppression measures — working towards the input — exactly the same to each stage. Four different ways of eliminating detection are shown in Fig. 1.

Inserting a small RF choke in the grid of an audio amplifier will reject RF without deteriorating circuit functions. If the beep is reduced but still remains, a similar choke is placed in the cathode leg. If the beep is further reduced but is still audible, put the same value choke in the plate circuit. This may completely remove the beep, but may also introduce low-level motor-boating. In this particular circuit the plate choke cannot be used because it has introduced inter-coupling feedback with the other two chokes and causes the stage to oscillate. Always try a choke in the plate, however. It often works and completes the "fix."

When oscillation develops, remove the plate choke and add a small capacitor across the grid and cathode (Fig. 1D). The capacitor's value should not be less than 25pf nor more than 100pf. A smaller capacitor will be ineffective, while a larger one will change the amplifying level and possibly the tone. Choke values should remain within a range of 100 to 1000μh. Optimum value is 500μh. Video peaking coils with values from 400 to 600μh have proven successful in numerous cases, providing they are capable of withstanding current drain of the tube.

If the beep is stubborn, a series-trap tuned to 222MHz is placed at the input junction of the grid RF choke (Fig. 1E). Be sure to remove the capacitor which you installed across the grid and cathode — it will nullify the series-tuned trap. Reactivating each preceding stage will quickly prove how effective the fix is.

Although it may be against the service policy of many service-dealers and technicians, besides being inconvenient, this fix should always be made in the customer's home. The reason is simple: this is where the beep is troublesome and where it predominates. Making the fix in the shop may not accomplish satisfactory results when the set is returned to the home. Installation of the series-trap will require drilling a hole in the chassis for secure grounding and availability for tuning the slug. To adjust this trap, a signal generator with modulated output is required. Feed a 222MHz signal into the circuit and tune the trap for minimum output, either audibly or with a VTVM for minimum ac swing in the following stage or at the finals.

Flashing On TV Screen

Where thin white flashes appear on a TV screen, the radar pulse is not entering the tuner or IF stages, but at the video detector, video amplifier or both.

In modern receivers where the video detector is contained inside an IF can, this trouble rarely develops. But sets that do not have the detector diode, series and coupling chokes shielded, can easily pick up radar interference.

This condition can be eliminated in two possible ways: If the receiver uses a crystal diode, place it inside a shield can. If a tube is used as detector — 6AM8, 6U8, etc. — it should be double-shielded by placing a large IF can over the tube and its original shield and make sure all chokes and immediate circuitry are well shielded. The below-chassis shields can be cut from thin metal and shaped to fit over the circuitry — the way it was done in some older receivers by the manufacturer.

If chassis layout makes shielding impractical or fails to completely remove radar flashing, insert a series-tuned trap to create a shorting path to ground as shown in Fig. 2. This trap is also tuned to 222MHz. In all cases, these traps must be tuned in the circuit to take up stray capacitance of surrounding circuitry. If changes or repairs are made in the circuit later, the trap may have to be retuned for optimum results.

Portables and table models have shorter volume, tone, and contrast leads and hence less radar pickup. But older sets and many new consoles with horizontal chassis have long leads which may have to be "over-shielded" by running them with coaxial or phono cable, then wrap them with aluminum foil (if you cannot find a new shielding tape which has recently come on the market) and ground both ends of the foil (or tape) to cancel out stray capacitance effect. If the ac switch is located on or near the tone, volume or contrast controls, these leads must be wrapped separately to prevent them from becoming counterpoise antennas and injecting radar into the audio/video lines. Now wrap bare, tinned wire the full length of the "foiled" leads (again if you don't have commercial type shielding tape), making them into a single cable and then bond the wire at both ends.

Those who handle one or two receiver brands that develop this problem, will find that lengthening or shortening the volume, tone or contrast leads, will reduce radar interference to a minimum — often without inserting suppression components. Once a fix is obtained, measurements can be made which

will facilitate preparation of future cables required.

Mike Cable Becomes Antenna

This is a condition which will prevail in audio communications systems in saturated areas. Even with a dead mike, the cable can become an antenna. To prove this, remove the cable from the amplifier and note loss or decrease of the beep. If there's no beep with the mike and master gain controls turned up full, then we have immediately spiked the mike cable as the culprit.

Many cumbersome and varied solutions exist for this problem. But two very simple measures have been devised. Regardless of the mike cable length, if it produces beep in the amplifier, simply cut off about a foot of the cable and re-install the connector. *Do not cut off more than a single foot.*

If it is impractical to cut the mike cable, extend it. We accomplish this by inserting a pi-trap from the jack to the grid of the first preamplifier stage as shown in Fig. 4. This is the same choke and capacitor arrangement mentioned before. By using the RF choke in this manner, we are electronically adding one foot to the mike cable plus a trap.

This applies to radio and TV consoles also. Lengthening the control cables may accomplish what otherwise fails. Here, of course, be careful when using the pi-trap. In video amplifier circuits, you can run into clipping difficulties.

A local juke-box distributor was plagued with radar interference. Lengthening the leads from the preamp to the main amplifier did the trick, without moving the amplifiers from the box. Time: 1 hour for locating the cause; an hour for cutting and measuring the cable when proper "zero" wavelength was obtained. Next time that same type of juke-box shows up elsewhere, a measured cable will be installed. Expected total time to complete the job: approximately 45 minutes.

Simple Field Strength Meter

It may be necessary to determine the strength of the radar signal under certain circumstances. How to contruct an emergency field strength meter is shown in Fig. 5. The unit can be thrown together in two ways: One way is to cut a piece of 30Ω twin-lead 26 in. long and tie the two conductors together at both ends — thus forming a 300Ω folded dipole. One conductor in the center of this piece is cut and the lead-in is attached to the two ends that result. The second method — preferred for continuous monitoring — is to cut an aluminum folded dipole of the same length and mount on the roof or on a stand. Both types make a half-wave 300Ω folded-dipole antenna. The aluminum construction allows for permanent mounting on the roof of the shop, with the transmission line brought down and connected to a 100μa meter.

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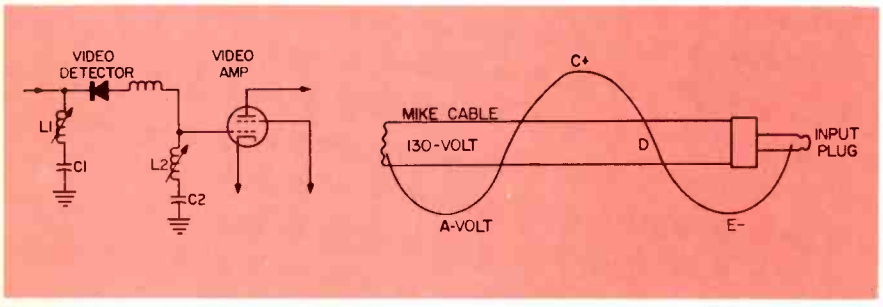


Fig. 2—Series-tuned traps inserted in both video detector and video amplifier circuits Both are tuned to 222MHz.

Fig. 3—Cutting mike cable so radar wavelength is terminated at "E" will give zero signal at jack input.

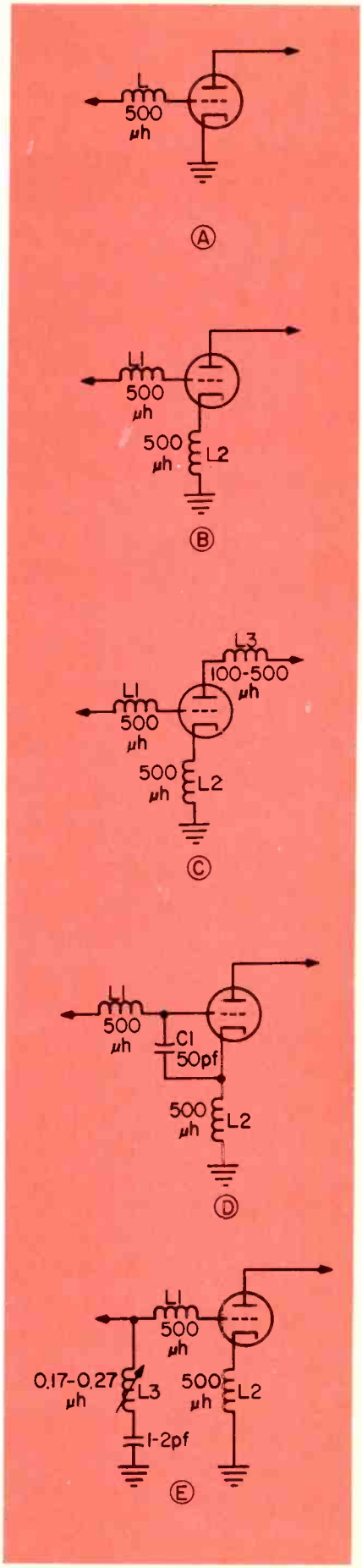
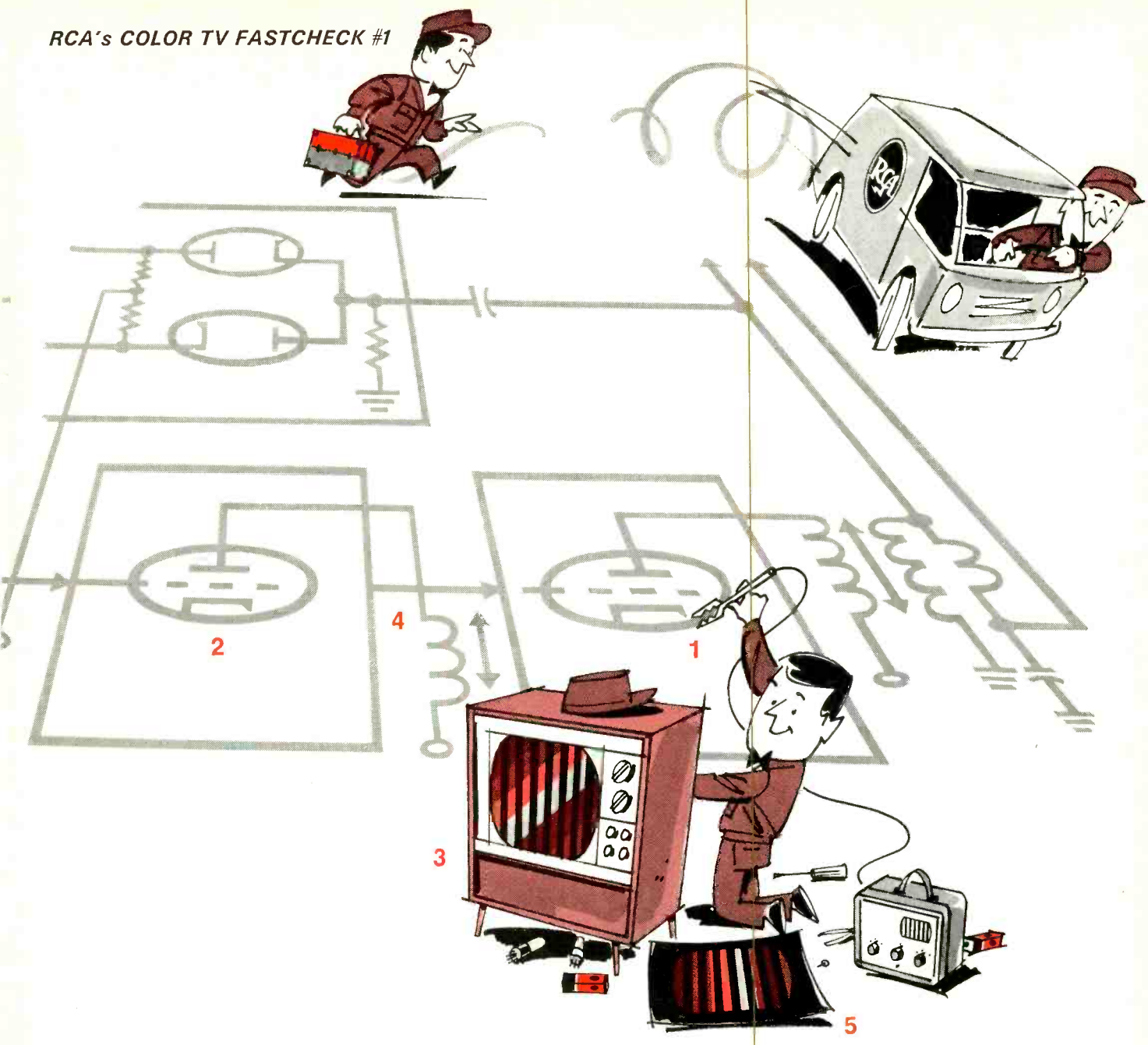


Fig. 1 (A) — RF choke audio amplifier grid. (B)—Choke is added to cathode circuit if grid choke does not eliminate interference completely. (C)—Choke added to plate circuit. (D)—Grid to cathode capacitor. In stubborn cases, insert series trap (E) and tune to 222MHz.

RCA's COLOR TV FASTCHECK #1



Loss of color sync?
TRY ADJUSTING THE PLATE COIL...

Loss of color sync is often caused by a defective 3.58-Mc/s oscillator. In some receivers, it may also be caused by misadjustment of the plate coil in the reactance tube control circuit. Next time you run into this trouble, follow this simple procedure and it may save you a time-wasting callback.

1. Connect a color-bar generator such as the RCA WR-64B to the receiver and get the ten-color bar pattern on the picture tube.
2. Short the control grid of the reactance tube to ground.
3. The bars may have bands or blocks of color across them. These bands are "beats" resulting from difference between the local oscillator and transmitted signal frequencies. These colors may drift diagonally across the bar giving a "barber pole" effect, or they may be locked into the bars in blocks of different hues.
4. Slowly adjust the reactance tube plate coil with an alignment tool. Turn the slug in the direction which reduces the number of color bands or blocks across the bars.
5. Adjust for a zero-beat condition. At zero beat, the bars will display individual solid colors from top to bottom. These colors may be locked in or they may drift slowly from bar to bar. Remove the short from the reactance tube grid and re-adjust the plate coil for solid lock-in of the color bars.

If you can get an exact zero-beat condition, it is an indication that the oscillator tube is good. If it is necessary to replace the oscillator tube, be sure to adjust the circuit for zero-beat as shown in step 5.

This color TV service hint is the first of a series of service hints from RCA. For satisfied customers and fewer callbacks, always replace with ultra-reliable RCA receiving tubes.

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

The Most Trusted Name in Electronics

COLORFAX

Philco 16QT85 Horizontal Circuits

Horizontal Oscillator and Reactance Circuit

This is a sine-wave horizontal oscillator (Fig. 1). The frequency is determined mainly by the variable coil and the capacitors across it. The reactance tube also helps to control the frequency. The reactance tube is coupled to the cathode of the horizontal oscillator and thus is effectively in shunt across part of the tuned circuit. The signal appearing at the plate of the reactance tube is actually from the horizontal oscillator.

Note the 100pf capacitor from plate to grid of the reactance tube. This feeds back a signal to the reactance grid which is capacitive, that is, it is leading the signal at the plate. This capacitive signal is amplified by the reactance tube and coupled into the cathode circuit of the horizontal oscillator.

Any change in bias of the reactance tube will cause a change in the output of the tube which means more or less of the capacitive current will be introduced into the cathode circuit of the horizontal oscillator. An increase in current will lower the frequency of the oscillator because of the apparent increase in capacitance. A decrease in current will increase the frequency because of the apparent decrease in capacitance.

The bias of the reactance tube is controlled by the setting of the horizontal hold control and by any dc voltage which may be introduced by the phase comparer. This dc voltage will be positive if the horizontal oscillator tries to drift higher and negative if it tries to drift lower.

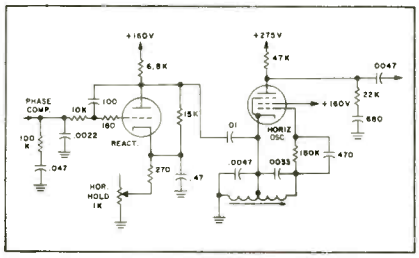


Fig. 1—Philco 16QT85 horizontal oscillator and reactance circuit

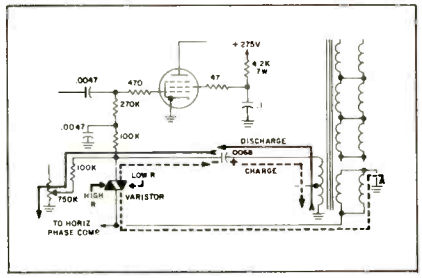


Fig. 2—Horizontal output circuit bias

Horizontal Output Circuit Bias

In addition to the bias developed by the drive from the horizontal oscillator, some bias is developed by the pulses from a winding on the HOT. These pulses appear across the horizontal bias control and the 100K resistor which is in series with it, through the pulse coupling capacitor (0.0068μf) shown in Fig. 2.

Another winding on the HOT is used for sampling for the phase comparer. This winding is placed in series with a varistor, which is also in series with the pulse coupling capacitor. The pulse from the bias winding will be a

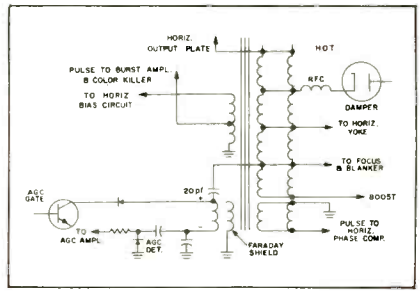


Fig. 3—Horizontal output transformer circuit details

positive going pulse, while the pulse from the phase comparer winding will be negative going. This causes a large, pulse-voltage difference across the varistor. With a large voltage across the varistor its resistance will be low. The coupling capacitor will charge, as shown by the broken current path in Fig. 2, during retrace pulse time. Because of the low resistance of the varistor, with pulses present, the charging time constant is short. The voltage developed will act as a bias source for the output grid. During line time the capacitor discharges, as shown by the unbroken current path in Fig. 2, through the 100K resistor and the bias control. At this time the varistor has high resistance. The discharge time constant is quite long and thus maintains the developed fixed bias for the horizontal output stage.

Any change in output loading of the horizontal circuits, including the high voltage, will be reflected as a change in pulse amplitude. For instance, if the output voltage increases, the pulse amplitude will increase. This will cause a reduction of varistor resistance from its normal pulse time value, shorten the charging time constant and allow the coupling capacitor to charge to a higher value. The bias developed will then be higher—more negative. This lowers the output conduction, compensating for the increase. Of course, if the output loading increases the output voltage will decrease. The bias will then be decreased, causing a compensating increase in output.

The two oppositely phased pulses are used across the varistor to give a greater resultant change to sense when pulse amplitude changes.

HOT Details

The horizontal output transformer circuit, shown in Fig. 3 performs a number of functions other than the obvious horizontal sweep, high voltage, focus voltage and boost. Several separate windings are used to couple out the retrace pulse for use in other areas of the receiver. Note the phase comparer winding, horizontal bias and and burst-killer winding, and the AGC gate winding.

The AGC gate winding is used to supply the positive gating pulse to the transistor collector. Because of the relative positions of the gate winding (with its positive pulse) and the horizontal phase comparer winding (with a negative pulse), some interaction would take place if not corrected. A portion of the negative pulse would be capacitively coupled into the AGC gate winding and collector load circuit. This negative pulse would cause AGC action and therefore prevent a true zero signal condition. Obviously, this coupled negative pulse must be eliminated. A Faraday shield between the gate and phase comparer windings reduces the interwinding capacitive coupling to a low degree. Because the Faraday shield is not completely effective, a small capacitor, 20 pf, connects between a positive pulse source and the gate winding as neutralization to cancel the remaining negative pulse.

Philco Color CRT Plant

Philco Corp. will spend approximately $20 million to build and equip a color television tube manufacturing plant at Lansdale, Pa., Robert O. Fickes, president, announces.

Mr. Fickes states that the new plant will be in operation early in 1967 and by the end of that year will be producing color tubes at the rate of 200,000 yearly. The plant's eventual capacity will be 500,000 tubes a year.

When fully in operation the facility will increase employment at the Lansdale division by 500 persons. The division now employs approximately 2300.

COLORFAX

Magnavox Color Service Hints
Power Transformer Hi-line Tap

All 45 Series and T904 Series Magnavox color chassis provide a hi-line tap on the power transformer primary, to provide for the wide variation in line voltage which exists in some areas. Two leads from the hot side of the primary are connected to a terminal strip with solderless connectors. One of the terminals on the strip is connected to the hot side of the ac line, the other is blank. Under normal line voltage conditions (108 to 128v) the black and red lead should be connected to the ac line terminals. Under "high line" conditions the black and white lead should be connected to the line. In either case the unused lead must be connected to the blank terminal.

Voltage Regulator Tube - 6BK4

The voltage regulator tube, type 6BK4, normally has an internal connection between the cathode (pin 1) and pin 3 and pin 3 was used in production for the cathode connection. It has been recently found that at least one manufacturer's 6BK4's do not have this internal connection. If a tube of this type is used, no high voltage regulation would exist.

A jumper wire is now being connected between pins 1 and 3 in production to prevent this possibility.

Motorola TS908 Service Experience

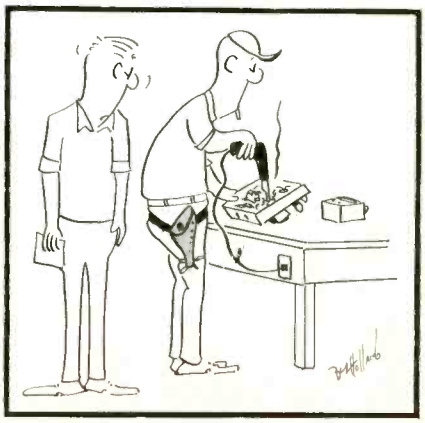
A 0.01μf capacitor was added across the color indicator light and resistor R923 (82K) was changed to 180K in the Motorola TS908 chassis. Adding this capacitor and resistor revised the circuitry so that it became a relaxation oscillator at approximately 1kHz. This change caused the color indicator light to burn continuously without any tendency to flicker.

On some sets, the 1kHz oscillation may be coupled capacitively from the light leads through the 12-pin plug on the chassis to the grid lead of the audio output tube. This can result in an audible note at low volume level when the color indicator light is on.

To eliminate this 1kHz note in the audio, it is only necessary to remove the 0.01μf capacitor. The capacitor is located on the 2-lug terminal strip on the UHF tuner mounting bracket. Removing this capacitor may cause the bulb to flicker. Reversing the neon bulb leads may cure the flicker, if not, polarizing the neon bulb will cure the flicker in most sets.

The neon bulb can be polarized in the following manner: Connect a 7.5K, 4w resistor to the right side (white wire) of the 2-lug terminal strip that feeds the neon bulb and ground. This will cause the neon bulb to fire. Allow the bulb to remain fired for not more than 10 sec.

In chassis coded TS908E08 and later, resistor R923 (150K) was physically moved from the 2nd color IF coil, T902, to the 2-lug terminal strip on the UHF tuner mounting bracket. Re-locating the resistor serves to isolate the lead wire running through the 12-pin chassis plug and reduces the danger of coupling the 1kHz note to the audio output tube.



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TECHNICAL INFORMATION

The RADAR SENTRY ALARM is a complete U.H.F. Doppler Radar System which saturates the entire protected area with invisible r.f. microwaves. It provides complete wall to wall—floor to ceiling protection for an area of up to 5,000 square feet. Without human movement in the protected area, the microwave signal remains stable. Any human movement (operation is unaffected by rodents and small animals)in the area causes the doppler signal to change frequency approximately 2 to 4 cps. An ultra-stable low frequency detector senses this small frequency change, amplifies it and triggers the police type siren—which is heard up to a half mile away.

In addition, the RADAR SENTRY ALARM's protection can be extended to other areas with the use of the following optional accessories:

- *remote detectors for extending coverage to over 10,000 sq. ft.*
- *rate of rise fire detector U.L. approved for 2,500 sq. ft. of coverage each (no limit on the number of remote detectors that can be used)*
- *hold-up alarm*
- *central station or police station transmitter and receiver (used with a leased telephone line)*
- *relay unit for activating house lights*
- *battery operated horn or bell which sounds in the event of: powerline failure; equipment malfunction or tampering*

Cash? Color Sets? Stereos? Portables? Consoles? Tubes? Test Equipment?

Add it up. What's the total? . . . $1,000.00? . . . $5,000.00? . . . $10,000.00? . . . more?

Can you afford a loss like that?

Can you afford to be out of work for two or three weeks because your test equipment was stolen? Or smashed? Because if a burglar isn't satisfied with your haul . . . he'll smash everything in sight.

And don't count on insurance to cover your losses . . . At best, you'll get only partial restitution . . . and nothing for all the time you lose.

When will your time come?

We hope . . . never.

Install a "RADAR SENTRY ALARM" security system . . .

And we know never!

But there's another reason why you should install "RADAR SENTRY ALARM" in your business. Before you know it you'll be installing them all over town. Because everyone needs protection. Of the more than 100 million buildings . . . stores, offices, factories, schools, churches and homes . . . only a small percentage are protected by an effective security system.

You can sell them! And you don't have to be a super salesman either. For hundreds of electronics professionals like yourself are selling them . . . all across the country. All you have to do is demonstrate it. It sells itself. A glance at the technical information shows why. It's the most unique, effective and advanced security system available.

Here is a list of just some customers who are protected by RADAR SENTRY ALARMS: U.S. Government; U.S. Air Force; Detroit Board of Education; Catholic Diocese of North Carolina and Detroit; Hundreds of Businesses, homes and factories.

You, too, can protect your possessions and property . . . the same way you earn them . . . ELECTRONICALLY . . . with a "RADAR SENTRY ALARM". And at the same time expand your business in a totally new area that yields high profits.

Don't wait.

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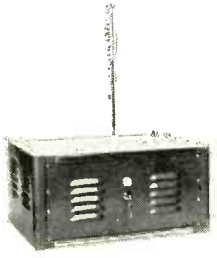
RADAR SENTRY ALARMS BY DAY . . . PROFITS BY NIGHT . . . PROTECTION

RADAR SENTRY ALARM



Mail to: RADAR DEVICES MANUFACTURING CORP. 22003 Harper Ave., St. Clair Shores, Michigan 48080

Please tell me how I can protect and expand my business with Radar Sentry Alarm. I understand there is no obligation.

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City_____ State & Code_____

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NEW PRODUCTS

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

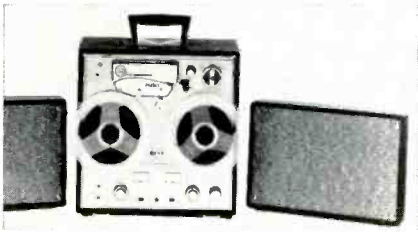
VTVM 200

A VTVM, which comes with fully assembled single ac/dc/ohms probe, is

announced. It has a 0.5vdc range and also provides P-P ac measurements. Precise.

Tape Recorder 201

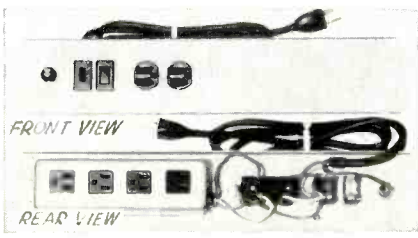
A portable 4-track stereo tape recorder, with detachable speakers is introduced. The model 880 includes a solid state, 10w stereo power amplifier with headphone jack. The two-way



detachable speaker systems contain 5in. woofers and 2in. tweeters with electrical crossover. Viking of Minneapolis.

Control Panel 202

A line of power control panels for standard relay racks and other applications is announced. The 904 series of rack mount units provides four 'U' ground outlets on the back of the panel in addition to two on the front.



The boxes also have an on/off switch, pilot light and choice of fuse or push-to-reset circuit breaker. The power control panels have UL-approved components and are rated at 15amp, 130v continuous duty. Waber.

Electron Tube Voltmeter 203

A VTVM (ETVM) which has a dc range of 1500v is introduced. Specifications are: ac ranges: 0 to 1.5, 5, 15, 50, 150, 500, 1500v; P-P ranges: 0-4, 14, 40, 140, 400, 1400, 4000v; output ranges (dbm): 20db to +65 db, (0db = 1 mw across 600Ω); input impedance: 1.4M shunted by 30pf;

frequency response (±5%) 30Hz to 500kHz; dc ranges; 0-1.5, 5, 15, 50, 150, 500, 1500v with input impedance 11M shunted by 2pf ±2%; resistance ranges: 0-1K, 10K, 100K, 1M, 10M, 100M, 1000M ±3%. Mercury.

Signal Generator 204

A sinewave generator with constant P-P amplitude over its entire frequency range is announced. Frequency range of the Type 191 is continuously variable from 0.35MHz to 100MHz in 7 ranges. A 50kHz reference output is also available. When the output is terminated in 50Ω, the selected frequency is within ±2% of the indicated reading on a 170deg arc scale, the manufacturer says. Output amplitude is in three ranges: 5mv to 50mv (±5%), 50mv to 500mv (±4%), and 0.5v to 5v (±3%). Ten calibrated steps on each range are direct reading from a front-panel con-

trol when the output is terminated in 50Ω. Unterminated output is twice the terminated value. The output is continuously variable, uncalibrated, between steps and to 10% over the top end of each range. Measures 8 x 6½ x 15⅝. Tektronix.

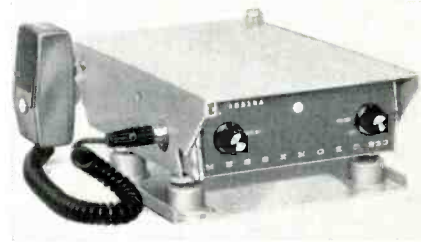
Mobile Radios 205

A series of several FM mobile two-way radios for cars and trucks is introduced. The radios can be used by businesses and governmental agencies. The unit can be mounted up front

under the dash, back in the trunk, or elsewhere in the vehicle — either level, slanted or on its side. The equipment is 4 x 12½ x 12¾. G-E.

Two-Way Radio 206

An all-transistor two-way radio transceiver designed to use the uncrowded, 3w business and industrial frequencies set aside for lower power



equipment is introduced. A 25-50MHz, 3w AM unit, the Messenger "333" provides communications for shorter ranges and is interchangeable for base station, mobile or field pack use. E. F. Johnson.

Why are RCA Solid Copper Circuits built to take a beating?

For fewer service headaches --Space Age dependability.

RCA SOLID COPPER CIRCUITS

They won't come loose. Won't short circuit. Won't go haywire. That's why they're the circuits of the Space Age.

RCA The Most Trusted Name in Electronics

NEW PRODUCTS

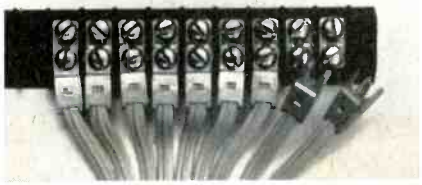
TV Lamp/Clock 207

A combination TV lamp and numeral clock is introduced. The time is read directly with seconds also appear-

ing on the face. An independent light functions as a TV lamp or the clock can be used as a night light in bedroom or nursery. Pennwood Numechron.

Flat Cable 208

A flat cable with a foam adhesive backing is announced. The vinyl foam is designed for gripping on porous or



sand-finished walls and surfaces. The No. 550 cable is a 22-gage stranded wire cable, available in groups of 2 to 24 conductors. 3M.

CB Walkie-Talkie 209

A nine-transistor entertainment radio and citizens band two-way radio is announced. The unit measures 6 x 3 x 1½ in. A flick of a switch changes the CB15 from an entertainment unit to a two-way radio. Transmit and

receive frequency is crystal-controlled, and the frequency, or channel, may be changed by plugging in other sets of matched crystals. List price $59.95. Includes one set of transmit and receive crystals and a leather case. Hallicrafters.

Spray Adhesive 210

A clear spray adhesive in an aerosol can is announced. Spray adhesive

77 can be used for bonding cloth speaker covers and adhering tube placement diagrams to wood or metal radio and television cabinets. The adhesive is packaged in an aerosol container. 3M.

Soldering Iron 211

A pencil style soldering iron is announced. This 23w iron has a stain-

less steel barrel and a replaceable copper tip. Weller.

Scope Probe **212**

A single probe containing demodulation, direct and lo-capacity sections is announced. Has demodulation section for tracing waveforms in RF and IF stages of TV and radio; direct section for maximum scope sensitiv-

ity in low frequency testing and low impedance circuits. Has 10-capacity section to trace wave forms in high impedance circuits, reduce distortion and frequency discrimination. Lo-capacity section provides 10 to 1 attenuation when used with scope having input resistance of 1.3M. Far Hills.

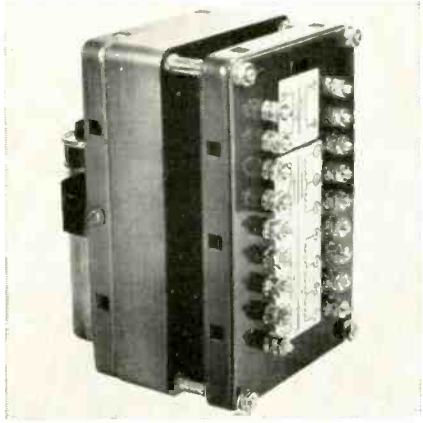
CB Transceiver **213**

A citizens band transceiver with 18-transistors and 9-diodes is announced. It has seven panel controls plus an output/S-meter. A switch mounted on the squelch control con-

verts the 650 to a public address system when used with an external speaker. With 12vdc and 115vac power supplies it measures 3¾ x 6¾ x 9½ in. Amphenol.

Multi-Tap Transformer **214**

A multi-tap constant-voltage transformer is announced. The CVR is



available in six models, each providing a wide range of dc output voltages. The six ratings available: 40, 75, 150, 225, 300 and 450VA. Sola.

Heard the great VIDOR is

Get set, America. Make room for IRC's high-quality, high-profit battery...VIDOR! A complete line of transistor and general purpose batteries. The same fine quality you associate with British hi-fi, record changers and other products from Great Britain. Get all the profitable details from your IRC representative right away. Consumer and Distributor Products Division, IRC, Inc., Philadelphia, Pa. 19108.

IRC®

news?

here!

Transistor

General Purpose

. . . for more details circle 54 on postcard

NEW PRODUCTS

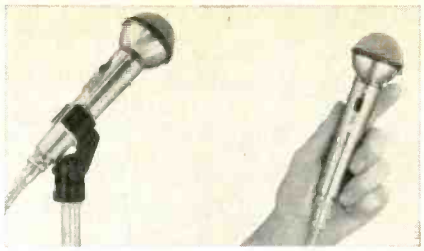
Paging Transmitter 215

A wireless paging transmitter is announced. The RP25 transmitter used in conjunction with any number of PM-

10 receivers comprises a personal wireless communication system enabling users to instantly contact personnel within a building or surrounding area. Round Hill.

Microphone 216

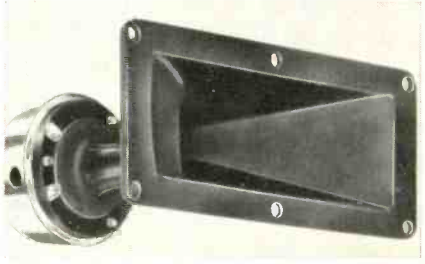
A microphone similar in appearance to the "ball" type microphones often used by TV entertainers is announced. The microphone is an ommnidirectional type that picks up sound from in front, in back and all around the microphone. It is designed for reproduction of music and voice



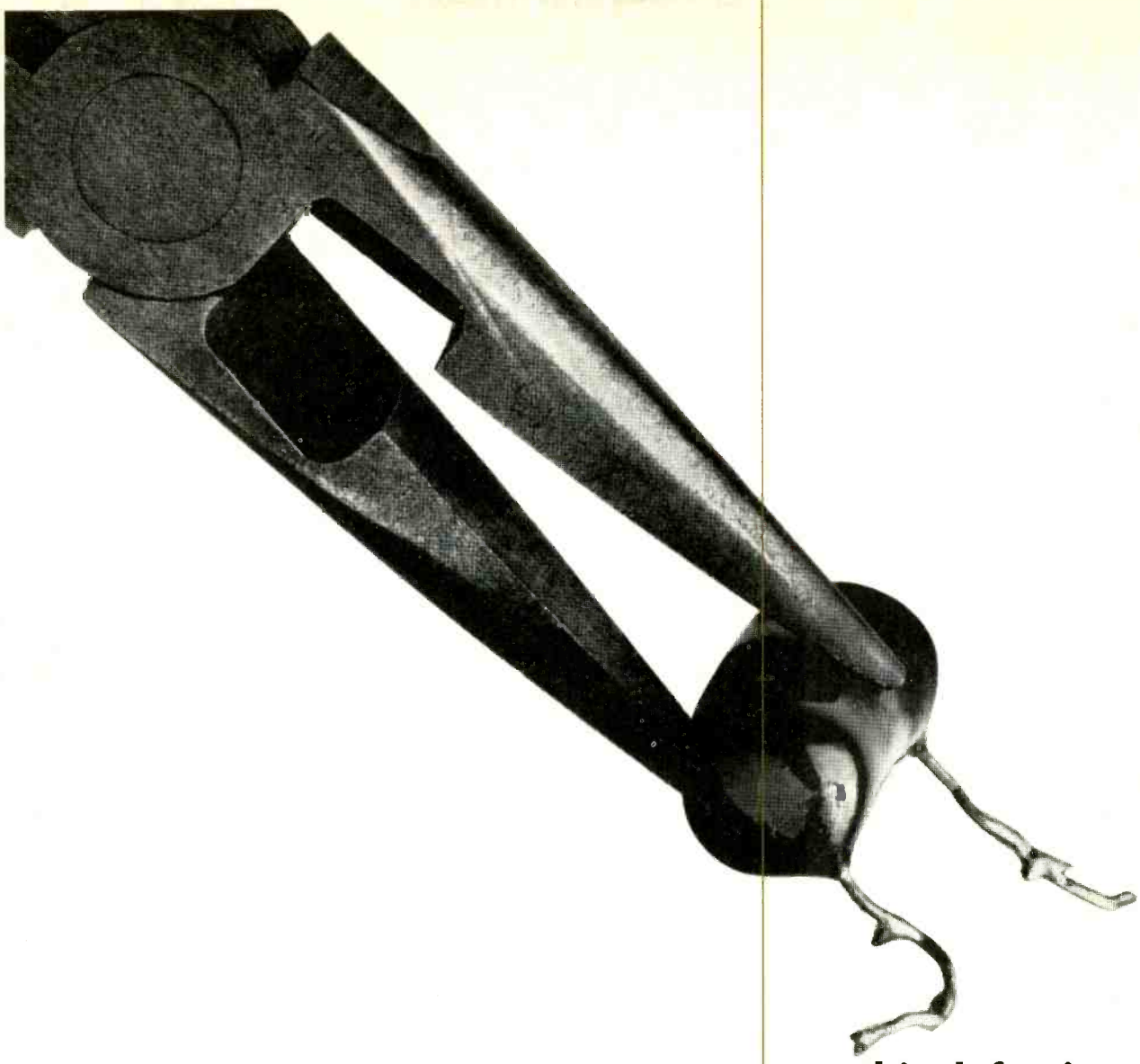
in all general-purpose, public-address installations, as well as theater-stage and tape recording applications where pickup of audience noise, loudspeaker squeal (feedback) or background is not a problem. Shure.

Horn Tweeter 217

A 20w die-cast horn tweeter is announced. It has a 1-in. voice coil



with 8Ω impedance and Alnico v magnetic driver unit. Frequency response is between 1.5 and 20kHz. Crossover frequency is 2kHz. Oxford.



This defective capacitor came from a four-month-old TV set. And you want to put in another just like it?

Why put up with that kind of call-back? Install a long-lasting Elmenco dp or VDM (high-voltage) capacitor, and the next time your service customer calls you, it's because he wants your kind of reliability.

Elmenco dipped Mylar®-paper (dp) capacitors last longer because they're vacuum-dipped for solid impregnation. They'll hold their rating, even at continuous 125° C operation. Water can't get in to cause leakage or breakdown because the casing's non-porous and moisture-proof.

Elmenco dp capacitors satisfy the requirements of missile manufacturers. And exceed the requirements of all radio and television manufacturers. That's why you should order some from your Arco-Elmenco distributor. They're built to be wired into missiles. And priced to be wired into TV sets.

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A DIVISION OF LORAL CORPORATION
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NEW PRODUCTS

Power Supply 218

A remote power supply that provides 6amp of regulated 30vac to a solid state CATV system from either of two connectors is announced. The output voltage is regulated to within 1% for power line voltage from 95 to 130vac and to within 2% for load

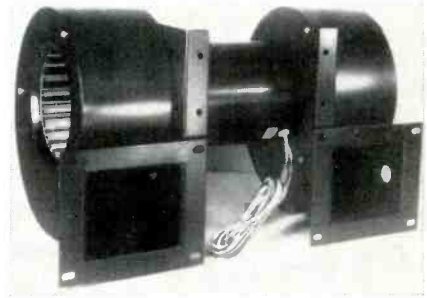
variations between 2 and 6amp the manufacturer says. The power supply has a built-in automatic re-set circuit breaker. An RF power filter provides a minimum of 60db isolation between power lines and the RF terminals. A meter permits constant monitoring of output current. The unit may be rack, wall or cabinet mounted. Viking Industries.

Circular Slide Rule 219

A 5-in dial circular slide rule is introduced. The engraved scales are molded in melamine plastic. In addition to all the usual scales, it includes a pair of spiral scales 50 in. long which provide 4-5 figure answers, plus a pair of vector scales. For normal calculations to 3-4 figures, the 13in. long C, D scales are used. Where precision is essential, the 50-in. long spirals are employed to obtain 4-5 figure answers. On the front are the 13in. C, D scales. CI and CIF (reciprocals), A & B (square and square roots), K (cubes), L (logs) and the trig scales. All are related to the basic D scale. The trig scales give all six functions directly, and having separate sine and tangent scales for small angles. The other side includes the two 50in. spiral C, D scales, each of which has four turns. A pair of vector scales obtains directly the third side of any right triangle with a single setting. Continuous LL and LLO scales give powers and roots of all numbers from 0.00005 to 0.990, and from 1.010 to 25000. Those for any other numbers are readily computed. Boykin.

Blowers 220

A line of single and dual centrifugal blowers that provide air deliveries from 10 to 1000cfm for direct connection mounting in cabinets,



computers, consoles or systems is announced. Motor and blower can rotate to blast in any direction. Motors may be mounted on right or left side of blower and are available in clockwise or counterclockwise rotations. McLean.

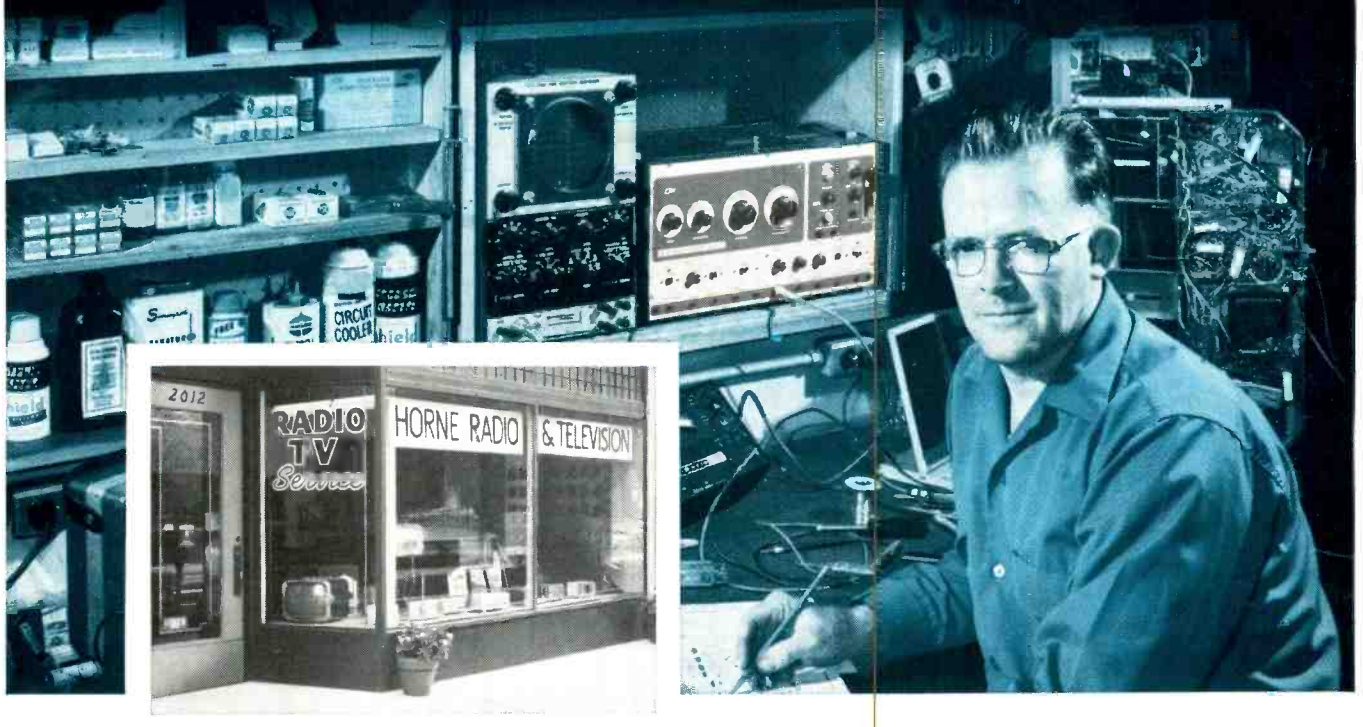
Sweep Generator 221

A sweep generator, covering the FM and VHF TV bands from 0.5MHz to 230MHz, is introduced. The sweep width of the TH200 can be varied from 0.1MHz to 230MHz, and the unit provides a leveled out-

put of greater than 0.25vRMS. It has provisions for accepting up to four plug-in solid state, single frequency (SM) or harmonic (HM) markers. The unit also has external marker input capability and can also be provided with an optional 0-70db turret attenuator. Texscan.

For more information on these
NEW PRODUCTS
See pages 97 and 98
READERS SERVICE

successful service shop beats rising costs with B&K television analyst



"As every serviceman knows, major TV repairs represent an increasingly large part of the service business and the average time per repair has increased"...

says Willard Horne of Horne Radio and Television in Evanston, Illinois.

After more than 25 successful years in the service business, twenty of them in the same location, Mr. Horne can be considered an authority on how to keep a business profitable. Mr. Horne says, "In order to be successful, our 3-man shop has to be competitive on the large jobs as well as the small ones. With the increase in bench time that we were experiencing and the limitations on what we could charge, there was a reduction of profit that had to be stopped. Then we bought a B&K Model 1076 Television Analyst."

"Now our customers get the same extra-value service on the big repairs and the small ones," said Mr. Horne. "We use the Television Analyst for troubleshooting a wide variety of complaints, particularly for those that require touch-up alignment, location of IF overloads and color convergence. We are more competitive now that we use the B&K Television Analyst because we spend far less time on the jobs that used to be dogs, with benefits both to the shop and our customers."

✱ B&K Model 1076 Television Analyst checks every stage in a black and white or color TV receiver. Nine VHF RF channels, 20 to 45 MC IF, audio, video, sync, bias voltage and AGC keying pulse are available. The model 1076 provides its own standard test pattern, white dot, white line crosshatch, and color bar pattern slide transparencies. It includes a blank slide which can be used for closed-circuit-TV display floor promotion. Its net price is **$329.95.**

Find out how you will increase your *TV service profits with a B&K Model 1076. See your distributor or write for Catalog AP 22.*

B & K MANUFACTURING CO.
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Export: Empire Exporters, 123 Grand St., New York 13, U.S.A.

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NEW PRODUCTS

Junction Box **222**

A water- and dirt-tight cast aluminum junction box for ½in. conduit and armored cable connection is attached to this industrial weatherproof speaker. A combination bulkhead mounting plate and adjustable U bracket adapts SPB3C to any bulkhead, beam, ceiling and wall surface. The conduit/armored cable junction box includes an adaptor plate with hardware to mount accessory linc transformers, and the box modifies during installation to mount a volume control. Atlas.

CB Transceiver **223**

A 12-channel dual conversion 5w citizens band transceiver is announced. It provides 12 crystal-controlled transmit and receive channels and complete tunable reception of all 23 CB channels. Adjustable squelch and

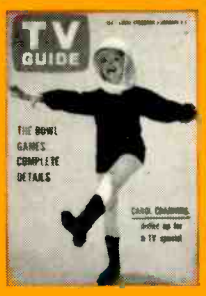
noise limiter, plus switches for 3.5w public address use, spotting and Part 15 operation, are all incorporated. Transistorized dual power supply operates from 12vdc and 117vac. Eico.

Transistor Checker **224**

A transistor/diode checker designed for servicing, field engineering, school and production line applications is introduced. The instrument can be used to check all types of junction transistors and diodes, including both small signal and high power types, and germanium and silicon units. It gives a positive indication of transistor or diode condition by a tone signal and is battery-operated. Workman.

For more information on these
NEW PRODUCTS
See pages 97 and 98
READERS SERVICE

You'll star in TV Guide



If you're "the right TV serviceman."

Get the jump on profitable color set repairs. Your Sylvania distributor will put your name, your town, your phone number in *TV Guide* as many as four times this year. If you're the right TV serviceman.

The right TV serviceman—Mr. Right—is any Independent Service Dealer who carries the most advanced replacement parts: our *color bright 85*™ picture tubes and our color receiving tubes. He may also carry competing brands. So he's in a position to give unbiased opinions on color set repairs.

This is what our double-page, full-color localized ads explain to *TV Guide* readers. Just see your Sylvania distributor and the ads will tell all those TV set owners about you. How about it, Star?

Sylvania Electronic Tube Division, Electronic Components Group, Seneca Falls, New York 13148.

SYLVANIA

SUBSIDIARY OF GENERAL TELEPHONE & ELECTRONICS GT&E

VIDEO TAPE RECORDER HELPS TRAIN SALESMEN

■ The American Can Co. is using a video tape recorder to enable sales and other trainees to see themselves, instantly, "as others see them."

The company's personnel and industrial relations department, in conjunction with its products sales department, is using a Sony tape recorder in its sales-trainee program. The equipment is used to record the trainee's final test — a sales interview with a real buyer. The tape is then immediately played back to the trainee, enabling him to see how he looks and sounds to a prospective buyer.

"We've been more than pleased with the results," says Robert S. Shrewsbury, manager of the organization development and planning group. "The sales trainees are their own harshest critics when they see the tapes replayed. They spot instantly where the interview was weakest, how they might have used a different approach, even how they might have worn a different tie for the occasion."

The record- and play-back unit weighs 75 lb. A small, 10-lb camera and a 40-lb TV monitor complete the highly mobile unit. All the action can be taped under normal lighting conditions. Total cost of all components is under $1500.

The training procedure, using the equipment, follows a set pattern. Each trainee is informed, before the mock sales interview, that he will be taped and will be allowed to see the tape immediately afterward. The trainee, who sees the tape by himself, makes a detailed critique of his performance. Then the instructors, as well as the buyer who participated in the interview, see the tape and make formal critiques of the trainee's actions. Finally, the tapes of all the trainees are shown for a group critique.

"We've had this unit since early December," Mr. Shrewsbury says, "and we feel that it's already paid for itself. We plan extensive use of video tape for any of the many training techniques that involve role playing: interviewing, post-appraisal discussions and other face-to-face situations."

Future plans would also include on-the-job taping of machine and maintenance operations for replay to apprentice training groups.

The video tapes, which can play a full hour, can also be duplicated. Mr. Shrewsbury points out that once enough video tape replayers and monitors are set up at major points throughout the company's 139 plants and facilities, it would be a simple matter to tape a major policy decision at the company's New York headquarters and send duplicate tapes throughout the country for instant replay. ■

FINCO®-AXIAL COLOR-KIT

the complete color TV reception system

FINCO-AXIAL COLOR-KIT, Model 7512 AB

High performance Indoor and Outdoor Matching Transformers convert old-fashioned and inefficient 300 ohm hook-ups to the new Finco-Axial 75 ohm color reception system.

List price for complete kit . . . 7512AB $8.95

7512-A Mast mounted matching transformer . . . list $5.40

7512-B TV Set mounted matching transformer . . . list $4.15

FINCO-AXIAL SHIELDED COLOR CABLE, CX Series

Highest quality, 75 ohm swept coaxial cable (RG 59/U) complete with Type F fittings, weather boot ready for installation.

Available in 25, 50, 75 and 100 foot lengths. List price . . . $5.55, $8.65, $11.50 and $14.20.

Write for Color Brochure # 20-349

For the best color TV picture

eliminates color-fade, ghosting and smearing!
Improves FM and Stereo, too!

QUICK, EASY INSTALLATION

ENJOY brilliant "TV-Studio" color reception today by changing over to the new Finco-Axial Color Reception System. NOW, color fade, ghosts and smears are a thing of the past. Finco-Axial shields color sets against signal loss . . . eliminates outside interference and mismatch problems.

THE FINNEY COMPANY 34 WEST INTERSTATE STREET, DEPT. 110, BEDFORD, OHIO

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Journeyman electrician calls shop for further instructions while enroute.

Mr. Newton, III, reports completion of job to the shop. He requests new assignments.

Miami Industrial Ups Efficiency

■ An industrial electrical contractor, I. E. Newton, Jr., of Miami, Fla., is a graduate electrical engineer with a crew of 14 journeymen electricians. His son, I. E. Newton, III, is a graduate of Georgia Tech and heads the company's power control panel division.

Mr. Newton remembers when Miami was a small sleepy resort city at the bottom of the Florida Peninsula. Today, it sprawls over hundreds of square miles, has a booming resort-industrial economy and supports a standing population of approximately 1¼ million people.

Some time ago his company decided to confine work to one segment of the market — industry. But let's allow him to tell the story. . . .

Makes Operations Flexible

"We made the discovery some time ago that we could improve total operating efficiency by at least 25 percent providing we could set up an effective communications system between the office and the men in the field. In new industrial work, no phones are nearby. When an electrician wanted to contact the office, he had to leave the job and often travel considerable distances before he could locate a public phone. Office direction was confined to those few periods during the day when the men would check in. Our operation became inflexible. A lot of wasted motion took place. Our problem was clear — either put on more men and trucks — or find some way to make our system more productive.

"We called in a local electronics distributor, checked out their equipment and then installed a 30w business two-way radio system. Believe me results have been

Mr. Newton, III, calls shop engineer regarding field problem. He orders necessary electrical materials to complete the job.

Electrical Contractor With Two-Way Radios

phenomenal! A powerful, clear signal puts me in the field with my men, instantly. Engineering and layout problems are solved on the spot; troubleshooters are routed from one job to the next without costly delays; material disbursements, procurement and delivery are now quick, easy and dependable.

"Our day to day use of two-way radio equipment is in orderly and efficient dispatching. Men call in immediately after completing a job and they are given new assignments and instructions. This includes description of local building codes and procedures to follow. At the end of each day's work, the men radio in and get assignments for the next day.

Speedy Action

"Our two-way equipment showed its effectiveness in a particularly significant manner last Aug. 9 when a local processing plant in Miami caught fire and exploded. One of our radio-operated patrol trucks was in the area and reported the incident. Specialists were immediately dispatched to the plant for possible salvage work and cooperative action with the local fire department. After investigation, we discovered that the entire electrical distribution room had been destroyed.

All circuits were out and remote controls, nonexistent. Radio was the only feasible means of communicating from the plant to the shop. Because of the speed with which we were able to attack the job, make necessary temporary repairs and eliminate hazards, we saved the company thousands of dollars and more than two weeks of operational time. All this could not have been accomplished without two-way radio communications service." *Photos: Courtesy Pearce-Simpson.* ■

NEWS OF THE INDUSTRY

Viking Introduces "Weatherama"

Viking Industries, Hoboken, N.J. is now manufacturing and accepting orders on their "Weatherama" that provides a 24 hours continuous television service of accurate time and weather information for community antenna television systems as well as closed circuit television systems in hotels, professional buildings, hospitals, transportation centers, television broadcasting stations and other locations where prevailing weather conditions and weather forecasting is of major importance.

The system consists of a television camera that focuses upon ten gages that report the date, time, rainfall, relative humidity, an automatic multiple slide projector, wind velocity, wind direction, barometric pressure, temperature and a weather forecast card slot that can also be used for limited live action telecasting.

Mark Products Transfer

Dynascan Corp., Chicago, Ill. announces transfer by the corporation of its Mark Products Div. to Edward F. Harris and related interests. The transfer is in exchange for the Harris interests' holdings of 230,000 shares of Dynascan common stock. Edward F. Harris and Joseph H. Fink will resign from the Dynascan Corp. board of directors.

The acquisition of the shares from the Harris interests will reduce the number of shares outstanding of Dynascan Corp. stock from 800,000 to 570,000.

E. F. Johnson Pays Dividend

E. F. Johnson Co., Waseca, Minn., paid a dividend of 15 cents a share on January 28, 1966, to shareholders of record on December 31, 1965.

E. F. Johnson, president of the two-way radio manufacturing company, said that although fourth quarter results are not yet final, earnings for 1965 appear to have exceeded 1964 by a good margin, and the outlook for 1966 continues to be favorable.

NAB Blackout Survey

A survey conducted for the National Assn. of Broadcasters among New York City area residents shows that three out of four persons interviewed were tuned in to radio during the Northeast power failure and that many felt radio's calm and cheerful reports averted panic. Most of those who listened to radio believed things would have been a lot worse without it.

The study was conceived by Howard Mandel, NAB vice president for research, and Sherril Taylor, NAB vice president for radio, to obtain first hand information about the role radio played when the lights went out, who was listening and for how long, and how people felt about radio's performance.

It was conducted under Mr. Mandel's supervision by Oxtoby-Smith and based on interviews with 494 residents — 284 women and 210 men — in Manhattan, the Bronx, Brooklyn, Westchester Queens and Nassau counties.

"The purpose of the NAB study was to assess, as precisely as possible, the true importance of radio's role in time of stress and emergency. The data we have obtained offers information that can not only help us who are involved directly in radio but the entire populace in dealing with similar emergencies," Mr. Taylor said.

Of those interviewed, 77 percent had listened to radio at some time during the blackout, mostly on their own battery-operated transistor radios.

Of those who listened, 28 percent were tuned in by 5:30 p.m. — shortly after the blackout began — and another 47 percent were listening by 6:00 p.m. Seventy percent listened for four hours or more and about three percent listened throughout the night.

Most of them felt things would have been a lot worse without radio. Many said they would have been frightened and panicky (29 percent) or concerned or worried (16 percent). Only five percent said the absence of radio would have made no difference to them.

Almost all of those who listened — 96 percent — felt that radio did a good job. Many of them — 42 percent — said radio gave them continuous, complete and immediate information, while 37 percent believed radio's calm and cheerful reports boosted morale and averted panic.

Of those who did *not* listen to radio, 89 percent said they would have liked to listen but were unable to do so. Most of them (62 percent) said they got reports on the blackout from people who were tuned in.

Columbia Wire Gets Patent

Columbia Wire and Supply Co. was issued patent number 3,219,752 recently by the U.S. Government Patent Office on a Durafoam VHF/UHF television transmission line. Under terms of the patent office protection, Columbia Wire and Supply is assured of exclusive manufacturing and marketing rights for the TV transmission line.

Raytheon Equipment for Boats

Raytheon marine electronic equipment has been ordered for 28 more patrol boats of Maryland's sea-going police force. Included in the order for more than $24,000 are three radars, four depth sounders, and 28 radiotelephones. The electronic aids will be installed by Carl Breland and Son of Solomons, Md. Type 1900A radars will be mounted aboard the patrol boats Talbot, Cecil and Fishing Bay, making a total of five boats radar-equipped. All boats are in the 40ft class and are used for law enforcement and search and rescue activities. The radars will give the patrol boats a detection range of 18 miles under any or all operating conditions.

The type DE718A fathometer depth sounders will be installed aboard four high speed, twin-screw vessels to aid in their own navigation and to help detect sunken vessels and objects to be investigated by the department's team of scuba divers.

The 28 RAY1055 marine radiotelephones will increase the effectiveness of the patrol fleet by making it possible for pleasure boatmen, fishermen and operators of commercial vessels to communicate directly with the marine police for emergency assistance.

The Maryland fleet was created in 1868 to protect Maryland's Chesapeake Bay oyster resources, the most productive beds in the nation.

Under the direction of Commander Roy Rafter, the Marine Police Div. of the Maryland Dept. of Chesapeake Affairs patrols 3190 miles of shoreline. The 112 marine policemen operate 42 large patrol boats of the inboard engine and cabin cruiser type, 45 shallow-draft outboard boats, a helicopter and 12 vehicles. They render emergency aid to some 1400 boatmen annually.

NEWS OF THE INDUSTRY

Sylvania To Fight CBS Patent Suit

Sylvania Electric Products states that it will fight a law suit filed against it by Columbia Broadcasting System, alleging infringement of two color television picture tube patents. Merle W. Kremer, senior vice president of the company's electronic components group, said "we have long believed that the key patent involved in the complaint (Patent No. 2,690,518, also known as the 'Fyler Patent') is invalid."

The company's reply will be "a complete and general denial" of the allegations, according to the officer.

Blonder-Tongue Tests Signal Strength

A fleet of Blonder-Tongue TV antenna research laboratory vehicles is currently cruising the country helping to test UHF signal strength with particular emphasis on new UHF stations, and aiding the firm's dealers in selecting reception equipment suitable for their areas.

Product manager Jerry Balash said one such test was completed in Birmingham, Ala., where the company representatives worked in cooperation with Channel 42.

Each lab on wheels is designed to demonstrate UHF/VHF/FM reception techniques and to test the signal strength of stations broadcasting in its vicinity.

Equipment on the vehicles consists of a 50ft antenna tower, a rotor and the company's complete amplifier and accessory line. The tower can be raised and lowered to duplicate reception conditions in any area.

P. R. Mallory and Co. Earnings

P. R. Mallory & Co. announces that 1965 sales exceeded $100 million for the first time and that earnings were at record levels, up 32 percent from the previous year.

G. Barron Mallory, president of the firm said sales for the 12 months ended last December 31 totalled $107,332,432, a 13 percent increase over the $95,025,568 of the previous year.

Mr. Mallory said 1965 earnings came to $6,227,991, or $3.23 per share, a $1,517,880 increase over the $4,710,111, or $2.45 per share of the previous year. He said the company's backlog at December 31 amounted to $23,167,000, a $9,518,000, or 70 percent increase over the same date a year earlier.

Transistor Radios in NY Offices

Portable transistor radios have become permanent desk accessories in many business offices in New York City according to a survey by Admiral Corp. Approximately 75 percent of business offices queried said that transistor radios were on someone's desk. Nearly 66 percent of the radios were there to stay, while the balance were taken home at night or on weekends. Fully 90 percent of the transistor radios were the personal property of employees, with the remaining 10 percent purchased by the firm.

Admiral's researchers also discovered that 58 percent of the portable radios had either been purchased or brought into the office following last November's power blackout.

No accurate measurement of the time the radios were played was possible, but all those interviewed said that they tuned in periodically to hear the latest developments in the January transit strike. The other major use for transistor radios appeared to be listening to astronaut launchings, other major news and the weather.

James C. Keefe Joins Stral

James C. Keefe, Jr. has joined the staff of Stral Advertising Co., 520 North Michigan Ave., Chicago, as account executive. His appointment is announced by Harold M. Stral, president of the agency.

Mr. Keefe comes to Stral Advertising from Maremont Corporation, where he was advertising supervisor. He had previously been regional advertising manager for Motor Age magazine, and advertising manager of the Automotive Division, Dayco Corp.

A graduate of Xavier University, Cincinnati, Ohio, Mr. Keefe resides in the Old Town area of Chicago.

Zenith Advertising Program

Zenith Sales Corp. has appropriated more than $4,000,000 for its first quarter, 1966, advertising program. The amount is 60 percent greater than that of the same period a year ago.

The program calls for a substantial step-up in local level newspaper advertising, continued use of advertising on all three major TV networks with week-after-week participations in full color on top-rated prime night-time shows and a powerful ad schedule in the nation's leading magazines.

Savannah CATV System Sold

The Savannah (Ga.) TV Cable Co. has been added to the growing list of CATV systems managed by American Cable Television, Inc., announces Donald R. Atwell, ACT president. The system, managed by John V. Burke of Savannah, brings nine channels into subscribers' homes along 50 miles of coaxial cable.

In making the announcement, Mr. Atwell said plans call for additional equipment to serve the entire city of Savannah. The purchase, by Bruce Merrill, chairman of the board, brings to 35 the number of systems managed by ACT.

CATV Now Under FCC Jurisdiction

The FCC has assumed regulation of the entire community antenna television industry (CATV). In asserting regulatory power over all 1600 or so systems the FCC extends rules which previously applied only to systems which were served by microwave.

While asserting this power, the FCC removed the 15 day before and after restriction on duplication of programing. That is, now the system operator must only delete the program of a distant station if the same program is being carried on the same day by a local station. If the local station does not carry the telecast in color and the distant station does, then the CATV operator need not blackout the program. The abolishment of the nonduplication rule frees the CATV industry of the regulation they most feared.

The FCC also moved for tighter control of CATV in the larger cities. FCC approval is now required for systems seeking to operate in the top 100 television markets. Hearings will be conducted to determine what effect the CATV system will have on existing TV stations.

NEW LITERATURE

Resistance Decades **300**

Literature describes a series of seven individual miniature boxes in resistance ranges of 0.1-0.9, 1-9, 10-90, 100-900, 1000-9000, 10-90K and 100-900K. One ohm step selection is accomplished by inserting a banana plug into the proper multiplier value marked by a front panel hole. Clarostat.

Chemicals **301**

Literature, form 112064, describes a line of service aids: plastic repair kits, cleaners, quick-freeze component coolers and other items. Rawn.

Plug-In Relays **302**

Bulletin 114 describes a line of plug-in relays for industrial control applications. Full specifications are included. Ward Leonard.

Digital Meter **303**

This 6-page brochure, form DMS-1065, describes the DMS3200 digital measuring system. It describes a precision electronic measuring instrument that displays readings in digital form instead of the difficult-to-read moving pointer meter display. The unit consists of a main frame and a number of accessory plug-ins which include dc and ac voltmeter, counter, frequency meter, ohmmeter, capacity and current meters, multimeter, ratio meter and others. Hickok.

Communications Switches **304**

A 12-page catalog describes 23 types of hermetically sealed coaxial switches, including complete mechanical and electrical specifications, photos and outline drawings. Also includes an ordering guide and details on voltages, RF connectors and power terminations. Electronic Specialty.

Switching Relays **305**

This data-sheet describes a line of five low-level switching relays for industrial and instrumentation applications. Includes slow and high-speed crystal-can types. Clare.

Industrial Capacitors **306**

A 53-page catalog lists a line of capacitors and resistors designed for industrial applications. Included are electrolytics, paper, film, metallized film, subminiatures, MIL types, ceramics and micas. Decade boxes, filters and resistors are also listed. Aerovox.

Test Instruments **307**

An 8-page booklet describes ac and dc current measuring instruments and an ac/dc voltmeter. Columbia.

Antenna Rotors **308**

An 8-page bulletin, 252-8P, tells what you need to know about antenna rotor systems. Oriented toward color, FM/stereo and UHF. Describes motor housings, motors, gears, bearings and hardware. CDE.

Tapes and Connectors **309**

A folder describes eight different specialized electrical tapes, a number of electrical connectors, splicing kits, insulating resins, sealers, splicing sleeves, cable clips and mounting plates. 3M.

Dynamic Microphones **310**

A line of dynamic microphones — low and high impedance — are described in this folder. Includes slim case styling, table-stand or lavaliers and learning-lab models. Sonotone.

Crystal Oscillators **311**

This 4-page folder describes a line of solid-state crystal oscillators ranging from 1Hz to 100MHz, oven and non-oven types. Gives complete specifications. Hill.

Every time Si Costa replaces a picture tube, he makes a friend.

Si can't afford to have people get sore at him. So when a picture tube goes on the blink, he plays it smart. He recommends and uses Philco Starbright 20/20. Si's found that Philco parts mean no costly callbacks. That's why he sticks with Philco parts almost all the way.

In fact, Si figures that it really doesn't pay to use anything less than Philco quality and dependability. Anything less only means extra trouble for his customer. Which could mean extra trouble for him.

And what's more, 99 times out of 100, when he needs a part, he finds it right at his Philco Distributor's. The hundredth time his part is shipped to him in 24 hours or less through Philco's Emergency Lifeline Service. That's some service.

Philco's Tech Data Service keeps Si up to the second on how to service Philco's new products. And he gets all the facts faster, fuller and at a lower cost than any other service.

Add to this a complete accident insurance plan for his men and himself, and you can see that Si Costa is a mighty happy man. You can be, too. Talk to your Philco Parts Distributor, or contact Parts & Service Department, Philco Corporation, Tioga & "C" Streets, Philadelphia, Pa. 19134

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NEW LITERATURE

ETV Antennas **312**
Catalog 1500 describes a line of ETV antennas for the 2.5 to 2.69GHz band. Includes regular parabolics, cylindrical parabolics and omnidirectional types. Also includes specifications. Taco.

Test Instruments **313**
A 16-page bulletin, No. 2072, lists and describes a broad line of test instruments for service-dealers and technicians working in TV-radio, Hi Fi, communications and industrial electronics service and maintenance. Information is also given on a number of accessories which are offered for use with the various types of test equipment. Simpson.

Alarm System **314**
How to protect a business against the hazards of vandalism and burglary is described in this 4-page folder. It describes an anti-intrusion alarm system now employed to protect numerous retail establishments, government installations, private homes and industrial and commercial facilities. It functions on an invisible radar pattern which, if invaded, sets off a powerful alarm. Pinkerton.

Screwdriver Sets **315**
This bulletin describes two types of drivers used on "scrulox" square recess screws. Xcelite.

Electronic Kits **316**
This 108 page catalog illustrates a line of electronic kits. Stereo components, amateur equipment, marine electronics, test and lab instruments, color TV and electronic organs are among the items contained in the catalog. Heath.

. . . OSCILLOSCOPE

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priced lab scopes use plug-in preamplifiers to achieve wideband sensitivity.

If you have any doubts about your scope in the area of wideband vertical amplifier response, you can check it with a relatively inexpensive squarewave generator. A forthcoming article will deal with this subject in greater detail.

Horizontal Amplifier Specifications

As we already know, our scope must also have a good horizontal sweep circuit. A linear time-base oscillator or generator, usually a relaxation-type, multivibrator or blocking oscillator saw-tooth generator, is used. We are faced here with a number of considerations not included in manufacturers specifications.

The horizontal time-base oscillator/amplifier and secondary circuits will be covered in the next article of this series. ■

VIDEO TAPE RECORDERS . . .

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heads (See Fig. 1) are being used in video tape recorders in the medium- and lower-priced areas.

Because fixed type heads presently appear to offer the greatest

possibilities for developing lower priced equipment, new techniques have been developed (by IIT and others) to increase the bandwidth by various methods, including two-, four-, and up to 10-track recording which will make it possible to reduce tape speeds to a relatively slow 120ips or less. Other methods, including electron-beam scanning with high speed switching are also being investigated. Other research efforts will no doubt be made to reduce tape speeds still further and obtain frequency responses ranging from 1 to 4MHz.

No one can accurately predict the year when video tape recorders will become another mass volume consumer item. Color TV lay practically dormant for years before it began to move significantly. Depending on many factors, the video tape recorder can begin to move within the next few years — or it can sleep like color TV for the next decade or longer. This does not appear likely, however, under normal national economic conditions and we propose that you keep an eye trained on developments. We plan to keep you informed as usual. ■

You and Color TV . . .

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It should be about —3v and in this case it measures less than —1v, telling us that the oscillator is not operating. Voltage and resistance measurements are then made to pinpoint the trouble.

Next, we remove the chroma information from the B-Y portion of the tube by disconnecting the lead from pin 7. All the blue information disappears from the screen. We again check the CRT grids with the scope and find that the red and green outputs are normal but there's no signal at the blue grid. A scope check of G3 of the B-Y section will reveal the absence of chroma information. The demodulator itself is not at fault. The scope can be used to trace the chroma signal and locate the source of trouble.

Opening the secondary of T2 results in all magenta colored bars with a normal background. Some ringing is visible in the background. The scope will reveal the absence of the burst pulses. The ground return of the crystal is also broken so the

oscillator is operating off frequency causing the previously mentioned condition.

If we open the primary of T2, the color sync is lost. Here again the absence of the burst signal at the secondary of T2 indicates the problem lies in some sync stage ahead of the demodulator.

Misalignment of the demodulator stage can also cause weak or complete loss of sync. If this is suspected, you should then realign the demodulator circuit completely.

Once again, some of the demodulator problems you may encounter will be: No color with a green background likely to be caused by a dead oscillator. A quick check of the oscillator injection voltage, which should be −3vdc, will tell you if the oscillator is operating properly. This problem could also be caused by the oscillator operating off frequency. Alignment should always be checked when the injection voltage varies too far from the −3v value.

Total absence of color is usually caused by a defective color amplifier stage prior to the demodulator. Tuner and IF problems could also cause total loss of color.

If all colors are present but you are unable to tune flesh tones, then check demodulator.

If you have color on the screen but not all colors are being reproduced, the chroma inputs to the demodulator tube should be checked with a scope and the dc voltages on the tube should also be checked. ■

'BEEPS' . . .

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Varying degrees of beep intensity are created by climatic conditions, clouds, ground moisture content or the radar can be operating on one of three different modes, giving various power densities. Knowing these variations can be of great help to technicians who receive calls to remove the beep from a receiver. By glancing at the density meter on the wall, the technician knows instantly if today is a good day to go out. If the radar signal is low, explain to the customer that it would be advisable to wait for better conditions and that the call will be

made when the signal is back to normal. Most customers will follow your advice and wait.

To make this emergency field strength meter, insert a pair of 1N54A diodes (any germanium diode with a high front-to-back ratio will do), mounted in reverse to polarize the transmission line. Add a 0.1μf capacitor across the line for filtering and time delay. Attenuation is through a pair of 100K 1/2w resistors. If mounted outside the shop, these small components should be weatherproofed. They can be mounted inside the shop but the shorter the line to the detection diodes and filter, the better.

The transmission line can be connected to VTVM or permanently installed to a microammeter and the radar beeps measured in voltage for day to day monitoring.

Since the radar scan rate is one revolution per 12sec, this frequency will energize the meter at the same frequency. If the meter reads 10 most of the time, then a lower reading indicates lowered power density for that period of time. Any other fluctuations are extraneous noise, not radar beeps. Rotating speed is not classified, but even so, it can quickly be determined by timing it with the second hand of a watch.

To determine points of radar radiation entry into an audio emplifier, disconnect all input lines — pull tubes, etc., until all traces of radar beep disappear. When removing covers from audio communications amplifiers, note how much the interference increases. The covers may later completely remove all traces of the beep.

Locating the first affected stages, *working from the input to speaker is a must.* (See Fig. 6.)

All choke-capacitors must be kept within ⅛in. of socket connections. Long lead-dress will defeat the purpose by becoming tiny radar antennas. This will make for tight work, but essential to the problem.

A 100 percent beep reduction is not necessary since normal volume levels in a home or audio system may drown out any trace of the beep. Church organs and electronic chimes are an example. Cases have arisen where the beep enters an electronic organ through the multiplier circuits during the striking of notes but when no music is being played the instrument remains in a fixed condition! The experts are waiting for someone to come up with an answer to this one. ■

ADVERTISERS INDEX

First UHF/VHF/FM 2-83 antenna that really works in fringe areas

New Winegard Chroma-Tel CT-100

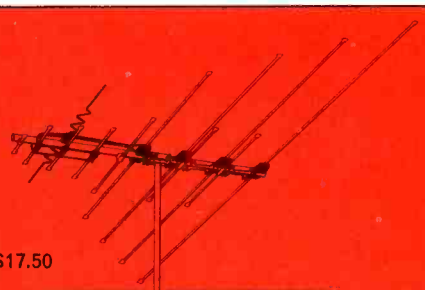
NEW! Model CT-100 $52.50

Wingard's sensational new CT-100 Chroma-Tel has 29 elements in all. And they're all working to provide the finest all-band reception (UHF-VHF-FM) even in difficult fringe areas.

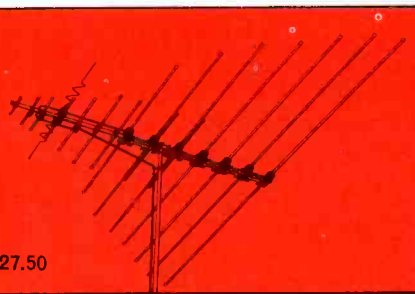
In addition to those 29 elements, the CT-100 incorporates a unique matching network that guarantees maximum signal transfer to the downlead—and on all channels 2-83 plus FM. Gives sharpest color and black & white reception.

And like all Chroma-Tels, it has Winegard's exclusive Chroma-Lens Director System (intermixes both VHF and UHF directors on the same linear plane without sacrificing performance) . . . and our Impedance Correlators (special phasing wires that automatically increase the impedance of Chroma-Tel's elements to 300 ohms).

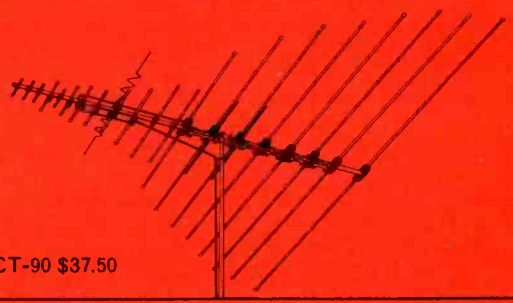
That's Winegard's new CT-100 Chroma-Tel. Bigger and better. But not too big. The full-line of Winegard Chroma-Tels still offers half the bulk; half the wind loading; half the truck space; and half the weight of all other all-band antennas—and at much lower prices. No wonder Winegard Chroma-Tels (now 4 models) are the hottest performing, hottest selling all-band antennas on the market! Better call your Winegard distributor or write for Chroma-Tel Fact Finder 242.



Model CT-40 $17.50



Model CT-80 $27.50



Model CT-90 $37.50

FREE!

Every Winegard Chroma-Tel, including the new CT-100, comes complete with free CS-283 UHF-VHF Signal Splitter. Hangs behind set and separates UHF and VHF signals coming from antenna to the two pairs of set terminals.

Winegard ANTENNA SYSTEMS Winegard Co. • 3000 Kirkwood • Burlington, Iowa 52602

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RCA all-new, rare-earth Hi-Lite Color Picture Tubes are being stocked by smart dealers who are ready for the replacement color picture tube business.

why?

Hi-Lite's rare-earth phosphors provide picture brightness unsurpassed in the color TV industry. Natural color reproduction. Great black-and-white pictures, too! **RCA's Hi-Lite Color Picture Tube Line is here. Now! Available in 19-inch and 25-inch rectangulars and 21-inch round tube types.**

What about you? Are you ready for color?

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

RCA **The Most Trusted Name in Electronics**