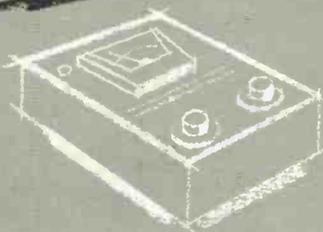
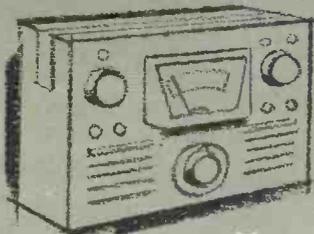
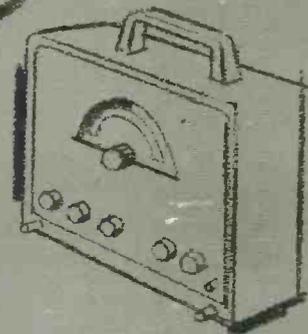
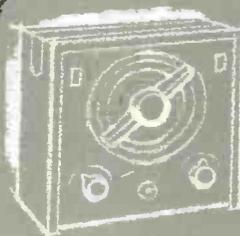
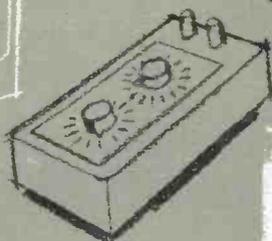
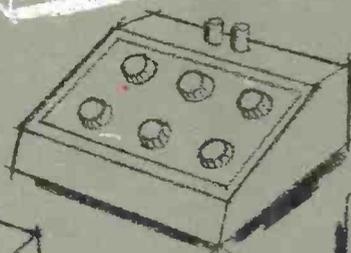
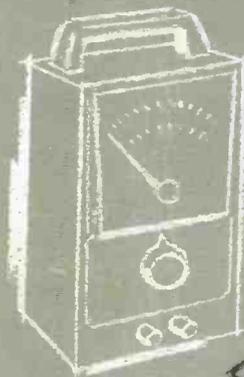
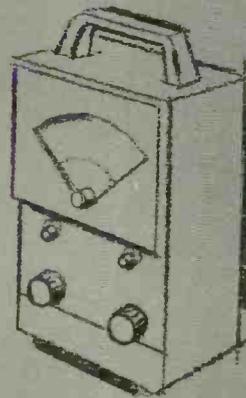
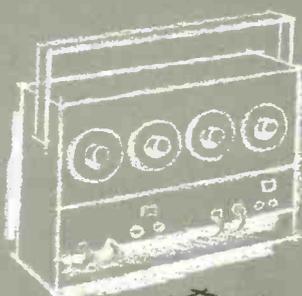
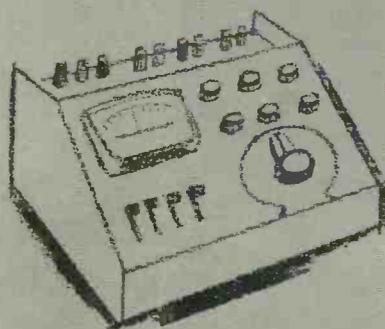


# ELECTRONIC TECHNICIAN



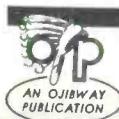
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**THE VTVM**  
**A VALUABLE TOOL**

---

**TEST EQUIPMENT**  
**REQUIREMENTS**

**SMALL INSTRUMENT**  
**ROUNDUP**



JUNE 1963

# SENCORE

## SIMPLIFIES COLOR SERVICING

### NEW! CA122

### COLOR CIRCUIT ANALYZER

A simple approach to a complex problem

Here is an instrument that is designed to eliminate the guesswork in color TV servicing. A complete analyzer that provides all required test patterns and signals for testing from the tuner to the tri-color tube. Additional analyzing signals for injection at each stage including audio, video and sync, brings to life a truly portable and practical TV analyzer for on the spot service; virtually obsoleting other analyzers with the advent of color. Sencore's simplified approach requires no knowledge of I, Q, R-Y, B-Y, G-Y or other hard to remember formulas. The CA122 generates every signal normally received from the TV station plus convergence and color test patterns.

The CA122 offers more for less money:

**TEN STANDARD COLOR BARS:** The type and phase that is fast becoming the standard of the industry. Crystal controlled keyed bars, (RCA type) as explained in most service literature, offer a complete gamut of colors for every color circuit test.

**WHITE DOTS:** New stabilized dots, a must for convergence, are created by new Sencore counting circuits.

**CROSS HATCH PATTERN:** A basic requirement for fast CRT convergence.

**VERTICAL AND HORIZONTAL BARS:** An added feature to speed up convergence, not found on many other color generators.

**SHADING BARS:** Determines the ability of the video amplifier to produce shades (Y Signal) and to make color temperature adjustments. An important feature missing on other generators.

**COLOR GUN INTERRUPTOR:** For fast purity and convergence checks without upsetting color controls. Insures proper operation of tri-color guns, preventing wasted time in trouble shooting circuits when CRT is at fault.



A must for color . . .

a money maker for black and white TV servicing

**ANALYZING SIGNALS:** RF and IF signals modulated with any of the above patterns for injection into grid circuits from antenna to detector. IF attenuator is pre-set for minimum signal for each IF stage to produce pattern on CR<sup>2</sup> thus providing a check on individual stage gain. Sync and video, plus or minus from 0 to 30 volts peak to peak, have separate peak to peak calibrated controls for quick checks on all video and sync circuits. Crystal controlled 4.5 mc and 900 cycles audio simplify trouble shooting of audio circuits.

**NEW ILLUMINATED PATTERN INDICATOR:** A Sencore first, offering a rotating color film that exhibits the actual color patterns as they appear on color TV receivers. Locks in with pattern selector control.

You'll pay more for other color generators only.

Dealer Net. . . . . 187.50

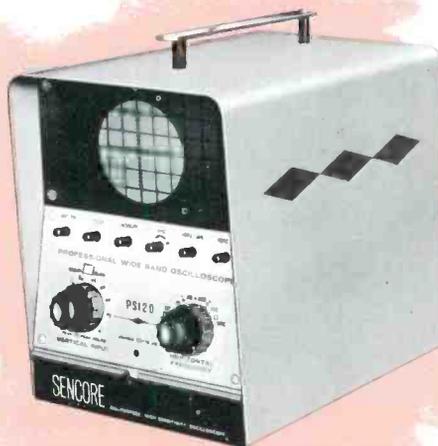
### NEW! PS120 PROFESSIONAL WIDE BAND OSCILLOSCOPE

A portable wide band 3 inch oscilloscope for fast, on-the-spot testing. An all new simplified design brings new meaning to the word portability . . . it's as easy to operate and carry as a VTVM. Though compact in size, the PS120 is powerful in performance: Vertical amplifier frequency response of 4 MC flat, only 3 DB down at 7.5 MC and usable to 12 MC, equips the technician for every color servicing job and the engineer with a scope for field and production line testing. AC coupled, with a low frequency response of 20 cycles insure accurate low frequency measurements without vertical bounce. Sensitivity single band vertical amplifier; sensitivity of .035 volts RMS for one inch deflection saves band switching and guessing. Horizontal sweep frequency range of 15 cycles to 150 KC and sync range from 15 cycles to 8 MC (usable to 12 MC) results in positive "locking" on all signals. New exclusive Sencore features are direct reading peak-to-peak volts —no interpretation; dual controls to simplify tuning; lead compartment to conceal test leads, jacks and seldom used switches. Rear tilt adjustment angles scope "just right" for easy viewing on bench or production line.

Size: 7" w x 9" h x 11 1/4" d. Weight: 12 lbs.

Dealer Net. . . . . 124.50  
(with low cap. probe)

Kit. . . . . 74.50



A must for servicing color TV in the home . . . lowest priced broad band scope. All hand wired — all American made

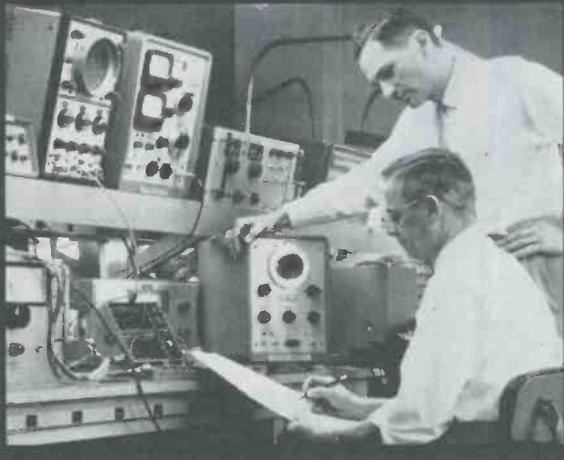
SENCORE, ADDISON, ILLINOIS

... for more details circle 35 on post card

from **JERROLD**,  
the world leader in master-antenna systems



... a revolution in  
TV/FM distribution systems—  
**ALL NEW FROM  
ANTENNA TO OUTLET!**



Always the innovator, always the source of improvements in master-antenna technology, JERROLD now goes another giant step ahead with this radically new signal-distribution system equipment tailored to your motel, hotel, and apartment-house market.

Here, for the first time, is an antenna designed specifically for a master-antenna system—the new "J"-series extra-heavy-duty Jerrold-TACO cut-to-channel yagis. Built to last as long as the system, these new, rugged high-gain antennas feed a selection of four exciting new high-output broadband amplifiers with

per-channel outputs (for 7 channels) of 0.2 to 1 volt at 0.5% cross modulation.

We've even given a new look to the individual room outlets, and the result is the beautiful yet durable and versatile Ultra-Tap, which delivers TV and FM signals through Jerrold's new 300-ohm or 75-ohm plug-in connectors.

In short, everything—from antenna to outlet—has been designed as a *system* to help you sell your share of the booming TV and FM market in motels, hotels, hospitals, and multiple dwellings. See your Jerrold distributor for full details.



A subsidiary of THE JERROLD CORPORATION

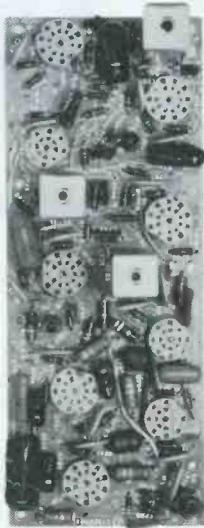
Distributor Sales Division, Philadelphia 32, Pa.

*Every RCA Victor New Vista® TV uses  
Space Age Sealed Circuitry...Circuits  
that are dependable and...*

# easy to service



Old-fashioned all hand-wired Circuitry



Precision Crafted RCA  
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Let your own TV  
service records  
prove the   
dependability  
of RCA Victor  
New Vista® TV

SEE WALT DISNEY'S "WONDERFUL WORLD OF COLOR!" SUNDAYS, NBC-TV NETWORK



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ELECTRONIC TECHNICIAN

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ELECTRONIC TRADE  
CIRCULATION**

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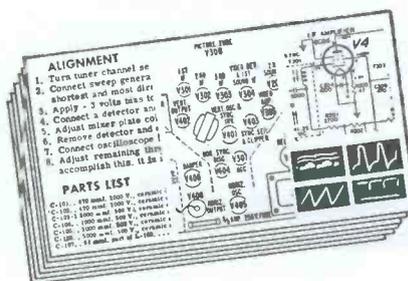


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**TEKFAX.....16 PAGES OF LATEST SCHEMATICS**



**AIRLINE: Radio Chassis Model GEN1731A**

**EMERSON: Stereo Radio-Phonograph Model P-1913**

**GENERAL ELECTRIC: TV Chassis MXT**

**RCA: TV Chassis KCS147 A & B**

**TRUETONE: TV Chassis 1096-243**

**WESTINGHOUSE: Radio Chassis V-2407-4**

# Harman-Kardon Shatters Old Concepts of Economy-Class Public Address Amplifiers!



COMMANDER CA-12



COMMANDER CA-23



COMMANDER CA-35



COMMANDER CA-65  
with extra mic pre-amp installed



COMMANDER CA-100  
with extra mic channels and  
area selector switch assembly

## New performance and versatility standards with the "CA" SERIES COMMANDER

*Unprecedented!* 5 New Commanders . . . every one with **CERTIFIED POWER RATING!** Now you can plan a job accurately, get the results you expect!

*Versatile!* Inputs for High and Low Impedance Mics—with on-chassis socket for plug-in mic matching transformer! Every quality or cable length requirement is now satisfied!

*Expandable!* Add Mic Channels as Needed! Space provided on medium and high power models for two additional mic channels. Up to four mic inputs now possible.

*Fidelity!* Socket for an optional plug-in mag phono-tape head preamp with genuine built-in RIAA and NARTB equalization. Works in aux channel; avoids loss of a mic input.

*Adaptability!* Every Commander can be set up for precedence operation, essential for background music systems, special and emergency announcements, etc. CA-12 has MIX-MUSIC-PAGE switch; all others function automatically.

*Flexible!* Optional area speaker selector assembly installs in CA-35/65/100 to provide selective paging and musicasting to any or all of 8 areas.

*It's impossible . . . to add here the numerous other MAJOR features of this remarkable new economy class public address line. But, a big new free catalog tells you the whole story about Commander and provides valuable, revealing information about public address amplifiers generally . . . Send for it.*

HK-108

Harman-Kardon, Inc. Desk G-6  
Commercial Sound Div.  
55 Ames Court, Plainview, L.I., N.Y.

Rush me the new p/a catalog that tells me the things I need to know about public address amplifiers.

Name \_\_\_\_\_

Address \_\_\_\_\_

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

**harman kardon**

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## LETTERS

TO THE EDITOR

### ET: Entertaining

Editor, ELECTRONIC TECHNICIAN:  
Electronic Technician is tops. I enjoy every issue.

O. DALE BURDGE  
Franklin, Ohio

### Tonecrest?

Please advise us as to who is distributor of "Tonecrest" Stereophonic equipment.

ODLE RADIO & ELECTRIC  
Yorwood, Colo.

● *Can anyone help?*—Ed.

### Big Order

I'd like to learn about all transistor 1963 car radios including also AM-FM car radios.

ROBERT NENDZE

● *TEKFAQ (Formerly Circuit Digest) has printed several schematics on these units. Watch for another article on their repair this summer.*—Ed.

### Association News

Last month I sent you an association press release. I expected to see it in the next issue. Since there was no association column in that issue, will you please inform me about this matter?

MAX LEIBROWITZ  
Astoria, N. Y.

● *The Association News column has been discontinued. Items of interest, however, may be found in News of the Industry column.*—Ed.

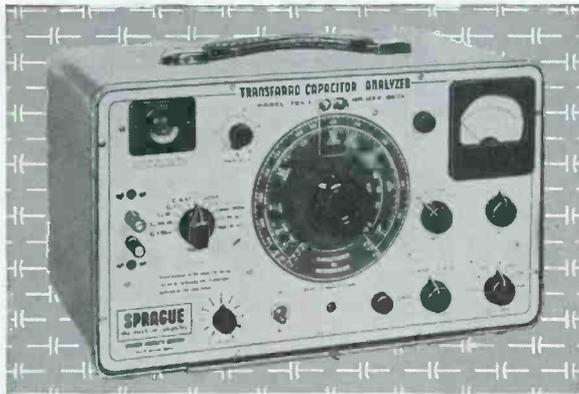
### Best

. . . I read ELECTRONIC TECHNICIAN every month and thoroughly enjoy it. I wouldn't be without your magazine.

MICHAEL E. FRANZEN  
Cornell, Wis.

### Too Much

. . . I cannot see why your magazine is so highly priced. A competitor of yours has a selling price of 35c. I should think that you would offer cheaper rates at about this time of year. Your competitor



The Sprague TCA-1 is specifically designed to safely test capacitors such as tantalum capacitors, low-leakage aluminum electrolytic miniatures, low voltage ceramics and low voltage paper and film capacitors used in transistor and other low voltage circuits. No industrial laboratory or modern electronic service shop can afford to be without one!

**MODEL TCA-1 TRANSFARAD 115 VAC/60 cy \$197.50 net**

**MODEL TCA-1RM FOR RACK MOUNTING**

Electrically identical with the standard instrument Model TCA-1RM has a standard 19" w. x 10½" h. panel so that it can be mounted in the conventional relay rack.

**MODEL TCA-1RM ..... \$207.50 net**

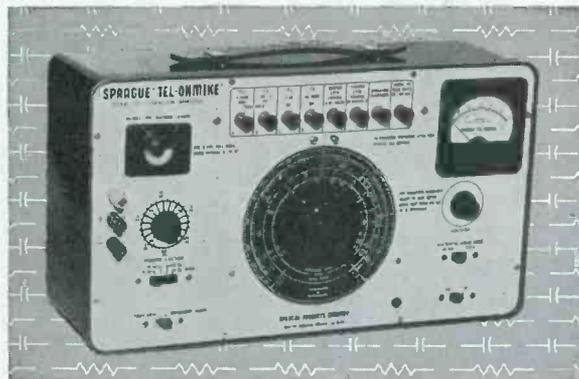
\*Trademark

**TCA-1 TRANSFARAD\***

**THE FIRST ANALYZER SPECIFICALLY DESIGNED TO SAFELY TEST TRANSISTOR CIRCUIT CAPACITORS**

- **CAPACITANCE BRIDGE** measures 1μF to 2000μF in five overlapping ranges. Only 0.5 volt is applied to the bridge from a continuously adjustable power supply. The voltage across the capacitor is less than this applied voltage, the amplitude depending on the capacitance being measured. No possibility of overheating or deforming any low voltage capacitor during measurements.
- **INSULATION RESISTANCE** directly read from 50 megohms to 20,000 megohms. Only 25v d-c is applied, permitting measurements on low voltage ceramic, mica, and film capacitors. IR of ceramics rated below 25v may be calculated from leakage current measurements at exact rated voltage.
- **LEAKAGE CURRENT** measured directly on meter at exact rated d-c voltage of capacitor. Sensitive circuit makes full scale measurements from 0.6 μa to 600μa in seven ranges.
- **POWER FACTOR** measured by Wien bridge from 0 to 50 per cent.
- **MAGIC EYE** null detector in high-gain amplifier has sensitivity control permitting accurate measurement of small capacitors.
- **SHORT-TIME STABILITY** is assured by dual regulation of the power supply. Specially processed etched circuits and complete encapsulation of the critical bridge-null amplifier insure long-time stability.
- **BINDING POSTS** are shielded against strays, assuring greater accuracy during low capacitance measurements.
- **FOR SAFETY** the capacitor under test is automatically discharged after testing. Three wire line cord grounds instrument case.
- **OPERATING PROCEDURES** are clearly shown on convenient pull-out slide.

**TO-5 TEL-OHMIKE® CAPACITOR ANALYZER**



The TO-5 TEL-OHMIKE capacitor analyzer is a must for checking all capacitors except special low voltage transistor types. The TO-5 is a moderately priced instrument with laboratory quality and accuracy—the highest accuracy of any instrument of its type available to the service trade!

**MODEL TO-5RM FOR RACK MOUNTING**

Electrically identical with the standard instrument, Model TO-5RM has a standard 19" wide x 10½" high panel so that it can be mounted in standard relay racks.

**Model TO-5RM.....\$102.50**



- **CAPACITANCE BRIDGE** measures up to 2000 mf in five overlapping ranges. The special 1 mmf to 100 mmf range is exclusive with the Tel-Ohmike.
- **INSULATION RESISTANCE** directly read on large meter up to 20,000 megohms for papers, ceramics, and micas. No guessing with neon lamps.
- **LEAKAGE CURRENT** of electrolytics measured directly on meter, with exact rated voltage up to 600v. applied from continuously adjustable power supply. Two ranges: 0-6-60 ma. No guessing on eye-width or counting lamp blinks!
- **POWER FACTOR** of electrolytics measured by Wien Bridge up to 55% in three ranges.
- **TURNS RATIO SCALE** to measure turns ratio of power and audio transformers.
- **MAGIC-EYE TUBE** simplifies bridge balancing for capacitance and power factor measurements.
- **PUSH-BUTTONS** for instant range selection, also discharge capacitors for safety upon release.
- **MODERN CASE** finished in two-tone gray; measures 8 7/8" high, 14 5/8" wide, 6 1/8" deep. Weight only 12 1/2 pounds.

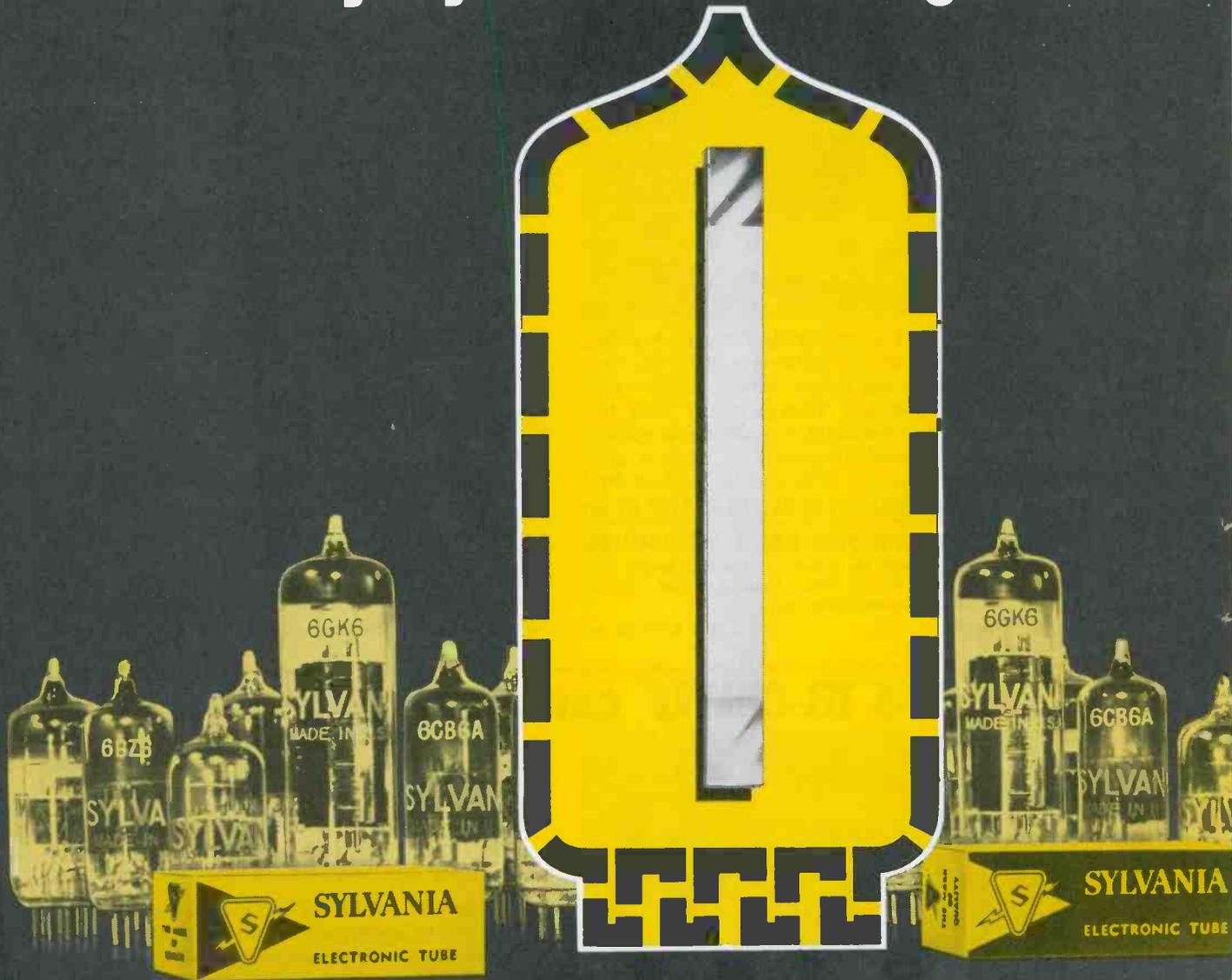
**MODEL TO-5.....115 VAC/50-60 cy.....\$92.50 net**

**Model TO-5X.....115-230 V/25-60 cy..... 98.75 net**

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# Only Sylvania receiving tubes



## LIFE-BOOST\* CATHODE...a big bonus in tube quality

Sylvania's exclusive LIFE-BOOST Cathode is putting new life into tubes — and sales. This latest evidence of Sylvania leadership in tube technology offers benefits you can really sell: it virtually eliminates performance slump, a major cause of profit-stealing callbacks. Besides stability, it produces significantly better tube life and uniformity. 90 types already have LIFE-BOOST, with more on the way...and it's being heavily promoted in national magazines and by mail. \*Trademark

New edition of Sylvania Technical Manual. Valuable 632-page dealer reference lists data on over 2,000 tube types, is fully indexed and tabbed for quick reference. Free supplementary data service to keep your manual current. Price \$3.00 through your Sylvania Distributor.



# give you these 2 big bonuses:



## S&H GREEN STAMPS...with the Service 'n Save Plan

Here's another big reason to go with Sylvania. S&H Green Stamps, exclusive with participating Sylvania Distributors, are given free to dealers with the purchase of Sylvania receiving tubes. They add up fast, especially when they're combined with stamps from the grocer and other merchants who give S&H Green Stamps. And the family can select gifts from a 144-page S&H Catalog full of everything from home furnishings to furs.

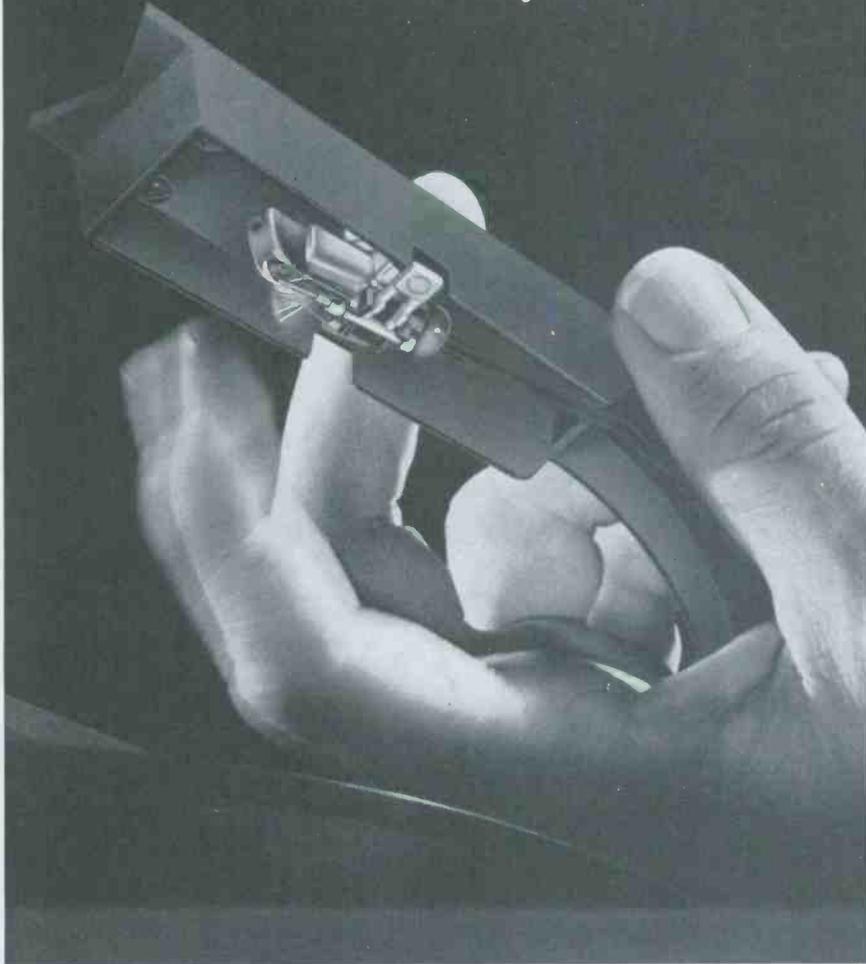
GO WITH SYLVANIA—TO PROFIT!

# SYLVANIA

SUBSIDIARY OF  
**GENERAL TELEPHONE & ELECTRONICS**



## New Sonotone Sono-Flex® Stylus



**try this with any other cartridge**  
(at your own risk)

No way to treat a cartridge, for sure—That is, any cartridge except the Sonotone models featuring the new Sono-Flex® needle. No more bent or broken needle shanks caused by flicking off some lint, dropping the arm, or scraping it across the record.

The newly developed Sonotone Sono-Flex® needle to the rescue! Gripped in a resilient butyl rubber mount, you can flex this needle shank in a 360-degree orbit without breaking. Pluck it—flick it—bend it—bump it—it will continue to perform as good as new.

Moreover, the Sono-Flex brings advantages in performance never before offered by any replacement cartridge: Higher compliance, wider and flatter frequency response, lower IM distortion, and longer needle and record life.

### Sonotone Sono-Flex® increases your profits two ways

Sonotone cartridges are better than ever, easier to sell, because they're better performers. Further, you eliminate callbacks because of broken needle shanks. Sono-Flex needles are standard right now in these Sonotone cartridges models: 9TAF, 16TAF, 916TAF and the Velocitone Mark III.

Sono-Flex opens up lucrative needle replacement business for upgrading these Sonotone cartridges models: 9T, 9TA, 9TV, 9TAV, 16T, 16TA, 16TAF and 916TA, original equipment in over a million phonographs. Replacement is fast, simple—requires no tools—assembly snaps into position easily, and gives immediate proof of better performance plus abuse-proof, longer needle life.

See your distributor today and ask for Sonotone cartridges with the Sono-Flex® needle.

**SONOTONE CORPORATION** Electronic Applications Division Elmsford, New York  
In Canada: Atlas Radio Corp., Ltd., Toronto • cartridges • speakers • batteries  
• microphones • electron tubes • tape heads • hearing aids • headphones

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## LETTERS

### TO THE EDITOR

does at times. Why is yours 60¢?  
JOHN L. KARG

Canonsburg, Pa.

● Our "competitor" is in a better position to know what its magazine is worth. We do not sell at reduced rates.—Ed.

### Love

. . . I extended my subscription for another 3 years today. I noticed Tekfax which is supreme — handy tear away sheets and easy filing plus beautiful schematics. I sometimes wonder how far man's imagination runs to create new things. Your editorial was food for thought and very good.

GEORGE C. TUSINA  
Lackawanna, N. Y.

### Needs Chart

We have a "do it yourself" tube tester made by American Scientific Development Co., Ft. Atkinson, Wisc. We would like to modernize it with new charts; our letter to them was returned — "not in business." Can you tell us who bought this company or where we can get a tube chart?

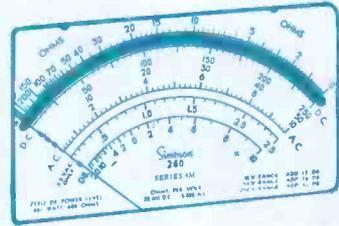
N. H. BOE  
Dubuque, Iowa

### Permanent Solution

I have just read an item in your "Tough Dog Corner" on "Horizontal Tube Causes Vertical Failure." This is a rather common failure on Sylvania's 1-542-3 chassis. However, Mr. Lingbech will have to keep on replacing 12DQ6 tubes unless the connection on terminal 3 of the horizontal tube socket is not moved to another terminal. Terminal 3 on this socket is used as an anchor for one of the filament supports of the tube. It is this ac filament voltage leaking across filament insulation inside the tube that causes the trouble. So in most cases, all 12DQ6 tubes will in time start doing the same thing. Change the connection from pin 3 to 1.

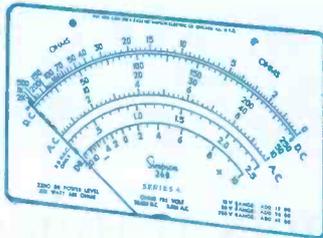
WM. E. MILLER  
Sunbury, Pa.

now  
there  
are



\*WITH MIRROR SCALE  
Series 4M  
**\$50.95**

# 2 new 260<sup>®</sup> VOMs



WITH STANDARD 260  
SCALE Series 4... Still Only  
**\$48.95**



## with 6 new features

Now the world-famous 260<sup>®</sup> volt-ohm-milliammeter is a better buy than ever before. Call your distributor now for immediate delivery on either of these two new 260's, or on any of the other 50 Simpson testers—the world's largest selection.

- New Self-Shielded Movement
- New Higher Accuracy: 2% DC, 3% AC
- New Ruggedness From Spring-Backed Jewels
- Greater Repeatability
- Increased Linearity and Stability
- \*Mirror Scale (260, Series 4M)

S I M P S O N   I N S T R U M E N T S   S T A Y   A C C U R A T E

Both new 260's can be used with Simpson's popular "Add-A-Tester" adapters. Write for Revised Stock Catalog 2064A.

**SIMPSON ELECTRIC COMPANY** 5208 West Kinzle Street, Chicago 44, Ill.

Representatives in Principal Cities ... See Telephone Yellow Pages

# Simpson

Phone: (312) ESTebrook 9-1121  
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London, Ontario

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## This straight shooter never gets trapped

**G-E "SG" straight gun picture tubes\* do away with ion traps.** No fuss, no call-backs. A G-E "SG's" rugged gun fires electrons with uncanny precision straight at the aluminized phosphor screen—assuring sharply resolved pictures up to 80% brighter. How's that for "Accent on Value"? These features save your time and give your customers thousands of hours of viewing pleasure.

And that's not all the value accents you get with these "straight shooters." A single G-E "SG" picture tube replaces as many as twenty other types, bent gun or straight gun—the types that get "trapped." In fact, with only 25 G-E "SG's", you're ready to replace 250 other picture tube types. You'll serve customers faster—and say *good-bye* to emergency pick-ups and the ion trap nuisance.

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ing is necessary in order to insure a minimum of harmonic distortion. Because of this matching, both transistors in the push-pull stage must be replaced in the event of failure. These transistors will be supplied by Magnavox only in matched pairs for replacement.

The power transistors dissipate a considerable amount of heat which must be carried off in order to prevent damage to them. The collector of the power transistor is connected to the metal case and the case is mounted to the chassis by means of an electrical insulator so that the collector is not grounded. A very thin mica insulating washer is mounted between the transistor case and the chassis and a layer of silicone grease (Dow Corning DC4) is applied to both sides of the washer. This silicone grease helps to carry off the heat from the case to the chassis. When the power transistors are replaced, this mica washer must be re-installed and a new layer of silicone grease must be applied to both sides of the washer.

## PACKARD BELL

### Color TV Chassis 98C6 — Loss of Video and Sync

In several sets capacitor C-313, 560 pf broke down and shorted out. This capacitor is in the plate circuit of the third picture IF ( $\frac{1}{2}$ 6AW8). Shorting resulted in loss of video and sync. The 470 ohm resistor R-317 burned out and in some cases resistor R-148, 5600 omhs, 5 w, also had to be replaced.

## PHILCO

### Model RC-21 Remote Control — Correcting Channel Changing at Turn-on

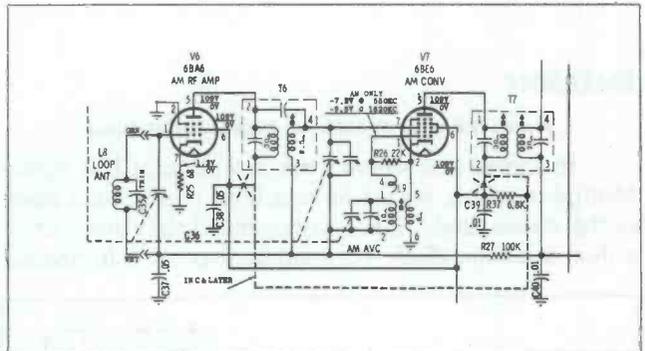
Some RC-21 remote control units change channels when the set is turned on and must be recycled to the correct channel. If this problem is encountered, R7, located across relay K1 should be changed from a 15 K to a 10 K resistor. This modification may also be

accomplished by shunting R7 with a 27 K resistor. The range of the unit will be somewhat reduced when this modification is installed.

## MOTOROLA

### Stereo Model H5997C — Production Changes

To reduce the possibility of distortion when tuned to a strong AM signal, R 37 (6.8 K, 1 w resistor)

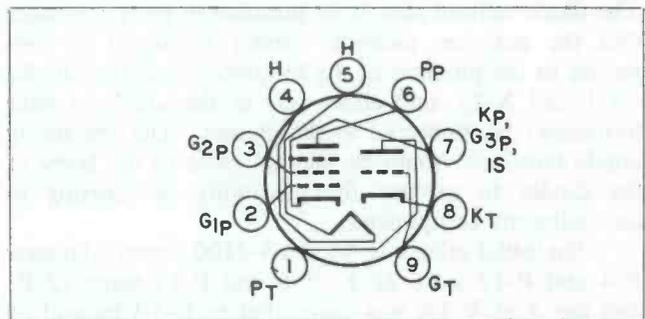


should be added and RF and converter stages rewired as shown in the accompanying diagram.

## RCA

### New Tubes — 5KE8 and 6KE8

Two new RCA tubes, the 5KE8 and 6KE8, will primarily be used for converters in new TVs. Both tubes utilize the "dark heater" and have controlled



11 sec. warm up times. The base diagram is shown in the accompanying drawing.

Continued on page 79

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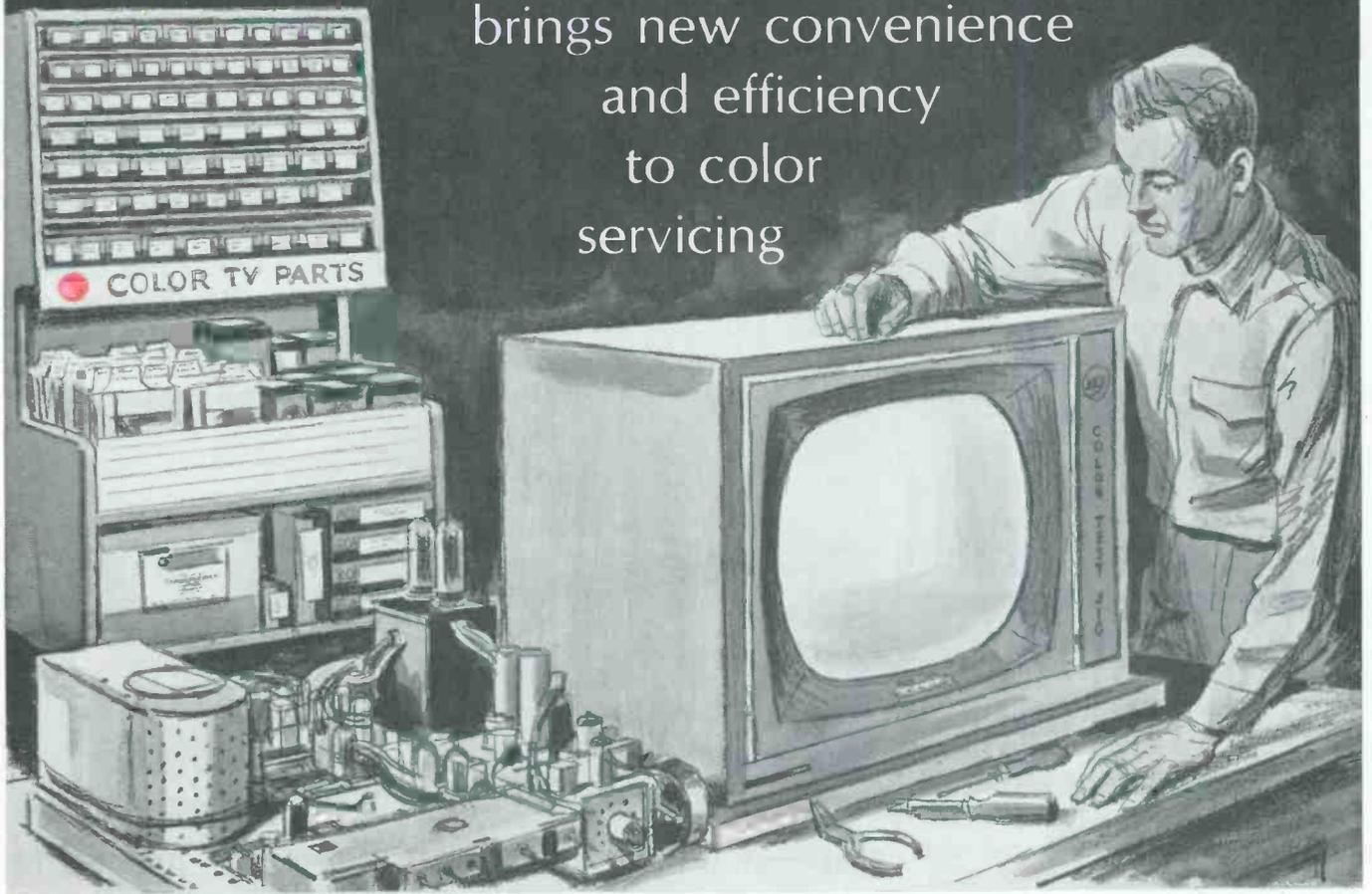
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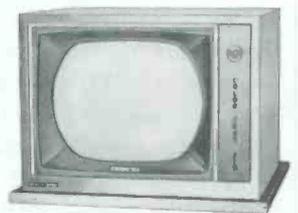
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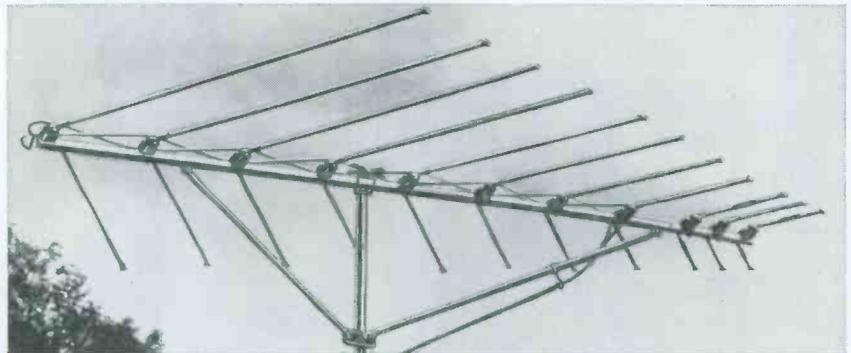
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## EDITOR'S VIEWPOINT



# Is the Distributor Running Your Business?

Would you let your competitors tell you what kind of parts to buy? Would you listen to a non-technical person extoll the virtues of a new rectifier? I hope not!

But that is exactly what some of you do each time you visit your jobber. Many of you, I'm sure, ask for components and tools by brand name. And the chances are pretty good that the last time you were at the jobber's counter a substitute was placed before you with the words "This is new — a lot better than the other." Or "We sell an awful lot of these things — best item we've got."

Many countermen are in a position to judge certain aspects of a component's quality. Returns and technician comments for example.

There are other reasons, however, why you get this treatment so frequently. Of course few distributors can profitably stock every brand that technicians want. But it doesn't end there. Let's look at a few of your distributor's motives and you judge if you want to continue to take this basically non-technical man's opinion on technical matters.

*Profit.* The biggest single income item on your books is probably service. Parts profit is important, but with that alone you couldn't exist. Your biggest problem with parts is reliability. The distributor, on the other hand, sells only parts. He must make as wide a profit margin as possible to be successful. To be competitive he may buy another less expensive line. This line may be as good, and again, it may not.

*Manufacturer exclusives.* Some manufacturers offer their lines to one distributor exclusively in a given area. Your jobber should be willing to tell you if this is the case.

*Poor delivery.* Some jobbers have tried a line and then abandoned it because of poor delivery schedules. Inability to get needed components rapidly can cause good customers to seek a new supplier.

*Sold down the drain.* One of the biggest factors for most jobbers when selecting a line is the sales pitch from manufacturers. This sales pitch is often a valid one — showing quality as well as mark up.

*Satisfied Customers.* Most distributors place heavy emphasis on this aspect. If you are continually given misinformation about various products, there's a good chance you will soon change suppliers. In most cases, the distributor is not trying to give you low-grade components.

In the final analysis, however, you are the most qualified to select the proper components. You know the ease with which a part may be installed, for instance; you have a general understanding of part specifications; you may have past experience to judge from; and you know what kind of customers you're dealing with.

Tough competition between component manufacturers generates continual improvements. Improvements to make their products more reliable and more attractive to you and your customers. Be aware of these improvements and how the manufacturer is helping you with your customers.

Specifications and information on particular products are offered by manufacturers with no strings attached. Read available manufacturers' information, advertisements, and, if necessary, write them for more or specific information.

The next time your counterman offers you something new or different, think about the consequences to you and your customer before you accept it. Weigh the counterman's remarks and then decide. It may only be a matter of principle, but that is one of the most important attributes you can have. Exercise it.

Remember I don't mean only the dollar and ten dollar items; nut and bolt type items are important too.

And not least, don't be afraid to change your mind once you've decided. What is best for you this month may be replaced next month by something far better.

Vic Beale

# Simplified TV Waveform Analysis

You can analyze waveform harmonic frequencies and relative voltages with 'in-your-head' arithmetic

by Bob Middleton

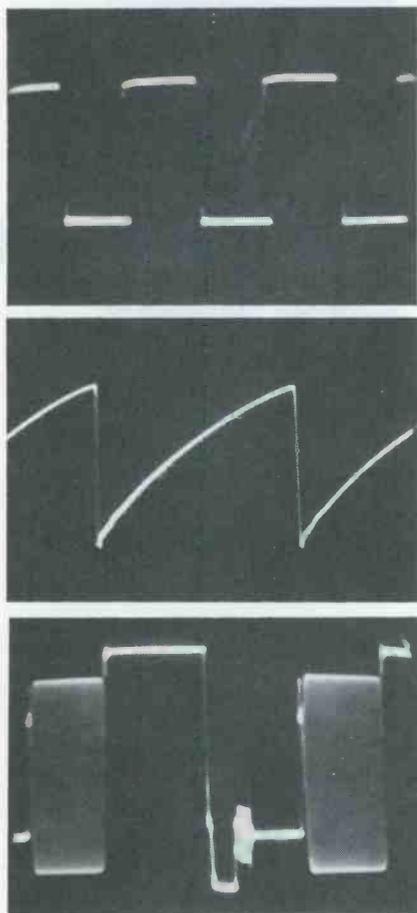


Fig. 1 — Some typical nonsinusoidal waveforms.

■ A nonsinusoidal waveform, as we know, is composed of a sinewave fundamental and a number of harmonics. And the highest harmonic in a waveform is determined by a TV receiver's bandpass circuit. Thus, if a video amplifier has a passband of 4 Mc, no harmonics be-

yond this frequency appear in the output waveforms. Some typical nonsinusoidal waveforms are shown in Fig. 1.

## Scope Shows Harmonics

A scope, with a simple absorption-type wavemeter or calibrated "wave trap" (Fig. 2), can be used to check a waveform for harmonic frequencies. If we apply a square or rectangular-type wave from a receiver circuit to the scope, the pattern will "ring," as shown in Fig. 3B and Fig. 4.

We will recall that a low-Q wavemeter causes ringing patterns at all frequencies and a high-Q wavemeter provides ringing patterns only at the harmonic frequencies contained in the waveform. For our pur-

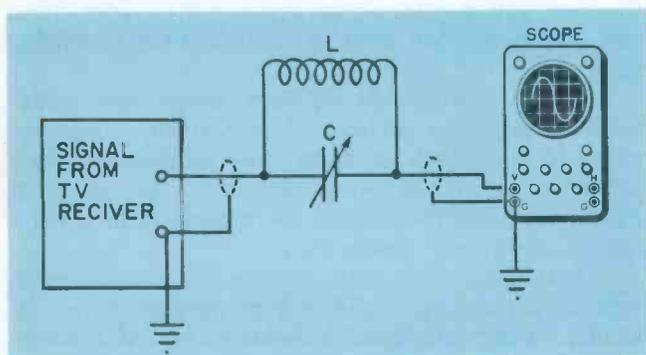


Fig. 2 — A hookup using a simple wavemeter or calibrated trap circuit will reveal harmonics of a complex waveform on the scope.

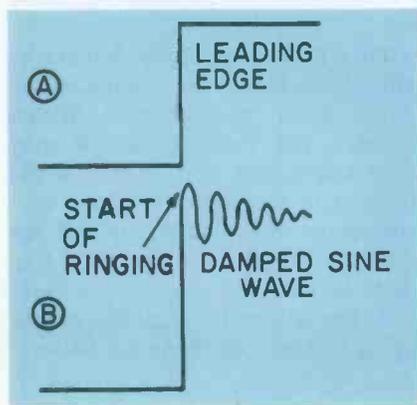


Fig. 3 (A) — Leading edge of a square wave. (B) Leading edge rings LC circuit of wavemeter.

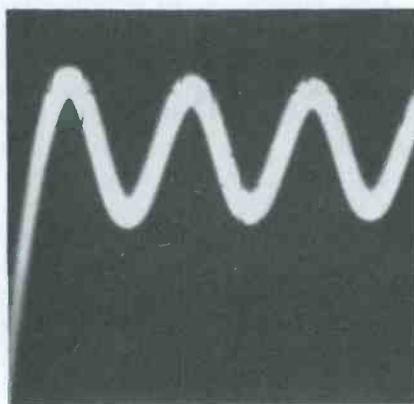


Fig. 4 — Typical scope ringing pattern corresponding to Fig. 3B.

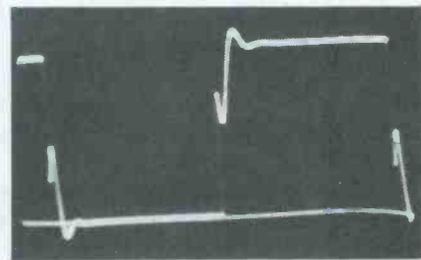


Fig. 5 — A low-Q wavemeter gives a ringing pattern which is damped and dies out quickly. It gives information about the leading edge only.

poses, the waveform must ring through its complete cycle. If a low-Q wavemeter is used, the waveform will ring only on the leading edge. Since the leading edge is a step function, it contains all frequencies. Suppressed or damped ringing patterns do not give the information we need. An undamped ringing pattern gives us information concerning the complete waveform. Results of using a low-Q wavemeter appear in Fig 5.

It is sometimes difficult to visualize a part of a waveform containing multitudes of harmonics, while the complete waveform contains a limited number of harmonics. This seems to be a paradox.

But waveforms, in themselves, do not "have" harmonics. Harmonics attributed to TV waveforms are actually circuit responses of a particular TV chassis. It is customary to consider that the harmonics in a waveform are those which the waveform *seems* to contain when the waveform voltage drives circuits: tuned transformers, traps, peaking coils, etc.

If you feed a square wave through two different video amplifiers you may come to the conclusion that the square wave contains either odd harmonics only, or all frequencies. It depends on the damping of the peaking coils. A highly damped peaking coil gives data concerning the square wave's leading edge only, and the amplifier rings at all square-wave frequencies. On the other

hand, an undamped (high-Q) peaking coil gives data through the complete waveform — and the amplifier rings only for odd harmonics of the square-wave's repetition rate.

From a simple and homely viewpoint, this is merely to say that a high-Q peaking coil has a flywheel effect, and acts like a pendulum which gets a "push" at each leading and trailing edge of the square wave. The "push" impulse will put any pendulum in motion. But, on the other hand, the pendulum develops a sustained oscillation only when the "pushes" have a repetition rate equal to the pendulum's natural period. It is as simple as that.

Perhaps the rebellious mind chooses to turn the picture around, and asserts: "Well, that is all very well, but how about the fact that a square wave is built up from sine waves of certain frequencies, as every schoolboy (technical schoolboy that is) knows?" If this argument is advanced, we go one step further, to point out likewise, that the square wave's leading edge is a step function, and that our hypothetical schoolboy also knows that a step wave is built up from sine waves of all frequencies.

Hence, whether we view a complex waveform through analysis, or through synthesis, we are lead to the inexorable conclusion that a square wave has a frequency composition which depends solely upon the circuit with which we are concerned.

## Classical Situations

Simple classical situations rest upon linear high-Q tuned circuit responses. A color-subcarrier trap or a sound trap are examples of this and are highly important in practice.

Look at the waveform in Fig. 6. Here we see a horizontal sync pulse and a color burst, as passed by a high-Q color-subcarrier trap. Note how the leading edge rings the sync pulse, and observe how the burst causes two trains of damped 3.58 Mc sinewave. Quite evidently, this is not the trap action we desire in a color-TV receiver — we want the trap to "wipe out" the chroma signal, and we want to avoid ringing action which causes "circuit ghosts." So, we will use a low-Q trap to get the desired action. A high-Q trap is converted to a low-Q trap by shunting a resistor across it.

By using the test set-up of Fig. 2, we find that a square wave has a fundamental frequency and a certain number of odd harmonics. That is, the waveform "rings" on the scope screen when the wavemeter is tuned to these definite frequencies. When we tune outside the receiver's passband, no more ringing patterns are obtained.

A square wave shows ringing patterns on the third-harmonic frequency, but shows no ringing pattern on the second-harmonic. The waveforms in Fig. 7 explain why. The actions of leading and trailing

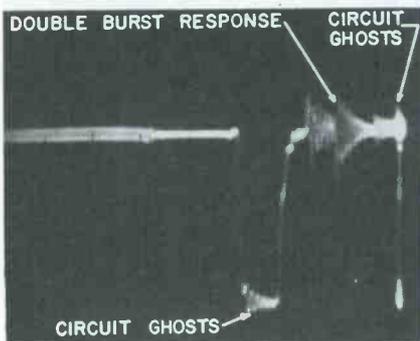


Fig. 6 — We must use a low-Q color-subcarrier trap to eliminate circuit ghosts and double bursts.

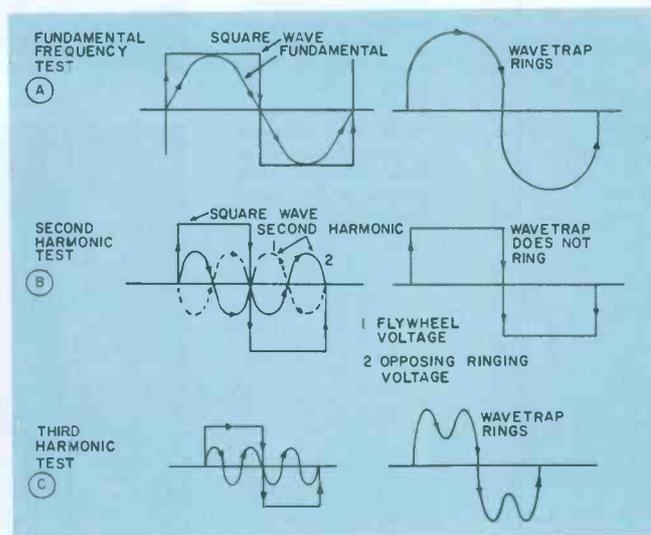


Fig. 7 (A) — Fundamental ringing frequency is sustained on each half cycle because the square wave and the ringing sinewave are always in same direction. (B) — A second-harmonic ringing frequency cannot be developed by the wave trap. A second harmonic of opposing phases is associated with the leading and trailing edges. (C) — A third-harmonic ringing is sustained on each half-cycle of the squarewave.

## Waveform Analysis *Continued*

edges cancel on the second harmonic.

Actions of leading and trailing edges reinforce on the third harmonic, however. You will note, too, that the third harmonic rings less strongly than the fundamental. Again, the fifth harmonic rings less strongly than the third harmonic. By observing the amplitudes of the ringing voltages, we will see that the third harmonic has one-fifth the strength of the fundamental, and so on. But remember that the wavemeter must have a reasonably constant  $Q$  as it is tuned over its range, or a correction must be made for the changing  $Q$ . If the coil has a very high  $Q$ , no corrections are required.

Consider next a sawtooth wave. The wavemeter and scope will show that it contains both even and odd harmonics. How the ringing waveforms reinforce at both even and

odd harmonics is shown in Fig. 8. Again, the amplitudes of the ringing patterns show the voltages of the harmonics with respect to the fundamental voltage in the waveform.

### Simple Analysis

In fact, when we consider simple waveforms like square waves and sawtooth waves, we can make a complete analysis "in our head," without connecting equipment. By using the elements of electricity, plus the aforementioned outlined principles, we can write down waveform harmonic frequencies and their relative voltages with mental arithmetic.

Another look at Fig. 7 and 8 will show that our lightning calculations also reveal the phase of each harmonic with respect to the fundamental. That is so, because the circuit is "pushed" by the leading and

trailing edges of the waveform. Suppose we consider a pulse waveform — a horizontal sync pulse. A moment's reflection leads to the conclusion that the peak of the pulse must coincide with the peak of its sinewave fundamental. The power of this analytical method is obvious. It throws Fourier series and differential equations right out the window. We don't need any higher mathematics.

Of course, there are many waveforms found in TV circuits which do not have simple geometrical forms. For example, consider the distorted sinewave shown in Fig. 9. Mental arithmetic is inadequate. We must use the test set-up shown in Fig. 2.

We tune the wavemeter, and observe the frequencies at which ringing patterns appear on the scope screen. As seen in Fig. 9, the waveform develops a "wobble" at a harmonic frequency. Again, we observe the amplitude of each ringing waveform, and its phase. Thus we quickly "buzz out" the waveform, no matter how odd or unusual its shape may be. ■

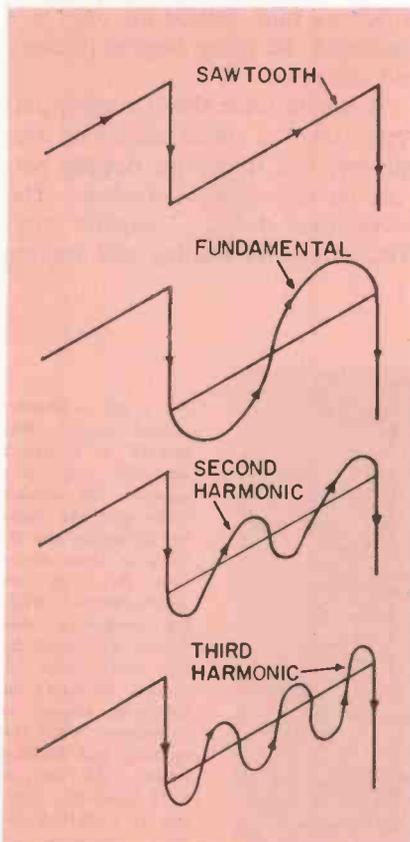


Fig. 8 — How a sawtooth wave rings a wavemeter on both odd and even harmonics.

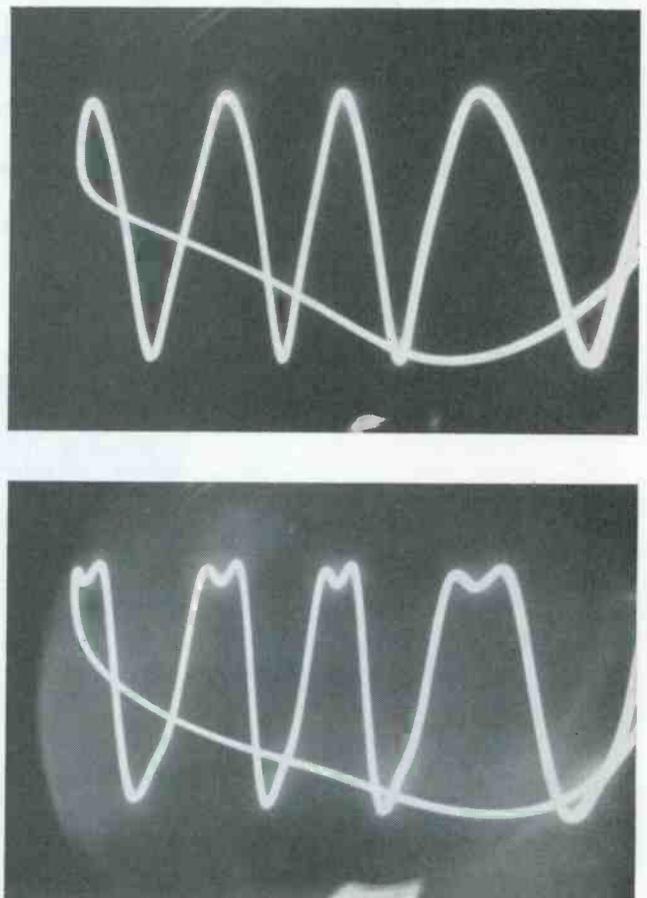


Fig. 9 (Top — A distorted sinewave. Inspection leaves us somewhat uncertain concerning its harmonic content. (Bottom) — The wavemeter test shows ringing patterns at each harmonic frequency in the waveform.

# Tips for Repairing Portables

Keep portable repair costs in line  
by converting labor into profit

by Max Alth

■ The cost of parts is one problem confronting service technicians when repairing portable receivers. Portables are frequently the second or third set in a family, and usually cost well under \$50. Customers invariably weigh repair charges against the radio's original purchase price. Because of this, it is important that the repair charge be kept at a minimum, but consistent with profit.

One way to keep portable receiver repair costs down is to reduce replacement parts. The single most expensive portable radio part is usually the cabinet, which in many cases can be repaired with Epoxy cement. All you need are the cabinet pieces. Epoxy cement costs about \$1 for enough to repair one or two cabinets.

The cement comes in two tubes. Contents of both tubes must be mixed together (1:1) before the cement can be used. One thing to remember is that the cement must be used in the given proportions for maximum strength. The cement must be well mixed too or it will not harden properly.

## Preparing Joints

Preparation of the joints to be cemented is simple. You need to make certain that the edges to be joined are neither dirty nor oily. If so, the cement will not adhere. If the pieces are flat they may be laid on a sheet of wax paper, and simply pushed together. You can use a weight to hold them in place. The pieces should not be moved for at least four hours when the room temperature is seventy or more. It should be allowed to dry for at least 24 hours. Excess cement can be removed later with a razor blade.

If a large number of parts are to be joined it is best to divide the task into two or three sections. Do not attempt to align too many parts at once. If the parts are curved they can be held together with friction or cellophane tape, (as shown in Fig. 1A).

If strain is expected on a cemented joint, back the break up with a thin sheet of plastic or wood. Care must be exercised to make certain that extra joint thicknesses do not interfere with replacing the chassis in the cabinet. Although the cement is usually stronger than the material it binds, there is a tendency for the cabinet to "sheer" or break again close to its original break. There may possibly be many invisible cracks along the line of the break.

When some screws have been pulled out of their holes, or hole threads have been stripped, cement can be used for a quick but permanent repair. By using a thin wood shaving to press a small amount of cement against the sides of the hole, the hole can be reduced in size, and self-tapping screws simply returned to place. Do not replace the screw while the cement is wet unless you want a permanent bond. Do not completely fill the hole unless you plan to re-drill and re-tap the hole, (Fig. 1B).

Because the new cement will adhere to metal, as well as other material, it can be used to tighten spring-clip knobs. The knob is removed and a thin layer of cement is applied to the flat on the shaft. When dry, the knob is replaced. If the layer of cement is too high it can be reduced by filing.

## Other Repairs

Another cause of time-waste and

expense is the battery clips. When these fail to provide proper tension, receiver operation may be erratic. If the contacts are "soft" but other-

*Continued on page 79*

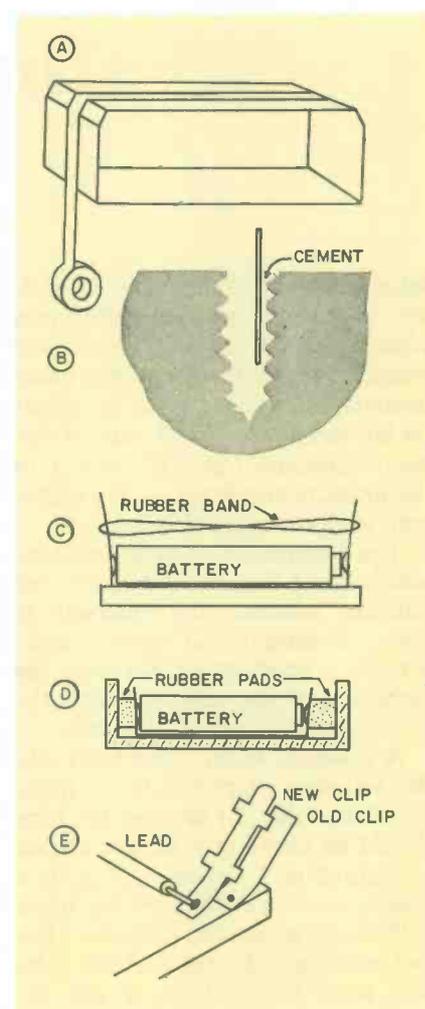


Fig. 1 (A) — Use friction, masking or cellophane tape to hold cabinet parts together while drying. (B) — Apply Epoxy cement to inside of stripped-thread screw holes with thin wood shaving. (C) — Rubber band holds clips tight against battery contacts. (D) — Rubber pads may be cemented behind clips to provide more pressure on contacts. (E) — Clip-stiffeners cut from shim-stock brass are crimped on existing clips.

■ It is generally agreed that the well-equipped technician must be able to identify a bad CRT every time. It is important to convince the set owner that his "big tube" is bad.

A professional CRT tester should, therefore:

1. Provide for rejuvenation and test of color and B/W CRTs.
2. Test all CRT types.
3. Check heater continuity.
4. Check for inter-element leakage and shorts.
5. Check CRT output or emission.
6. Check CRT bias conditions.
7. Check life expectancy.
8. Reweld opens.

No instrument can repair all bad

The life-expectancy test of a CRT is a relative test and requires prior knowledge on the technician's part to evaluate how rapidly the emission falls off since it is directly related to the amount of emitting material on the cathode. The question of gas content (or contamination from original state) will shorten its life as the gas particles ionize within the tube leading to the familiar negative picture effect. A gassy tube must be replaced once this effect has become severe.

Reactivation or rejuvenation may be accomplished in progressive steps and with two choices: The first choice is boosting the filament voltage and watching it reactivate. Serv-

method of reactivation, is the sweeping current or "shot" method. Basically, depressing the "rejuvenate" button applies a high voltage to the CRT grid.

The filament boost method is best used on tubes that indicate a good chance for reactivation on emission and life-expectancy tests. If the outlook is only fair, the shot method is recommended to obtain whatever improvement it will provide.

When the latter is used, emission should be noted before the attempt and again immediately after the first shot. If any improvement has been obtained, another shot may be tried. If adequate emission is not realized after two or three shots at the high-

## The Practical CRT Tester

Select an Instrument to serve your needs fully

tubes but it should have the capability of telling service technicians when a CRT is repairable and when it is not. It should also guide technicians in using their judgment on borderline cases and transfer difficult decisions (on CRT risks) to the ultimate consumer — the customer who owns the CRT.

The instrument should simultaneously check filament continuity and indicate whether the filament is open. It should also show if leakage or a short exists between the cathode and grid elements and the cathode and filament elements.

A practical tester should indicate the emission characteristic or quality of the tube. In this test the tube should be tested in a normal circuit configuration. Otherwise, a bad quality reading is obtained for tubes with nearly exhausted cathodes. The bad reading indicates that the tube will need reactivation, if not replacement.

An instrument that provides cut-off voltage for the CRT is also desirable. This makes it possible to measure the contrast ratio that the tube will have on its screen. This may be offset, however, if the cathode emission is high.

ice technicians should be able to see whether the picture tube responds to reactivation. When done in the home, the TV set owner can also see the results obtained with his tube. Frequently a one or two minute period of heating the cathode can dislodge some of the impurities on the cathode and bring the tube to normal emission. Care must be exercised, however, to avoid the danger of heater burn-out.

The second choice, a more potent

est position, further efforts in this direction are probably just a waste of time.

The elevated filament method is more time consuming, generally taking 15 to 30 minutes if it works (after successive tries). There are cases in which the shot method succeeds after the filament technique has failed.

Each method involves some dangers. The shot method may cause total cathode failure or the arc that

B & K's Model 440 CRT tester and rejuvenator.





Sencore's CR 125 cathode ray tube tester.



GC's Model 36-616 tester-reactivator.

## and Rejuvenator

by Walker Kruck G-C Electronics

forms during the pulse duration may damage some other part of the electron gun. The strain of the elevated voltage may cause a heater to open. These possibilities should be spelled out to the set owner. In either case, nothing is lost if the tube is not in useful condition. This point should be made clear to the set owner; *then the decision to go ahead with the attempt is the set owner's decision. This last point cannot be over emphasized.* ■



Paco's Model T-36 picture tube tester and rejuvenator.



Mercury's Model 800 tester-reactivator.



Anchor's Model T-75 Reacto Tester.

## CAPACITOR TESTERS



Lafayette's model TE-44 capacitor tester gives good-bad indication. \$14.95.



Heath's model IT-22 in-circuit capacitor checker, available in kit form only. \$10.95.

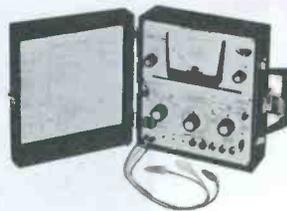


Sprague's model TO-5 Telomike capacitor analyzer tests and measures all capacitors with 3 percent accuracy. \$92.50.

EICO's model 955 capacitor tester measures actual capacity. \$19.95, kit; \$39.95, wired.



## TRANSISTOR TESTERS



SECO's model 250 transistor analyzer tests transistors without setup. Also checks tunnel diodes. \$74.50.



Sencore's transistor tester also combines a signal generator in the unit. \$24.45.



Heath's transistor tester has built-in supply with provision to use external supply. Kit only. \$54.88.



EICO's transistor tester checks common transistor parameters in or out of circuit. \$39.95, wired; \$25.95, kit.

## TUBE TESTERS



Triplett's tube analyzer is a lab-type mutual conductance instrument. The unit can also be used to plot characteristic curves. \$349.50.

Precision's model 650 tube tester checks most common tubes. Five rotary switches are used for set up. \$69.95.

SECO's 107A has a large number of similar sockets to check tubes with only load and filament voltage settings. \$149.50.



Hickok's 725A is designed to test seven and nine pin miniatures, compactrons, nuvistors, novars and gas tubes. \$345.

# SMALL EQUIPMENT FOR BIG JOBS



Precision's model IC-60 capacitor tester also checks electrolytics. \$32.95.



Cornell - Dubilier's model BF-71 tests both low and high voltage capacitors. \$129.75.

Lafayette's transistor analyzer tests all common types of transistors. \$12.75.



Electronic Measurements Corporation's transistor tester is available in kit or wired form. \$48.50, wired. \$13.50, kit.

■ Here's a roundup of several categories of test equipment. The list is not meant to be all-inclusive, but to give you an idea of some of the equipment available and a range of costs.

If additional information is requested on a specific line or item, go to standard literature sources or write the manufacturers directly. In any case, if you're in the market for new test instruments, buy carefully. Spending your money wisely doesn't necessarily mean buying the latest expensive piece of equipment.

Look carefully at special features of the equip-

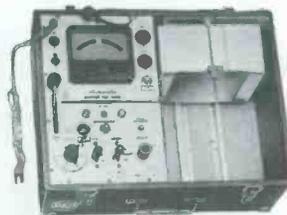


B & K's model 625 Dyna-Quik tube tester tests all common tubes, nuvistors and compactrons. Unit employs multiple socket approach. \$139.95.



Mercury's model 1200 tube tester employs push button set up and short testing switches. Checks common tubes, CRTs and transistors. \$119.95.

RCA's tube tester comes complete with a set of 239 punched cards which are used to "set up" the tester. \$199.50. Gas tube adapter, \$2.95 additional.



EMC's small unit uses slide switches for set up. The unit measures common tubes and nuvistors. \$24.90.



Heath's TT-1A mutual conductance tube tester is available only in kit form. Unit checks all common tubes, including thyratrons. \$149.95.

## VOLTAGE CONTROLS



SECO's Vari-Volt has up to 1000 w capacity and controls standard line voltages from 0 to 120 v. \$19.95.

Heath's IP-22 isolation unit controls standard line voltage from 90 to 140 v. Maximum capability: 500 intermittent; 300 continuous. Kit only, \$54.95.



ment and determine how beneficial they will be in your situation. Check to see if the equipment is well built and can still be used as foreseeable advancements are made. If your bench area is displayed before the public, appearance should be one of the deciding factors. Portability should also be considered in some instrument types.

There are just a few of the many factors you should consider; now look at a few of the many pieces of test equipment you might consider. ■

## COMPONENT SUBSTITUTERS



G-C Electronics substitution box has common values of resistors, common capacitors and electrolytics. \$24.95.

Precision's model 1904 capacitor substitution unit. Capacitor values in 100 pf steps are available from 100 pf to more than 1  $\mu$ f. \$29.95.



Mercury's component substituter for carbon and wirewound resistors, common and electrolytic capacitors. \$37.50.



Sencore's component substituter allows substitution of carbon and wirewound resistors, common capacitors, electrolytics and rectifiers. \$39.95.



## SIGNAL GENERATORS



Heath's IG-102 is a compact instrument designed for general shop work. Kit only, \$27.95.

Triplet's model 3432A RF signal generator covers 160 kc to 110 Mc in seven bands. \$119.95.



Precision's E-75 operates to 120 Mc on fundamentals and to 240 Mc on harmonics. \$48.95.



Conar's signal generator operates from 170 kc to 60 Mc on fundamentals. \$29.50, wired; \$21.50, kit.



Lafayette's TE-20 is a general purpose signal generator operating on fundamentals and harmonics. \$27.95.



## Test equipment requirements and limitations for TV and audio service work

by Aaron Shaw

# EQUIPMENT for the

# 1 -MAN SHOP

■ Just what equipment a one-man shop *must* have to operate a TV-radio-Hi Fi business successfully is a widely disputed subject. Many old timers in the business haven't kept up with the trends in color and FM multiplex which may soon alter their equipment investment picture. Others, who have been in business only a short time have not yet accumulated some items.

Take stock of your equipment and make arrangements to obtain the items you do not presently have. Since there is a wide range of equipment, let's start with the basic items and build from there.

### For All Service Work

*The VOM.* Probably one of the most valuable tools in any shop. The unit is portable, and finds a multitude of uses. Probably the most serious limitation of this instrument is its relatively low impedance. The user's most serious limitation is his lack of understanding of this.

*The VTVM.* This unit has all the functions of the VOM but lacks portability in most cases. Its chief advantage over the VOM is its very high input impedance.

*The Oscilloscope.* One of the

most valuable tools for certain alignments, waveform checking; graph-like readout of bandwidth and instant representation of voltage or current vs time. Although the scope is an extremely important tool, the VTVM can replace it for some tests which are normally thought of as "scope only" tests. Time is saved in all cases when using a scope, however. Even with all its claims to fame, the scope is one of the least used items in the average shop.

*The RF Signal Generator.* A basic tool for BC receiver alignment and for troubleshooting almost every type of radio equipment. Most

# 1 -MAN SHOP

Continued

function over a normal range of line voltage variations. Line voltages in the home are rarely the same as those in the shop.

## Special Items

Besides those items which are used daily, several pieces of test equipment fall into the category of "used once in a while." Included in this category are power supplies, bias boxes, special probes, etc.

*Multiplex Generator.* This will be an absolute necessity if you plan to



Circuit analyzers such as the Win-Tronix can be a valuable time saver.



The transistor radio analyst by B & K is one of the special types designed for a specific repair area.

generators are capable of producing RF frequencies from 100 kc to 50 Mc. Modulation is usually provided externally or internally with a 400 cps signal. The audio signal is frequently available from the instrument separately.

*The Audio Signal Generator.* An almost indispensable tool for troubleshooting audio equipment. This is one, however, that you can get by without if you don't do Hi Fi work.

*The RF Sweep Generator.* To do a professional job on TV or FM equipment this is absolutely necessary. Don't try to skimp-by without it. RF and IF alignments cannot be done accurately unless you want to spend several hours with a VTVM,

RF signal generator and some graph paper.

*The Tube Tester.* This, too, can be pushed aside and not used. But the alert service technician uses it to great advantage by selling more tubes, preventing call-backs and assuring the customer that he's not buying something for nothing.

*Transistor Tester.* Unlike the tube tester, a good transistor tester is difficult to get along without. Most models combine diode and rectifier test functions as well.

*Auto Transformer.* Another test item that you can get by without. That is, if you don't care about call backs or boarder-line repair jobs. This instrument should be connected to every set to find out if it will

do any FM multiplex service work. The generator is actually a miniature Stereo FM signal transmitter. Pilot and sideband signals are all sent in the same manner as a station signal.

*Color Bar and Dot Generator.* Another instrument that's absolutely indispensable in the modern service shop. Most instruments of this type are not only good for color work, but will prove valuable for B/W troubleshooting as well.

*Flyback and Yoke Tester.* Another item most shops are doing without. But stop and think. What single area of servicing gives you the most trouble? If you're typical, you'll say the flyback or yoke. One of these testers or an impedance

bridge is the only way to get an accurate check.

**Distortion Testers.** If you're setting yourself up as a Hi Fi authority and service shop, you'll need equipment to measure distortion. You must be able to prove to yourself and the customer that there is or is not distortion present in his system.

### The Finishing Touches

The aforementioned pieces of equipment, although sufficient to troubleshoot components normally

make your job easier and faster.

Other available equipment combines the functions of several basic instruments. The tube tester which also checks transistors and rejuvenates picture tubes is an example of this. Whether such equipment is a good buy or not is largely a matter of the type of shop you operate. In the case of a one-man shop, it may be an economy. On the other hand, where several technicians will use the equipment, or where it will be taken on house

bench, should also be considered. If you 'do it yourself,' provisions should be made to feed the unit with low, medium and high output circuits. This is to handle standard outputs, plate outputs and some transistor outputs which use a 500 ohm speaker.

Capacitor checkers can also be very useful equipment for the service shop. While they are not necessary to pin down most malfunctions, they can be extremely reliable indicators of future trouble.



Semcore's two-in-one VTVM and VOM.

encountered, are not the answer to all your problems. The technician should understand the operation and application of each unit. In addition, he should obtain certain other items to make his job easier.

Although batteries can be haw-wired to serve as a "bias box," one of the several units on the market will usually do a better job. Often two or three different voltages are needed. The resulting wire from this kind of lash-up is most frequently a headache.

Batteries can be used in place of power supplies for transistor and car radios too. But this is expensive, and several units available at your distributor combine current and voltage measuring functions to

calls, certain functions of the equipment may not be available when needed.

Highly specialized equipment is also available to do jobs that might otherwise be very time consuming. Some of these types serve to isolate stages in the RF, IF, or sweep circuits by complete substitution of the circuit. Other similar units are available for radio work.

Tube filament continuity testers also frequently save time. Although it is advisable to check all tubes with a high quality type tester, there are occasions when it is feasible to find only the open filament; such as on a relatively new receiver.

Test speakers, either enclosed in a small cabinet or built into the

Of course, several special probes are also valuable. Probes are available to measure high voltage and high frequencies with standard meters or scopes. Other available probes can change meter ranges without moving meter range switch.

The list of adapters, extensions, tracers and injectors for TV and audio work is very long. If you want to speed up your service work and make your job easier, be alert to new test equipment, its functions and how it can complement the equipment you already have.

Don't be taken in by a something-for-nothing deal, but be sure to obtain the equipment that's absolutely necessary, now. Don't risk your reputation with half a shop. ■

The jobs this versatile instrument will perform are limited only by your knowledge and imagination

# Your VTVM is a Valuable Tool

by Don Henderson

■ Your vacuum tube volt-ohm-meter is a test instrument that has no practicable substitute. Sure, your scope can perform part of its work — and better. So can a capacitor checker. And a high ohm/volt VOM can give a VTVM a run for its money in some situations. But, in the shop, a single-instrument VTVM remains the versatile top-dog TV-radio tester, indicator, analyzer, troubleshooter, alignment tool and measuring instrument. That is — when we know how it works,

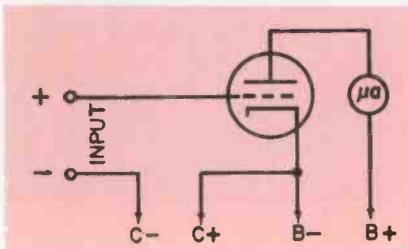


Fig. 1 — Fundamental VTVM circuit.

how to use it properly and how to maintain it in good working order.

## Know Your VTVM

One important thing to know about our electronic volt-ohmmeter is how it differs essentially from our VOM. For one thing, it is more sensitive. A sensitive instrument is needed to make low-voltage critical-circuit measurements. A VTVM has a much higher internal resistance and doesn't upset critical circuits. A tube isolates the meter circuit from the measured circuit and incidentally offers considerable excess-current protection to the meter movement. A typical VTVM may have a constant internal resistance of 10 Mohms or more. Our VOM, of course, has a much lower internal resistance which varies with the VOM's range settings.

Our typical VTVM also has a

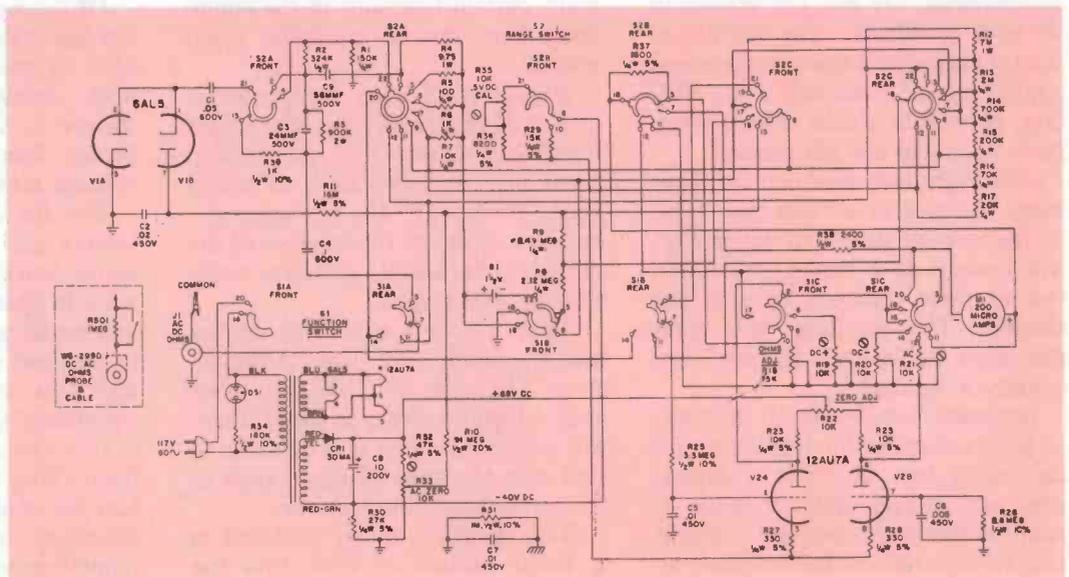
wide frequency response. This allows RF voltages to be measured up to about 250 Mc when a diode probe is used.

A simplified fundamental VTVM circuit is shown in Fig. 1. In practice, a range switch and resistors are used to cover a wide range of voltages.

The triode tube acts essentially as an amplifier; the voltage to be measured is applied to the grid and bucks or aids the grid bias (depending on input polarity) which causes an increase or decrease in the tube's grid current. When the plate meter is properly calibrated, voltages are read directly on its face. A typical VTVM schematic is shown in Fig. 2.

Our typical VTVM uses a double-triode bridge circuit as shown in Fig. 3. The bridge circuit may be degenerative (with resistance arms

Fig. 2 — Schematic of RCA WV-98C VTVM.



connected cathode-series as in Fig. 3A), or as a push-pull dc amplifier with the meter between the plates (Fig. 3B). A typical VTVM uses one or the other circuit arrangement. It is interesting to note that the meter movement does not have to be extremely sensitive as in a VOM. The typical service-shop VTVM may have a 200  $\mu$ a meter movement.

Our VTVM also has a number of variable resistors for adjusting the meter. The zero-volt and full-scale (ohms-infinity) adjustments are most commonly used in day-to-day work. The other controls are used for periodic calibration against factory or lab measurement standards.

Most regular VTVMs are equipped with a double diode for ac voltage measurements — usually a 6AL5 tube. This may be wired in a half-wave voltage-doubler configuration as shown in the simplified circuit of Fig. 4. This circuit provides P-P measurements for complex waveforms, including RMS sinewave voltage measurements. A variable control is used to balance out small dc voltages between tube elements. Capacitor C1 makes it possible to measure various types of ac voltages appearing in "live" dc-powered circuits. Modern

VTVMs are usually equipped with a flip-switch probe for measuring both dc and ac. Another switch is provided on the meter's front panel for reversing polarity.

### On the Job

A substantial book could be written outlining all the various possible applications for a VTVM.

It's a whiz when analyzing video signal, AGC, AFC and radio oscillator circuits. It should always be used when testing any high impedance circuit. If there is a danger of circuit-loading caused by capacitance of the probe-cable, use a one-Mohm resistor at the probe tip.

Our VTVM is an ideal tool if we want to record accurate voltages throughout a TV's video circuits. But let's not forget to check voltages under "no signal" conditions (channel selector on a vacant channel), unless otherwise specified in manufacturers' service literature.

Some video diode detector problems can be easily and quickly isolated with a VTVM. Assuming normal video at the detector input, for example, but no picture is being received, adjust the VTVM to zero-center and connect it across the detector circuit as shown in Fig. 5. Note the amount of needle deflection from zero. Now flip the

channel selector to an active channel and fine tune it for maximum voltage on the meter. Note the amount of needle deflection from zero. If the deflection is the same as in the first test, the diode is probably bad. In this circuit a sync-negative signal appears at the video output-tube grid and the voltage should increase substantially over the first reading — in a negative direction — if the crystal diode is good. If a substantial voltage increase is obtained, check the video output and CRT circuits.

In the event improper video does not appear at the video detector input, we can use our RF probe and move from grid-to-grid through the video IF stages and obtain similar significant information regarding each stage operation.

If your VTVM has a fractional voltage or millivolt scale it can be used to make stage-by-stage gain checks in audio amplifier systems by feeding a fixed-level 1 kc signal into the system's input from an audio-signal generator.

By placing a proper resistance and power value load resistor across an audio amplifier's output your VTVM can be used to quickly compute the amplifier's power output in watts.

Assume, for example, the ampli-

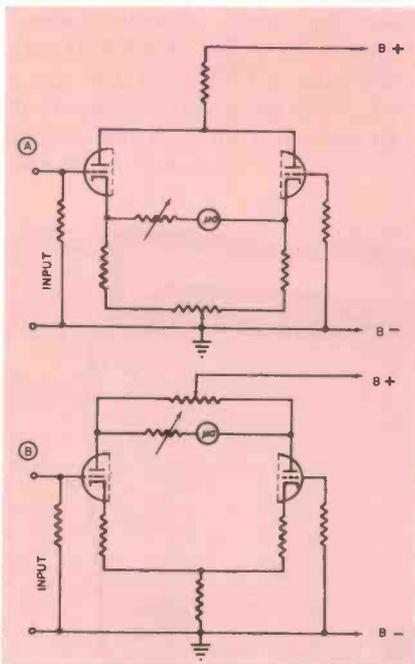


Fig. 3 (A) — Degenerative cathode-series VTVM bridge circuit. (B) — Push-pull dc amplifier bridge.

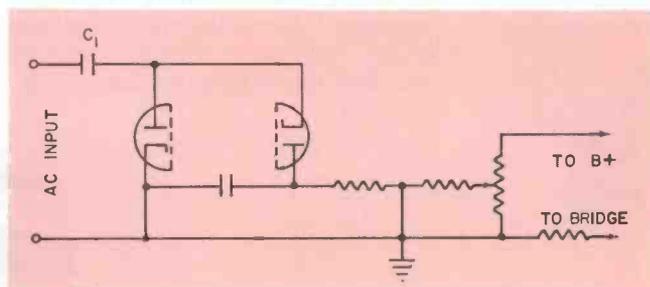


Fig. 4 — Double-diode VTVM voltage doubler ac input provides P-P measurements for complex waveforms.

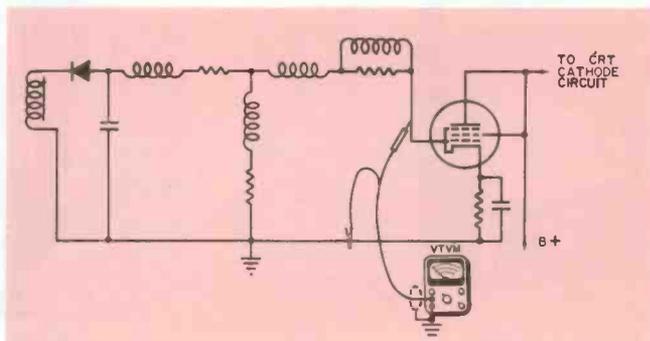


Fig. 5 — Checking video detector with VTVM.



Heath kit model IM-13 VTVM.



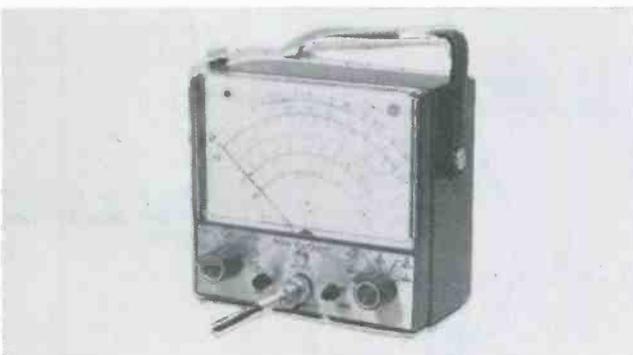
B & K Model 375 VTVM.



Lafayette Model KT-202.



Conar Model 211.



RCA WV98C VoltOhmyst.



Triplett Model 850.

fier is rated at 25 w and calls for a 16  $\Omega$  load across the speaker terminals. The load resistor should be rated at 50 w. After the amplifier has been switched on and warms up, set the tone controls to center and turn the volume control up to maximum. Connect the VTVM across the load resistor and inject a 1 kc audio signal into the amplifier's input. Increase the audio generator's gain slowly and watch the meter needle move up until it reaches 20 v. By ohms law:

$$P = \frac{E^2}{R}$$

we know the amplifier is putting out 25 w. It may or may not be distorted, but it's certainly operating normally power-output wise.

When manufacturers' literature specifies P-P voltage values for sync pulses and saw-tooth waves at vertical and horizontal oscillator grids,

vertical and horizontal output grids, etc., quick checks can be made with your P-P-reading VTVM.

And many experienced benchmen use a VTVM to "snoop-out" ac or vertical saw-tooth leakage to B+ supply lines when a scope is not immediately available.

Color sync and demodulation checks — adjusting color amplifier coils, hue controls, etc.; accurate HV measurements with a HV probe — are only some of the chores a VTVM can take care of in color TV servicing, troubleshooting and repair.

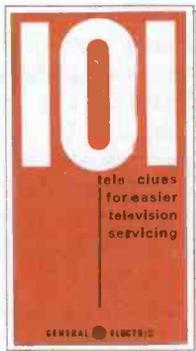
Our VTVM has one limitation. We will have to substitute the VOM, with its amp, ma and  $\mu$ a scales, for quick, accurate current measurements. But if a VOM isn't handy, the VTVM can still do a good job with a little cooperation from you. Just measure the voltage

*Continued on page 82*



Enter General Electric's ONE-O-ONE Contest. 101 prizes given every month... \$10 to \$100 with a Grand Prize of \$500 in cash. See your General Electric tube distributor for complete rules and official entry blank.

Get this book **FREE** with the purchase of G-E tubes. Here's *101 Tele-Clues* to help make TV repair easier and more profit-



able for you. Your General Electric tube distributor will give it to you free in appreciation of your purchase of G-E tubes and electronic equipment. Enter the ONE-O-ONE Contest. Get *101 Tele-Clues*. See your General Electric Distributor today.

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- - - for more details circle 18 on post card

Your eyes should focus up close, quickly and accurately for today's repair jobs

# SOLVE YOUR VISION PROBLEMS

*by James R. Gregg, O. D.*



Sharp vision at arm's length may call for a trifocal or a special bifocal on some electronic jobs.

■ Eyesight is your most valuable tool. But it may be far from adequate unless you have given it particular attention. This is so because electronic technicians have some very special seeing needs, seldom solved by ordinary methods. Strangely enough, this may be particularly so if you wear glasses.

Electronic work creates a big variety of visual demands — looking at many heights and distances, and in all kinds of seeing conditions. It can put unusual burdens on eyes. There is the matter of seeing for safety too. And where critical closework is necessary, as it is on virtually every job, sight preservation is particularly important. These are things you should know if you want to get the most from your eyes.

## Eyesight Requirements

Don't be fooled by 20/20 eyesight. Your distance vision should be clear because nearly all of your work requires it. Yet 20/20 eyesight is no guarantee you have the visual skills most essential in electronics. You need eyes that focus up close, quickly and accurately, to see tiny connections and your eyes

must aim precisely over a large area to size up the whole job. Your eyes should coordinate together and have good muscle balance, and they must have plenty of focus-power for near objects. Without these sight facilities your job would be difficult indeed.

Because of the detailed nature of some electronic work and the need to get very close to it, the burden on eyesight is greater than for many other jobs. This may put a strain on eyes that can't focus well. Even young technicians can have this difficulty. It may take lenses for inspection, assembly and repair to make seeing easier. The work does not ruin your eyesight, it is simply hard to do.

Here are some danger signals to watch for: Blurry near vision, headache, fatigue, seeing double, and frequent blinking. The symptoms of faulty sight can be vague and uncertain; perhaps loss of interest, more errors or slowing down. Don't wait until your eyes hurt, you may need visual care before that happens.

The most annoying problems start when you reach the bifocal age. Everyone reaches that age because

the human eye slowly loses its own automatic focusing ability. Near objects become blurry, and the closer or smaller they are, the harder it is to see them. The solution is simple as far as restoring clear vision for any desired near-seeing distance. But the matter is very complex for electronic work because there is generally a variety of working distances involved. Perhaps even more significant, the need for near vision is not always downward in a customary "reading" position, but can be anywhere from floor level to high overhead, and sometimes in awkward positions as well.

## Considerations

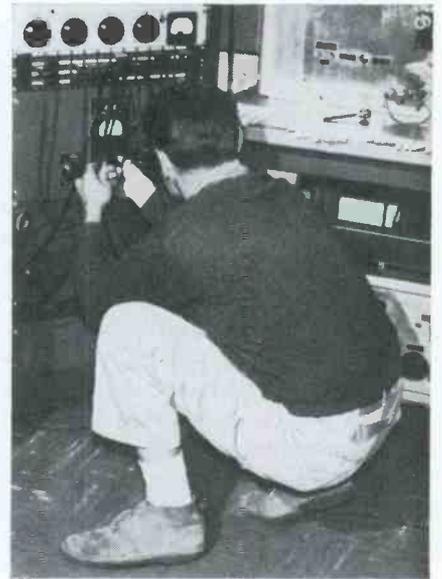
If you need to wear glasses for your work, here are some tips: Be sure the frames are wide enough to give you a good field of view. When moving around on the job, you'll need all the side vision you can get. Properly fitting frames should have temples (earpieces) that hold them snugly in place. Loose glasses will not give satisfactory service for your work. There is even eye hazard on your job (a screwdriver can slip or a loose wire strike your eye) and safety lenses are wise insurance.



Some jobs require the precise vision of minute repair work and at times it may be necessary to get close up.



When glasses become necessary, no ordinary bifocal, focused for a customary reading distance will be satisfactory for a job like this.



You should know your exact job visual requirements because seeing heights and distances vary widely.

These can be heat-treated glass or plastic lenses.

No one lens will thoroughly solve all electronic technicians' seeing problems after the mid-forties. At the very beginning, "ordinary" bifocals may do, if the eyes can still focus some without glasses. "Reading glasses" (same focus all over the lenses) can provide good near-vision but they make everything more than a few feet away appear blurred. They may do very well for close jobs only but this means taking glasses off to look at any distance, or when walking around the job. If a distance correction is necessary also, two pairs of glasses must be used. Some kind of multifocal lens offers the most practical solution, even if no distance correction is required, since they can eliminate the blurry distance-seeing of the single-vision near lens.

Some acute problems for the electronic technician arise because the range of vision (inward or outward) possible with any one lens power is not great enough for much of the

work he performs. General electronic work is from 18 in. to arm's length away from the eyes and may not require fine critical seeing, yet it can't be done with blurry vision. Fine repair and detail work is another thing, often as close as 10

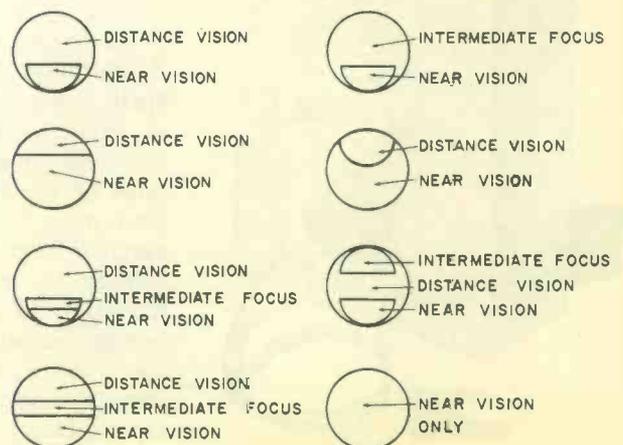
to 12 in. and this calls for the sharpest eyesight possible.

But good vision is also essential out to arm's length, 24 to 30 in. and beyond, on many jobs; particularly at eye level and above. Ordin-

*Continued on page 82*

CHART 1

TYPES OF MULTIFOCALS USEFUL FOR ELECTRONIC WORK



Multifocals are the answer for many visual problems encountered in electronic work.

## AUDIO ANALYZER

For Manufacturer's brochure of this equipment circle 400 on post card.

Heath's IM-22 Audio Analyzer kit at \$56.95 — Here's a unique instrument that will prove to be a valuable tool for the audio service technician. The unit combines the functions of an ac VTVM, wattmeter and IM distortion analyzer. With leads connected to an amplifier's input and output, the analyzer checks power, noise and distortion by simple manipulation of the controls.

Although no other test instruments are needed to perform these standard tests, a separate signal generator enables the unit to perform complete response tests. Auxiliary loads are not necessary; 4, 8,

16 and 600 ohm loads are built into the tester.

Not only can an overall check be accomplished with the IM-22, but a stage-by-stage check is possible using the high impedance input.

The ac VTVM portion of the instrument is flat within 2 db from 10 to 100,000 cps; the wattmeter is within 2 db to 50 kc. Ten ranges are available with full scale readings from 0.01 to 300 v. It is also calibrated in dbm from -40 to +50. The wattmeter reads from 0.15 mw to 150 w; distortion full scale readings are from 1 to 100 percent in five ranges.

The output impedance is 3 K; 60



and 6000 cycles are available externally. The unit measures 13 x 8½ x 7 in.

Although this unit does not measure harmonic distortion, it will go a long way toward setting up a Hi Fi test center and satisfying yourself and your customers who decide that "it doesn't sound just right." Don't give yourself credit for having a golden ear — there aren't too many of them around. Buy the right equipment and use it.



# TEST INSTRUMENTS for Bench and Caddy

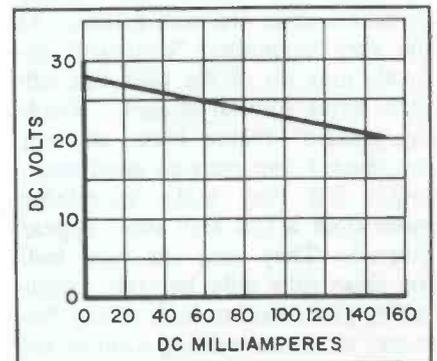
## POWER SUPPLY

For Manufacturer's brochure of this equipment circle 401 on post card.



Electro Products Laboratories EC-3 Power Supply at \$19.95 — Small power supplies have become an important part of servicing transistor equipment. Some of the features of the EC-3 are particularly interesting: The bias is continuously variable from 0 to 7 v; the supply voltage is continuously variable from 0 to 20 v; the maximum rated voltage output can supply 150 ma continuously; and both bias supply voltages and ma are read on the same meter.

Operation of the unit is very simple. Three color-coded leads (which can be stuffed in the cases) supply



the power and bias. To set up the instrument, the output voltage knob is rotated full counterclockwise and a screwdriver is used to adjust the bias registered on the meter. Rotation of the output control then indicates the supply voltage.

To check the current drain, a slide switch is moved from VOLTS to MILLIAMPS.

The unit measures 6¼ x 5 x 3¼ in. Rubber feet are located on the bottom and the back of the unit.

Continued on page 60

# The morning after the night of a big wind...



## ...TV antenna business tends to be brisk

But you'll be busier *all* the time when you can offer these extra sales features of masts and towers made from Armco ZINCGRIP® Tubing: strength, rust-resistance, lasting good looks. They'll stand up better, too, when the big winds come—gain good-will for you.

For names of manufacturers of these rugged masts and towers, write Armco Division, Armco Steel Corporation, Dept. A-1493, P. O. Box 600, Middletown, Ohio.



## Armco Division

... for more details circle 12 on post card



**Dick Nyholm, Radio & TV, 108 N. Lower Ave., Centralia, Washington**

"Television antennas represent an important part of my business. Since handling Winegard Colortrons, my business has increased greatly. Seems that one person tells another and your advertising also pays off."

**Edwin L. Fisher, Fisher Appliances, Inc., 107 N. E. Front Street, Milford, Delaware**

"During the thirty-one years I have been in the Radio and Appliance business few new items have been so immediately successful as your Colortron antenna."

"Our sales of color television testify that your new Colortron antenna has been the answer. In fact we will not sell a customer if they are not willing to install a proper type antenna to operate the new color set."

"Hoping this letter will encourage you to further efforts in developing more new products."

**Ken Kesler, Electromatic, Inc., 237 N. E. Broadway, Portland 12, Oregon**

"We have used the Winegard assortment of antennas for over three years and find that whatever situation we encounter, Winegard has the answer."

"We have been especially pleased with the WINEGARD COLORTRON which we have used extensively since Color TV has come into its own."



**Ray Summers, Ray Summers, Inc., Louisville, Illinois**

"We live in an area which has the poorest television reception in the State of Illinois. There are no stations closer than 100 miles. Our TV and antenna sales have more than doubled since using the Winegard Colortron as it has improved reception to the point where we can get good reception from several channels."



**George W. Terry, Terry's Electric, McLean, Texas**

"I am so pleased with the new Winegard Colortron antennas that I would like to tell you about the reception we have here in McLean, Texas."

"We have these antennas as far as 100 miles from our local stations in Amarillo, Texas and the customers are overjoyed with the reception."

"We have installed over 200 Winegard Powertrons and Colortrons on a money back guarantee. As yet we haven't had the return of even one antenna!"



**Twin City Radio & TV, Inc., 97 National Avenue, Chehalis, Washington**

"We are especially pleased with Winegard Colortrons and the Nuvisor amplifier is the best by far. Keep up the great engineering and your fine advertising—both help us sell more antennas and boosters."



# THEY SAY IT BETTER THAN

*Some of America's leading dealers tell why they think Winegard Colortrons are*



**Dave Tucker, Avon Television Co., 189 Bway, Amityville, New York**

"We here at Avon T.V. have used many different antennas for our color installations and have found that for best all around results in color as well as black and white reception the Winegard Colortron is superior in every respect."



**William D. Miles, Miles Electronic Co., Baxley, Georgia**

"We are over one hundred miles from the nearest commercial station. We have tried most of the so-called color antennas. Thanks to Winegard's high signal-to-noise ratio and high directivity Winegard is the only acceptable antenna-booster combination which was found to meet our 'customer's satisfaction' requirements. Beautiful color is being received now with the Colortron."



**Roy Sahlin, Central Television & Appliance, 911 Chehalis Ave., Chehalis, Washington**

"Finest piece of equipment we have worked with in electronic field. The Winegard Colortron and all Winegard products have no competition."



**Walter Finkbeiner, 107 New Jersey Ave., Absecon, New Jersey**

"I have found the Winegard Colortron and Electronic Power Pack to be the most powerful antenna in our fringe area. Colortron antennas make a perfect combination with our Admiral Color television installations."

"I install Colortrons on trial and have not lost a sale to date."



**Charles Dumaine, Dumaine Antenna Service, 735 Woodtick Road, Waterbury, Conn.**

"Among the top three antennas I have found it to be the best for any reception. The AP220N Nuvisor Amplifier is tremendous in controlling both high and low channels; eliminating all types of interference. Being an exclusive Winegard dealer, I make between 30 to 40 installations per week of the Winegard Colortron and Amplifier. The people for whom the installations were made are all well satisfied with the performance; bringing more business my way than I can handle."



**Leonard P. Hellenenthal, Nielsen & Nelson, Inc., 1462 Glendale Blvd., Los Angeles 26, California**

"I am extremely happy to inform you that we have been a constant user of the Winegard line of antennas and related products for six or seven years."

"We are now moving into the Colortron series which we find to be another added improvement in new type hardware and improved over-all performance."

"As you know, our clients in this area consist of many television and movie stars as well as prominent city officials. We are, therefore, of necessity, quite concerned about the equipment we use and its performance. We are looking forward to future success with this newer series of antennas and amplifiers."



**J. C. McNiven, The Gester-McNiven Co., 305 N. Tower, Centralia, Washington**

"We feature Winegard Colortrons because they have helped us immeasurably to sell more color sets. They really bring in a magnificent color picture and black and white is also the best. Finest antenna on the market, and we've tried them all."



**G. Borders, Borders Radio & TV Service, Flora, Illinois**

"In my opinion, the Winegard Electronic Antenna is perhaps the finest piece of equipment I have worked with in the last thirty years."



**J. A. Etchison, Etchison Brothers Appliances, Flora, Illinois**

"The new Winegard Colortron with the twin nuvistor amplifier permits us to give our customers the best television reception ever!"

**Berkeley M. Phelps, TV & Radio Repair, Washington Depot, Conn.**

"The high gain of Winegard antennas and boosters give the customer excellent pictures on channels that were not usable before. Winegard equipment does not require sales pressure—seeing is believing!"



# WE DO!

*the world's finest TV antennas...*



**Jack Ross, Smith's Home Furnishings, Portland 2, Oregon**

"This is hilly country, with lots of tall trees. We install and service thousands of sets a year. We've found many real problem areas—where only a Winegard Colortron antenna with Nuvistor amplifier will pull in the kind of picture a set owner has the right to expect. We recommend Colortron to our customers—especially to the many people now buying Color TV."

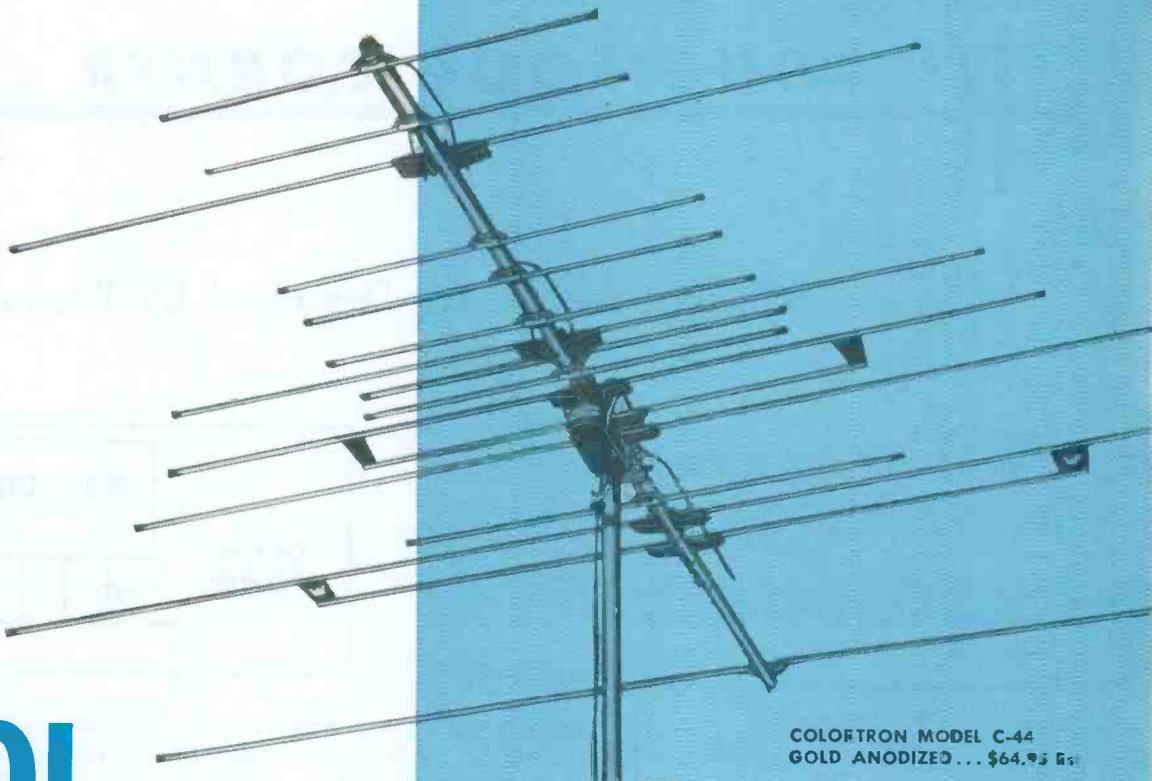
**David B. Newman, Radio Service Co., 262 Ninth St., Astoria, Oregon**

"With the new Colortron TV antenna and Stereotron FM antenna and matching Nuvistor boosters we have obtained excellent reception of the Portland, Oregon TV and FM stations. We are 100 miles from Portland with the coast range of hills between us. We also obtain good results from Seattle, 150 miles away. These are the finest antennas on the market today!"



*If you haven't tried Winegard Colortron antennas or Colortron Nuvistor amplifiers, we hope you will try a few soon.*

*We feel confident there is nothing on the market that can match them for performance and quality. Write for technical bulletins or ask your Winegard distributor.*

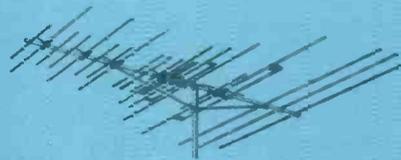


**COLORTRON MODEL C-44 GOLD ANODIZED... \$64.95 list**



Takes up to 400,000 Microvolts input—  
Model AP-20CN  
\$39.95 list

**COLORTRON Twin Nuvistor AMPLIFIER**



**MODEL C-43 \$51.90 list**



**MODEL C-42 \$34.95 list**



**MODEL C-41 \$24.95 list**



**Winegard**  
ANTENNA SYSTEMS

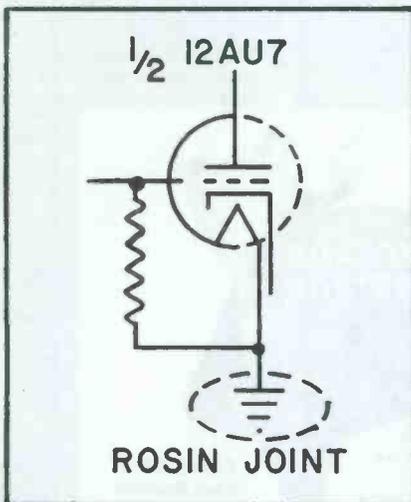
3019-6 KIRKWOOD • BURLINGTON, ICWA  
— for more details circle 41 on post card



## Difficult Service Jobs Described by Readers

### Rosin Joint

An RCA TV KCS83C Chassis was brought into the shop with hum in the picture. All electrolytic filters tested good. The hum remained when all "video-carrying" tubes except the 6X8 and 12AU7 video amplifier tubes were removed. A scope



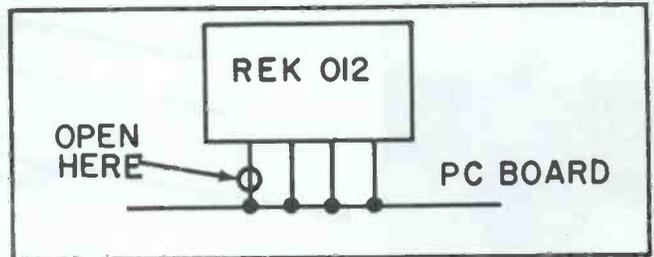
Rosin joint on video tube socket caused ac to be impressed on grid.

showed the hum to be originating in the grid circuit of the 12AU7. The low side of the 470 K grid resistor in this stage shares a common ground-return wire with the grounded side of the filament. The wire was connected to a grounded lug of a nearby capacitor "twist-tab" with an intermittent rosin joint. Resoldering this connection cured the hum.—*Glen H. Bryant, Hoisington, Kan.*

### Open Couplate Lead

This is a tough dog problem which I encountered; A G-E portable TV model 17P1330 was brought into our shop for repair of the audio circuit. The customer complained that the volume would rise and fall five minutes after the

Break in couplate lead caused intermittent sound.



set was turned on, however, after the set had run for a period of time, the volume returned to normal. I tested the tubes, checked the discriminator transformer and associated circuit and also resoldered many connections on the printed board in the audio circuit thinking perhaps it was a faulty joint, however, none of these tests revealed the cause of the trouble.

After some time I found the trouble to be caused by a break in one of the leads to a de-emphasis audio couplate part #REK-012.

This break could not be seen because the broken wire was butted together and appeared to be whole. The other three leads held the couplate firmly in place. — *Verne M. Carlson, Sioux Falls, S.D.*

### Morning Glory Kills Sound

I ran across an unusual situation the other day on a TV call. The customer explained that her color set was not getting channel #12 sound while channel #3 had good sound and picture. Investigating, I found channel #12 a little snowier than usual. I changed both tuner tubes to no avail. Then the customer told me her other set was doing the same thing.

I reasoned that it must be in the antenna system. I disconnected one set from the coupler but had the same symptom. It was pointed out by my associate that a morning

glory vine had grown winding up the lead-in to the antenna. By cutting the vine the sound and picture were restored to normal.—*Wesley Bazell, Yazoo City, Miss.*

### Diode Kills Video

A Magnavox 19 in. table model was brought into the shop with sound — no video on any channels — and a small raster (chassis 34-01-00).

With these symptoms, naturally, power, sweep, video and AGC were checked. My shop man was at the end when I walked in, pointing at the set and explaining the tests made, he threw up his hands and went for lunch.

I fired up the set and took careful notice of all symptoms. Noticing a horizontal drive line I wondered if horizontal oscillator could be weak — although the 6DQ6B didn't show signs of over heating. I took the voltage reading at the

*Continued on page 76*

### TOUGH DOGS WANTED

\$10.00 paid for acceptable items. Use drawings to illustrate whenever necessary. A rough sketch will do. Photographs are desirable. Unacceptable items will be returned if accompanied by a stamped envelope. Send your entries to "Tough Dog" Editor, ELECTRONIC TECHNICIAN, 1 East First St., Duluth 2, Minnesota.

# Find it and Fix it in 1/2 the time!

EASILY SOLVES "TOUGH DOGS"... INTERMITTENTS... ANY TV TROUBLE



MODEL  
1076

## TELEVISION ANALYST

BLACK & WHITE AND COLOR

**By Easy Point-to-Point Signal Injection, You see the Trouble on the TV Screen and Correct it—Twice as Fast and Easy!**

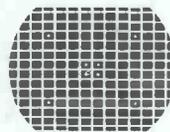
Simplified technique stops lost hours never recovered on "tough dogs", intermittents, and general TV troubleshooting. This one instrument, with its complete, accurate diagnosis, enables any serviceman to cut servicing time in half... service more TV sets in less time... satisfy more customers... and make more money.

With the Analyst, you inject your own TV signals at any time, at any point, while you watch the generated test pattern on the picture tube of the television set itself. This makes it quick and easy to isolate, pinpoint, and correct TV trouble in any stage throughout the video, audio, r.f., i.f., sync and sweep sections of black & white and color television sets—including intermittents. No external scope or waveform interpretation is needed. Checks any and all circuits—solves any performance problem. Gives you today's most valuable instrument in TV servicing—proved by thousands of professional servicemen everywhere.

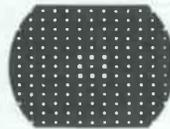
Available on Budget Terms. As low as \$30.00 down.

Net, \$329.95

### SIMPLIFIES COLOR TV SERVICING, TOO



Enables you to troubleshoot and signal trace color circuits in color TV sets, or facilitate installation.



Generates white dot, crosshatch and color bar patterns on the TV screen for color TV convergence adjustments.



Generates full color rainbow display and color bar pattern to test color sync circuits, check range of hue control, align color demodulators. Demonstrates to customers correct color values.

### Time-Saving, Money-Making Instruments Used by Professional Servicemen Everywhere



Model 960 Transistor  
Radio Analyst



Model 360 V O Matic  
Automatic VOM



Model 375 Dynamatic  
Automatic VTVM



Model 700 Dyna-Quik  
Tube Tester



Model 440 CRT  
Rejuvenator Tester

See Your B&K Distributor  
or Write for Catalog AP 20-T



### B & K MANUFACTURING CO.

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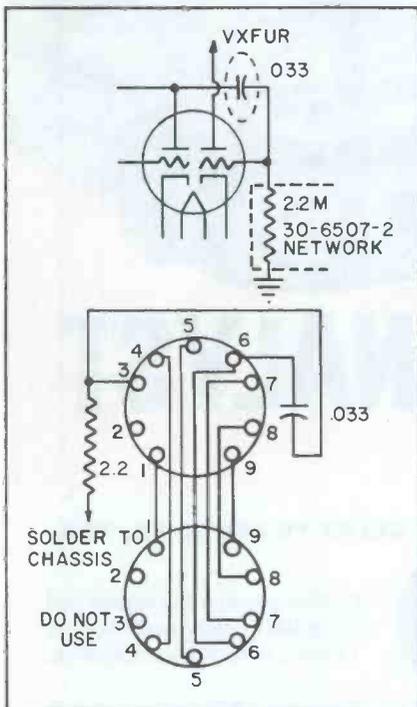
Canada: Atlas Radio Corp., 50 Wingold, Toronto 19, Ont.

# SHOP HINTS

SERVICE TIPS FOR THE PROFESSIONAL TECHNICIAN

## Removing Component Topside

A common affliction of Philico chassis 8L41-2-3 and 8P51 is leaky coupling capacitors from the verti-



Top — Bypassing faulty capacitor in Philico chassis can be accomplished without chassis removal. Cutting marked lead No. 1 on network No. 30-6507-2, above the chassis. This lead is easily reached by pulling the 5U4 removes 2.2  $\mu$  resistor from network. Bottom — Wiring of new circuit.

cal oscillator to the output section causing bottom fold-over. These chassis take time to remove since they are vertically mounted with complex side and front controls. Adapters for the vertical oscillator-output tubes, constructed and wired as shown will "out-circuit" the faulty capacitor. A Vector P-9 plug, a 9 pin miniature socket, 0.033  $\mu$ f, 600v capacitor and a 2.2M,  $\frac{1}{2}$  w resistor are all that is needed. The long leads on the plug permit direct and rigid wiring of the socket. Total cost of this job is \$.93 and 20 minutes of time. A big saving over removing the chassis.—*Philip Ross, Fort Lee, N.J.*

## Color Coding Test Sockets

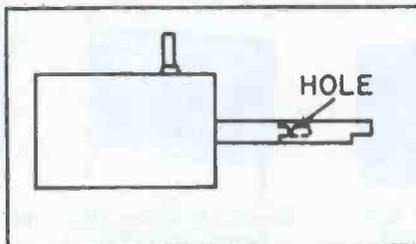
When using test sockets for taking measurements on tube side of chassis, put a dab of paint next to each test point using a standard RETMA color code. This is very helpful in a poorly lighted or crowded chassis to quickly identify pin numbers. Most test sockets have the pin numbers between the two test points and make it difficult to know which way to go. I just paint the even numbers 2, 4, 6, and 8, having no trouble identifying the odd ones falling in between. This has greatly increased my speed and accuracy in taking above chassis measurements. The four colors can be obtained at most dime stores or hobby shops for a dime each. — *General Electric Co., Owensboro, Ky.*

## Tuner Shaft Repair

On Portable TV sets where the Tuner Shaft is insulated from the chassis the shaft sometimes slips where the insulation joins the shaft together.

To repair this trouble, align the shaft so the channel knob indicates the correct channel then drill small dia hole through the shaft. Insert a pin made from a fiber glass rod or other strong non conducting material.

This type of repair can be made

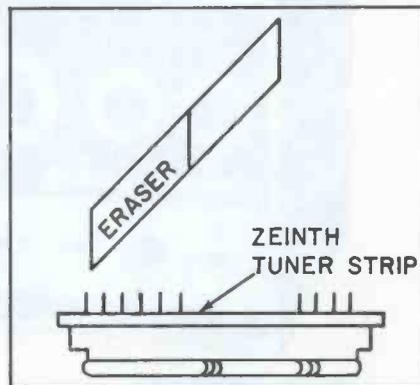


Fiber glass pin prevents slippage on insulated tuner shafts.

strong enough to do the job and still provide isolation from the chassis.—*Carl Adcock, Aurora, Mo.*

## Eraser Cleans Contacts

Older Zenith turret tuners have



Eraser cleans contact strips on pin type tuner strips.

flat protruding contact points. I have found that cleaning a tuner of this type with sprays does not last very long. After disassembling the tuner I use a pointed five cent eraser, and polish each side of each contact. This gives a much cleaner and longer lasting cleaning job.

This works very well on the regular flat contact tuner strip also.—*Darrell Nissen, Jackson, Minn.*

## Bleach Cleans Knobs

A fine way to clean "knurled" knobs consists of "soaking" the knob in full strength Clorox for 15 to 20 minutes. Then remove knob and wash with water.—*Moe Schleicher, White Plains, N. Y.*

## SHOP HINTS WANTED

\$3 to \$10 for acceptable items. Use drawings to illustrate whenever necessary. A rough sketch will do. Unacceptable items will be returned if accompanied by a stamped envelope. Send your entries to Shop Hints Editor, ELECTRONICS TECHNICIAN, Ojibway Building, Duluth 2, Minn. The hints published in this column have not necessarily been tried by ELECTRONIC TECHNICIAN editors and are the ideas of the individual writers.

**FINEST  
MONEY-MAKER  
FOR  
Professional  
Servicemen**

# Multiple-Socket Speed with Gm Accuracy

**PLUS OBSOLESCENCE PROTECTION**

**TESTS**  
All TV and Radio Tubes  
—Old and New

**TESTS**  
Nuvistors and Novars

**TESTS**  
European Hi-Fi Tubes,  
Voltage Regulators, and  
Most Industrial Types

**TESTS**  
the New 10-Pin Tubes

**TESTS**  
for True Dynamic  
Mutual Conductance (Gm)

**TESTS**  
New 12-Pin  
Compactrons



## Model 700 DYNA-QUIK DYNAMIC MUTUAL CONDUCTANCE TUBE TESTER

See your B&K Distributor  
or Write for Catalog AP20-T

**TESTS BOTH OLD AND NEW TUBE TYPES—SELLS MORE TUBES PER CALL**

All over the nation, thousands of professional servicemen rely on the "700". Once you use it, you'll be as enthusiastic as they are. *Everyday use has proved its speed . . . its accuracy . . . its efficiency.* This up-to-date, obsolescence-proof tube tester is designed for maximum use *today and tomorrow.* Provides multiple-socket section to quick-check most of the TV and radio tube types the *true dynamic mutual conductance way—plus* simplified switch section to check new tube types in Dyna-Quik emission circuit. Also includes provision for future new sockets.

Makes test under set-operating conditions. Checks each section of multi-section tubes separately. Checks for *all* shorts, grid emission, leakage and gas. Makes quick "life" test. Exclusive *adjustable* grid emission test provides *sensitivity to over 100 megohms.*

Makes complete tube test in seconds. Checks average set in a few minutes. Discovers weak tubes that need replacement. *Satisfies more customers. Sells more tubes. Saves call-backs. Insures your reputation. Pays for itself over and over again.* Net, \$169<sup>95</sup>

*Time-Saving, Money-Making Instruments Used by Professional Servicemen Everywhere*



Model 960 Transistor  
Radio Analyst



Model 360 V O Matic  
Automatic VOM



Model 375 Dynamatic  
Automatic VTVM



Model 1076  
Television Analyst



Model 440 CRT  
Rejuvenator Tester

**NEW TUBE INFORMATION SERVICE**  
Available every 3 months, on subscription,  
for all B&K Dyna-Quik Tube Testers



**B & K MANUFACTURING CO.**  
Division of DYNASCAN CORPORATION  
1801 W. BELLE PLAINE AVE. • CHICAGO 13, ILL.

— — — for more details circle 14 on post card



*SECO Crystalign Meter Model 500A at \$48.95* — The Model 500 is actually a two-way radio tester and combination crystal checker.

In crystal test functions the unit tests 20-40 Mc overtone types, 1-20 Mc fundamental types and 400-

500 kc low frequency IF types. A factory calibrated accessory is available for testing output of crystals in-circuit.

The Model 500A indicates modulation, RF field strength, audio output (across voice coils) and beat note in RF comparisons. It generates a crystal controlled RF signal with 400 cps tone modulation and serves as a .05 v audio frequency signal source. Current is checked in ranges from 0-5 vdc and 0-1-50-100 ma dc. With the RF probe, the unit can be used as an RF voltmeter for 0-25 v and as an RF wattmeter for 0-10 w.

Two "C" cells are required to operate the transistorized unit. Indications are easy to read on the large diameter, high contrast 3½ in. meter scale.

Accessories available include a factory calibrated RF probe at \$7.95, field strength cable at \$4.95, the Attenuload at \$15.95 which serves as 50 w dummy antenna and 50-5 w attenuator, and special crystals cut to any requirement with .002% tolerance.

The unit can be used for all types of two-way radio, remote control devices and industrial control apparatus.

## TEST INSTRUMENTS

Continued from page 52

### REACTO-TESTER

*For Manufacturer's brochure of this equipment circle 403 on post card.*

*Antronic T-475 Reacto-Tester at \$64.95* — The T-475 CRT tester and rejuvenator checks and reactivates all B/W and color tubes now being used.

Six filament voltages from 2.35 to 12.6 v. The unit checks for opens, shorts, and emission and corrects them when possible. Two stages of reactivation are used for tubes that are "a little off" and for "do or die" cases.

We used the tester on several tubes and were able in some cases to bring tubes which were not usable to a reasonable brightness level. The tester was also used to "even up" the emission in a color tube with reasonable success.

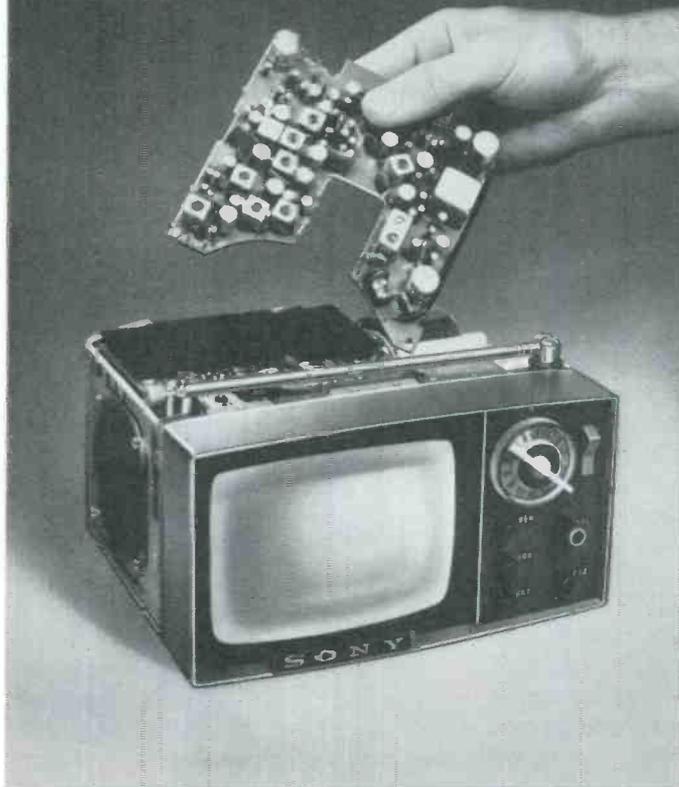
Most technicians are missing the

boat when it comes to CRT rejuvenation. In many cases, the technician rejuvenates a tube but fails to charge the customer. The equipment and time costs you money — so charge for it. In most cases you can offer a money back guarantee for 30 days and a percentage of the cost back when it becomes necessary to purchase a new tube. It's a simple way to assure yourself of a job when the tube finally goes and it builds the customer's confidence.

This is a unit that you can be proud to carry into the home, and one that's easy to use. It is entirely portable and comes in a suitcase type package. The unit measures 10 x 9¾ x 4½ in.



# Easy to Service



# Easier to Sell...



## SONY MICRO-TV...the only TV of its kind tested in thousands of American homes

SONY MICRO-TV is the easiest set to service. Practically all components (including the 25 transistors) are mounted on two snap-out printed circuit boards. Standard trouble-shooting techniques will isolate the defective component, and permit quick replacement. It's also the easiest TV set to sell. Just a demonstration of the remarkable picture and the incredibly small size and weight (only 8 lbs.) practically

guarantees a "second-set" sale for use indoors or outside. Micro-TV is also the most versatile TV on the market. Since it operates on its own rechargeable battery pack, 12v power and AC, it can be used nearly anywhere outdoors, in the back of a car\* or boat, and indoors, with equal ease. It is, truly, the Television of Tomorrow.

**SONY**  
RESEARCH MAKES THE DIFFERENCE

Rechargeable battery, accessories extra. **\$189<sup>95</sup>**

*\*Before installing or using a TV set in an automobile, check with your Motor Vehicle Bureau to verify permissibility.*

**SONY CORPORATION OF AMERICA**  
580 Fifth Avenue, New York 36, N.Y.  
Regional Offices  
Western: 500 West Florence Avenue, Inglewood, Calif.  
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Please send me more information on how I can become a selected SONY dealer.

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SONY Corp. of America, Dept. ET-6, 580 Fifth Ave., New York 36, N.Y.

# NEW PRODUCTS

FOR MORE INFORMATION CIRCLE PRODUCT NUMBERS ON POST CARD FOLLOWING PAGE 82

## RADIO-PHONO 200

The SWING-ALONG, Model 6550 is claimed to be the "teen-age rage" in Europe. In making pos-



sible both live and recorded music in a 2-in-1 cordless combo, the unit reportedly offers a host of different features which, the company feels, should also made the SWING-ALONG extremely attractive to the American "Swing-Age Market." Specifically, the unit is a 6-Transistor Fringe-Area Radio combined with a 45 RPM precision phono with an "invisible" tone arm. The unseen tone arm ingeniously plays from underneath the record. The phono reportedly will play on end while user is carrying it like a briefcase, and will even work upside down without damage to phono or radio. The Swing-Along which carries a 90-day free repair warranty, can be sent directly to the manufacturer or serviced locally. It lists for \$79.95. Channel Master Corp.

## AVALANCHE RECTIFIER 201

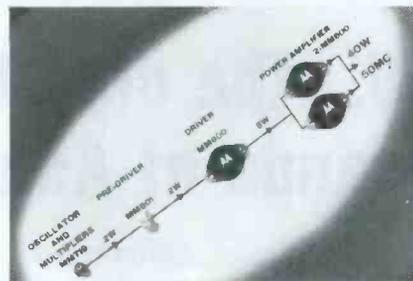
Control of the reverse breakdown voltage regulation characteristic within 10 v maximum, in the ava-



lanche region, is the main feature in a new line of silicon flangeless rectifiers. The close control of this dynamic reverse characteristic is said to provide greater junction uniformity, surface stability, and increased transient voltage protection. In addition to a general purpose series, the rectifiers are also available in a line specially designed for high temperature applications. The latter reportedly features a guaranteed forward voltage drop of 1.2 v maximum at 1 amp, and a guaranteed reverse current of  $1\mu\text{a}$  maximum at  $25^\circ\text{C}$  ambient temperature, at the rated peak reverse voltage. Atlantic Semiconductor, Inc.

## VHF POWER TRANSISTORS 202

A line of silicon transistors consists of four devices including: a 15 w and a 10 w, 50 Mc power amplifier, a 3.5 w driver/amplifier and an oscillator/multiplier. These de-



vices reportedly represent the first complete line of transistors for high-power, high-frequency transmitter applications to be put in mass production. The new 50 Mc power devices, types MM800 and MM799, have a guaranteed power gain of 7 db at 15 w power output and 5.2 db at 10 w power output respectively. The MM800 has a guaranteed rated carrier power of 20 w at 50 Mc. In 50 Mc FM or CW transmitters, two MM800 devices will produce a power output of 40 w with an 8 w drive signal while operating from a 28 vdc source. In AM transmitters operating at 30 Mc from a 15 vdc source, two devices provide 30 w of power when 100% modulated. The MM801

has a guaranteed power gain of 10 db for a 3.5 w power output at 50 Mc. It is rated at a maximum power output of 5 w. The MM719 "STAR" passivated amplifier transistor is designed to deliver 70 mw at 60 Mc. Motorola Semiconductor Products Inc.

## LUBRICANT 203

This non-staining, dry-lubricating powder of TFE "Teflon" is called Fluoro-Glide 200 and reportedly



imparts the unmatched low friction character of the slippery plastic to all sprayed surfaces. The white powder clings electrostatically to virtually all materials, to lubricate where oils, greases, waxes and graphite are inefficient or cannot be used. Since its static and dynamic coefficients are essentially equal, Fluoro-Glide 200 does not exhibit stick-slip characteristics. The powder possesses the near-universal chemical inertness of TFE "Teflon", as well as its high temperature resistance and toughness. The price of a squeeze bottle containing 10 grams is \$0.98. Chemplast, Inc.

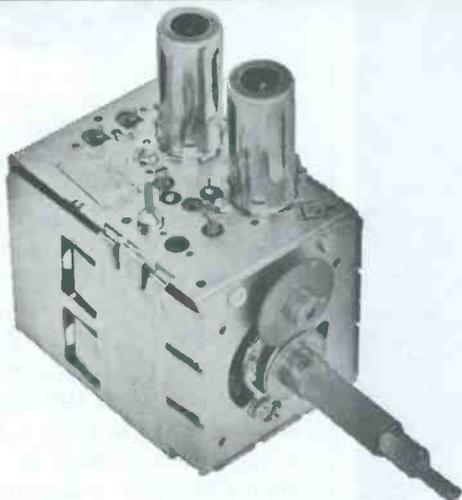
## SPECIAL EFFECTS 204

Color-blended patterns and hues of reds, greens and blues are combined for home or commercial display by this device. Known as the



Prices effective January 1, 1963

Tarzian offers  
**FAST, DEPENDABLE  
TUNER REPAIR  
SERVICE** (ALL  
MAKES)



It just makes sense that a manufacturer of tuners should be better-qualified, better-equipped to offer the most dependable tuner repair and overhaul service.

Sarkes Tarzian, Inc. pioneer in the tuner business, maintains two complete, well-equipped Factory Service Centers—assisted by Engineering personnel—and staffed by specialized technicians who handle **ONLY** tuner repairs on **ALL** makes and models.

Tarzian-made tuners received one day will be repaired and shipped out the next. Allow a little more time for service on other than Tarzian-made tuners.

Tarzian offers a 12-month guarantee against defective workmanship and parts failure due to normal usage. And, compare our cost of \$9.50 and \$15 for UV combinations. There is absolutely no additional, hidden charge, for **ANY** parts except tubes. You pay shipping costs. Replacements on tuners beyond practical repair are available at low cost.

Ⓢ Tarzian-made tuners are identified by this stamping. When inquiring about service on other tuners, always give TV make, chassis and Model number. All tuners repaired on approved, open accounts. Check with your local distributor for Sarkes Tarzian replacement tuners, replacement parts, or repair service.

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## NEW PRODUCTS

Colorsound Translator 3500, each individual unit operates up to 500 w per color with a combined output of 1500 w. This high output gives the user ample versatility for deploying Colorsound in a manner that pleases his taste. Although each translator has a special output socket at the rear of the chassis, the unit is also equipped with three separate ac type sockets, one for each

color channel, enabling the user to create his own lighting arrangement. Colorsound can be installed with any high fidelity, stereo or sound system, regardless of make or style. Suitable phone type output jacks, low level — 100 K ohm impedance, 0.01 v for full output or high level — 500K ohm impedance, 0.1 v for full output, are located at the rear of the translator. Measuring 13 $\frac{5}{8}$  in. wide, 8 $\frac{5}{8}$  in deep, 5 $\frac{1}{2}$  in. high, it weighs 9.5 lb. Net price is \$225. Decorator lamps and accessories are optional. Colorsound, Inc.

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## DIODE ANALYZER

205

A diode analyzer includes tests for Zener diodes, silicon and germanium power diodes and signal



diodes as well as selenium rectifiers. The Model 210 provides a 0-1-10-30 amp forward voltage drop test, a 0-150 v and 0-1500 v reverse current leakage test and 0-30 v and 0-300 v zener saturation knee test. It tests a wide range of diodes from 20 ma to 30 amp and from 0 to 1500 v. Zener diode test range is from a fraction of a volt to 300v and up to 100 ma. Selenium rectifier range is from a fraction of a volt forward drop to 300 v. A manually reset over-current relay is incorporated in the 10 and 30 amp circuit. Five sources of power are incorporated in the Model 210 circuit to provide over a dozen combinations to test voltages and currents. All are controlled by a variable voltage control on the primary of the transformer. Information is displayed on two calibrated mirrored scale meters. Price is \$154.95 net. Seco Electronics, Inc.

## BROADBAND AMPLIFIER 206

A broadband TV-FM amplifier, the MLA-FM, is a high gain, high output VHF amplifier especially designed to overcome coaxial cable and distribution system losses in television and FM master antenna



# STEREO



## Let **RCA** equip you with **EVERYTHING YOU NEED FOR STEREO SERVICING**

RCA—entertainment leader of the world—now offers you a complete set of test instruments to put you in the stereo servicing business. And now's the time to get in because it's growing bigger and more profitable by the day.

### **A. NEW! RCA WR-51A FM STEREO SIGNAL SIMULATOR**

Generates signals necessary to service and maintain stereo multiplex FM receivers and adaptors. Generates...Choice of 4 FM signals—Left Stereo, Right Stereo, Special Phase Test, Monaural FM • Choice of 8 sine-wave frequencies (400 cps, 1Kc, 5Kc, 19Kc, 28Kc, 38Kc, 48Kc, 67Kc) available separately or for modulating FM signals • 100 Mc carrier tuneable  $\pm 0.8$  Mc to permit selection of a quiet point in the FM band • 19 Kc subcarrier, crystal-controlled within  $\pm 2$  cps • 100 Mc sweep signal adjustable from 0-750 Kc at 60 cps rate • Choice of 3 composite stereo output signals—Left Stereo, Right Stereo, Special Phase Test • Choice of 3 sine-wave frequencies for composite stereo

signals • Crystal controlled markers for receiver if and rf alignment • Zero-center meter for checking the balance of stereo amplifier output. **\$249.50\***

### **B. RCA WA-44C AUDIO GENERATOR**

Generates sine-wave and square-wave signals over range of 20 to 200,000 cps to test audio systems. Can be used to measure intermodulation distortion, frequency response, input and output impedance, speaker resonance, transient response and phase shifts. Less than 0.25% total harmonic distortion over range of 30 to 15,000 cps. **\$98.50\***

### **C. RCA W0-91A 5" OSCILLOSCOPE**

A high-performance, wide-band 'scope—serves as a visual VTVM. Choice of wide band (4.5 Mc—0.053-volt rms/inch sensitivity)

or narrow, high-sensitivity band (1.5 Mc—0.018-volt rms/inch sensitivity). New 2-stage sync separator provides solid lock-in on composite TV signals. **\$249.50\***

### **D. RCA WV-98C SENIOR VOLTOHMYST®**

For direct reading of peak-to-peak voltages of complex waveforms, rms values of sine-waves, DC voltages, and resistance. Accuracy: 3% full-scale on both AC and DC, with less than 1% tracking error. Color-coded scales differentiate peak-to-peak from rms readings. New 0.5 volt full scale DC range for use with low-voltage transistor circuits. 6½" meter. **\$79.50\***

### **E. RCA WV-76A AC VTVM**

Measures voltages down to 0.001 volt. Decibel scale for measure-

ments from -40 to +40 db. Built-in amplifier which may be used separately as a preamplifier. Typical applications include: frequency response tests of preamplifiers, power amplifiers and tone control circuits, signal tracing; measurements of audio level, power level and gain; amplifier balancing applications and general audio voltage measurements. **\$79.95\***

### **F. RCA WG-360A STEREO PHASE CHECKER**

A quick, simple, positive way to check phase alignment of low and mid-range speakers in stereo systems. Completely "sound-powered". Snag-proof recessed grille design. For use with a VOM, VTVM, or oscilloscope. **\$14.95\***

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RCA Electron Tube Division, Harrison, N. J.

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# NEW COMPLETE 2-WAY RADIO LAB SELLS FOR JUST \$48<sup>95</sup>

## FEATURES

- Tests crystals in or out of circuit
- Indicates modulation
- Indicates RF field strength
- Indicates audio output across voice coil
- Generates crystal controlled 400 cps mod. RF signal
- Serves as .05 V audio frequency signal source
- Checks 0-5 VDC and 0-1-50-100 maDC current ranges
- Can be used as 0-25 V RF voltmeter with accessory probe
- Can be used as 0-10 W RF power meter with accessory probe

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## WIDE APPLICATION

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- Police or fleet radio
- Remote controls
- Garage door openers
- Industrial apparatus

## ACCESSORIES

Get extra use from your Model 500A with these handy accessories: RF probe, field strength cable, attenuator and special crystals cut to .002% accuracy. Write now for full details.

### Model 500A \$48.95 Net

\$55.95 net with accessory probe



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## NEW PRODUCTS

systems without signal degradations, according to the manufacturer. The device consists of two amplifying sections: one covering TV channels 2 to 6 plus FM, and a similar section for TV channels 7 to 13. Each section features an individual gain control and a pre-set control for bandpass tilt alignment. This reportedly provides a large degree of flexibility for balancing the signal strengths of different TV channels in any system. It also compensates for coaxial cable losses which are higher at the upper channels. Gain is over 33 db on channels 2 to 6 and FM; and 40 db on channels 7 to 13. Price is \$101. Blonder-Tongue Labs, Inc.

## CRT BRITENERS 207

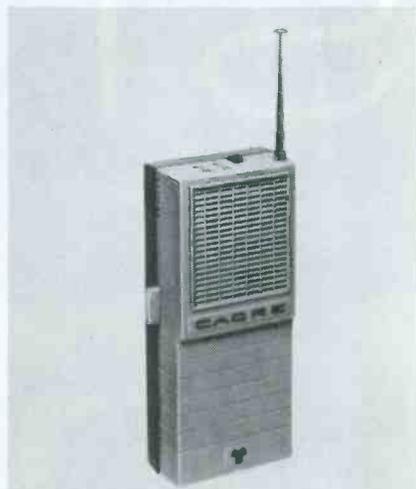
While supplies last, a package of Four Seasons "Perfect-Pair" Spin-Cast fish-lures will be included with



each \$9.95 pack of twelve C401 Vu-Brites for parallel wired TV sets and each pack of twelve C402 Vu-Brites for series wired sets. According to the manufacturer, the lures are tested and proven fish-getters, and come with complete instructions for getting maximum fishing results. "This makes them a perfect companion to our Briteners," a company spokesman said, "since results in hundreds of thousands of TV sets demonstrate the Vu-Brite's effectiveness." Distributors now have the special Vu-Brite packages with the fish-lures in stock. Perma-Power Co.

## CB RADIO 208

Said to be the most powerful hand-held, portable CB transceiver available today, the C-75 features a

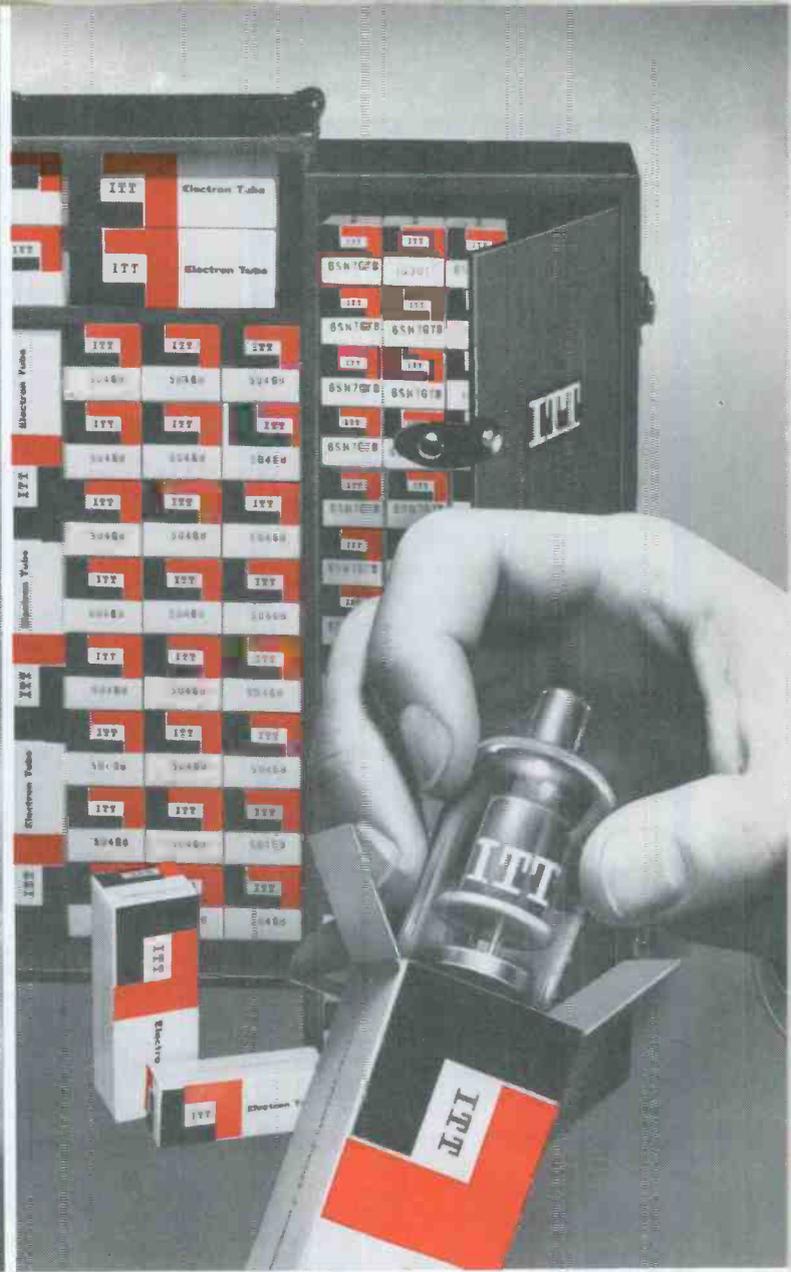


1.5 w transmitter input power. This completely transistorized unit (11 transistors, 2 diodes) reportedly has a range of five miles in virtually all operating conditions. The C-75 is available with rechargeable batteries and can be used as a base station while recharging. The unit can also be operated from penlight cell batteries. Total weight of the unit, with rechargeable batteries, is 2 lb. The C-75 has a suggested retail of \$109.95, and with two nickel cadmium batteries and recharger \$139.95. Cadre Industries Corp.

## TAPE STORAGE UNIT 209

The "storette" cabinet is designed for businesses which store small quantities of tape. Each unit will hold a maximum of 36 rolls of either 5 in. or 7 in. sound tapes, or 10 6½ in. video spot announcement reels. The units stack or interlock so that space may be easily increased for storing larger quantities of tape. Each unit is self-standing, with protective feet to prevent sliding or marking desks and table tops. The back is key slotted so the unit may be hung on a wall. The units, which usually are valued at \$12.95 each, will be available at a special





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ITT batteries—penlites, C, D, and 9-volt miniatures — now offer the same “extra value” and acceptance already experienced with fast-moving ITT Receiving Tubes.

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**AEROVOX MYLAR® BYPASS CAPACITORS PROVIDE SUPERIOR PROTECTION FOR EVERY SERVICE JOB!**



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**AEROVOX CORPORATION**

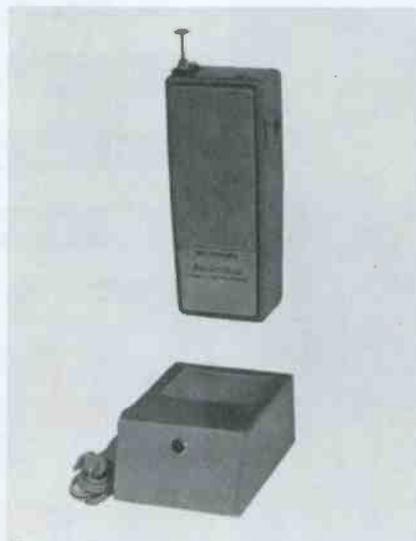
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Technical Leadership—Manufacturing Excellence

## NEW PRODUCTS

price of \$6.95 to the purchases of 36 rolls of either 5 or 7 in. reels of "Scotch" brand professional recording tapes. Minnesota Mining and Manufacturing Co.

### CITIZENS' BAND 210

The Realistic Model TRC-2 is a 9-transistor portable radio which runs on self-contained batteries or



uses a 117 vac power supply converter to run on house current. Special features of the TRC-2 include push-to-talk operation, all-transistor operation with 9 transistors and 1 diode, long-short range control for sharp reception at every distance, small size (only 6¼ x 2¾ x 1½ in.) and lightweight (about 2 lb). The TRC-2 sells for \$39.95. The ac/dc power supply converter, with special plug-in receptacle sells for \$6.95. Radio Shack Corp.

### UHF CONVERTER 211

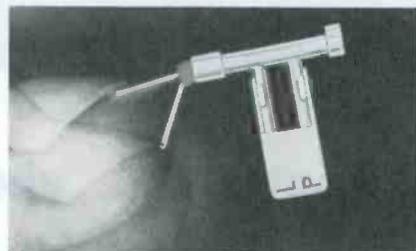
The Ultra-Vista is claimed to be the only converter on the market with a built-in stage of UHF pre-amplification. This "top-of-the-set" converter also is claimed to feature slide-rule tuning — tunes as easy as a radio. The circuitry is new to the converter market. It combines a frame-grid tube, a nuvistor, a diode and a transistor — for a unit with low-noise and high-gain characteristics. Designated the Model UVC-7083, it uses a 6DL4/



EC88 frame-grid tube as the RF preamplifier — boosting weak antenna signals before applying them to the mixer diode. The mixer-diode is the K3D, a silicon crystal type presently used in radar receivers for low noise figure and long life. The Ultra-Vista reportedly conforms to the FCC rules for radiation. Input impedance is 300 ohms with a VSWR of 1.5 maximum. Output impedance is 300 ohms. List price is \$49.95. Distributor Sales Div., Jerrold Electronics Corp.

### FLEXIBLE PHONO NEEDLE 212

Bend it, knock it or flick it — the "SONO-FLEX" reportedly springs back into playing position without damage. A special formulated butyl rubber makes possible the flexing action of the "SONO-FLEX". This rubber expansion link between the stylus and lever arm of the needle assembly gives the needle the springiness that enables it to



withstand rough treatment. The new unit has an increase of 40% in cartridge compliance compared with previous specifications. This high compliance complements the low effective stylus mass so that mechanical impedance is minimized over the entire recording range. This increases record life as well as stylus life. Sonotone Corp.

### COLOR TELEVISION 213

Three 21 in. lowboy color television sets feature two-knob control intensities and hues. An additional feature is all channel UHF convertability which can be accomplished in the home by the techni-

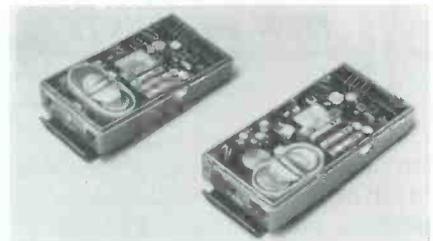
cian, without the addition of cumbersome attachments or change in the appearance of the set. Similar to the company's black and white models introduced last December, the UHF conversion can be accomplished at the customer's convenience, through the addition of a UHF modification kit. The new color sets also may be ordered with UHF, factory installed. The new color sets carry manufacturer's suggested list prices of \$599.95 for model 21LC11 in Danish Modern; \$629.95 for model 21C12 in Early



American, and \$725.00 for model 21C14 in Italian Provincial. The UHF conversion kit carries a manufacturer's suggested list price of \$30. Sylvania Electric Products, Inc.

#### RADIO PAGING SYSTEM 214

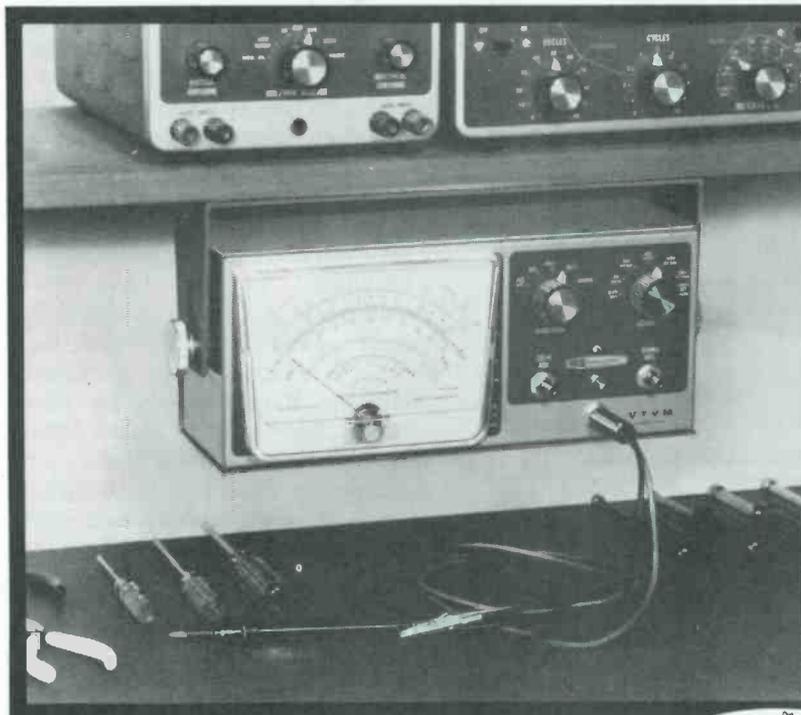
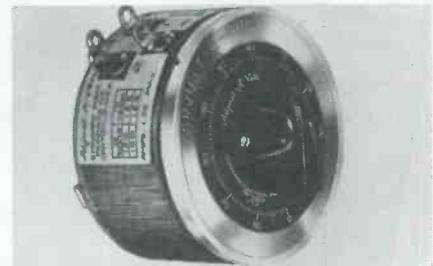
The "Messenger" Selective Radio Paging System is designed to alert selected individuals by a radio "tone" or voice message broadcast from a central point directly to a tiny pocket receiver carried by the individual. The "Messenger" system utilizes a tiny "pocket" receiver, a selective call encoder and a 25 to 54 Mc remotely controlled AM base station transmitter. By simply keying a number on the "Messenger's" master encoder console, a receptionist or switchboard operator instantly alerts the *one* man she wants through his personal receiver and talks directly to him, if necessary. Two different personal receivers are available with the "Messenger" system — one is alerted with a "tone"; and the other is alerted with a "tone" and is able



to receive a voice message as well. E. F. Johnson Co.

#### VARIABLE TRANSFORMER 215

The 175 series of "Adjust-A-Volt" units is enclosed in a 2-13/16 in. dia, 2-3/32 in. deep envelope. This ac unit, with relatively low wattage requirements, is said to be a more efficient replacement of bulky rheostats or other resistive type controls. Features of the open unit for panel mounting include:



## Service Bench VTVM

- UNIQUE MOUNTING—
- BIG 6" METER—
- BIG VALUE—

### New from Heathkit

World's biggest value in a Service Bench VTVM! . . . the new Heathkit model IM-13! Time-proven circuitry, high accuracy and dependability plus brand new styling for added convenience and versatility. Look at these features . . . new low-profile styling and "gimbal" mount for convenient under shelf, bench top or wall mounting for best viewing . . . new 10 turn vernier Zero and Ohms adjust controls for smooth, accurate zero settings . . . new single AC/Ohms/DC test probe for added convenience plus a big 6" 200 ua meter for fast, accurate readings. Meter tilts to any angle for best reading and to eliminate light reflections. Measures AC (RMS) & DC volts to 1500 volts in 7 ranges, Resistance to 1000 megohms in 7 ranges and DB in 10 DB steps. Separate 1.5 and 5 volt AC scales are provided for accurate low level AC measurements. Test leads included. 5 lbs. Kit IM-13 . . . no money down, \$5 mo. . . . **\$32.95**

#### NEW SPECIAL VALUE PRICE \$24.95 FOR HEATHKIT'S WORLD FAMOUS VTVM

Measures AC volts (RMS), AC volts (peak-to-peak), DC volts, Resistance and DB. 4 1/2" 200 ua meter, precision 1% resistors, single AC/Ohms/DC test probe. Easy circuit board assembly. Kit IM-11, \$5 mo. \$24.95. Assembled IMW-11, \$5 mo. \$46.75



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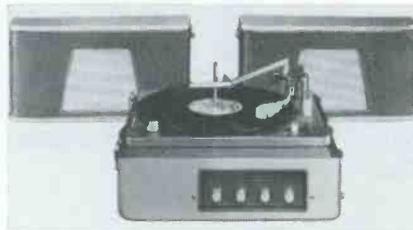
Prices subject to change without notice. Dealer and export prices slightly higher.

## NEW PRODUCTS

strong metal base; easily replaceable brush of new design and soldered or push-on connections. The 50/60 cps unit is \$8.50 with delivery from distributor. Staco, Inc.

### STEREO PHONO 216

A fully automatic 4 speed portable stereo phonograph reportedly is engineered to deliver the fidelity



and room-filling "Music-In-The-Round" usually accomplished only by full size console units. Weighing only 24 lb, the portable carries in a compact case about the size of a portable typewriter. It takes a stack of up to 10 records — automatically intermixing 7, 10 and 12

in. sizes — with push button starting and reject and automatic shut-off after the last record has played. Manufacturers suggested list price is \$139.95, with full mark-up to dealers. Mercury Phonographs.

### ELECTROSTATIC TWEETER 217

Known as the JanKit 51, this speaker uses the JansZen Electrostatic mid and high frequency tweeter in a single radiator version that reduces cost and cabinet space requirements. The electrostatic tweeter is acoustically paired in with an

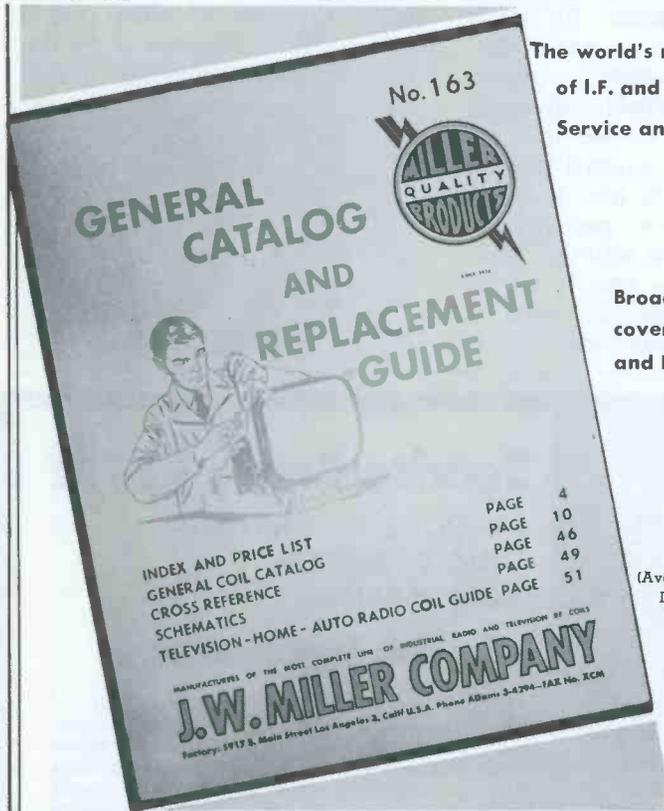


eleven-inch Model 350A dynamic woofer designed to provide low frequency reproduction which complements the aural characteristics of the tweeter. The entire frequency spectrum from 30 to 30,000 cps is said to be covered with low distortion when enclosed in simple, infinite-baffle cabinets as small as 2 cu ft. The special reflective tweeter housing provides a way of acoustically "curving" the flat surfaces of a standard JansZen Electrostatic radiator. It reportedly provides 72-degree sound dispersion and high electrical efficiency that previously could be achieved only by using multiple, flat radiators aimed directly at the listener. Price of the complete JanKit 51 is \$94.95 including a built-in power supply and high-pass filter. Neshaminy Electronic Corp.

### COLOR BAR GENERATOR 218

The model number CG126, uses the same counting circuits as the firm's CA122 to provide keyed color bars at NTSC phases, adjustable white dots, crosshatch, vertical bars and horizontal bars. Desired pattern is selected by connecting the CG126 to the antenna terminals, setting the TV to Channel 4 and

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## MOVING?

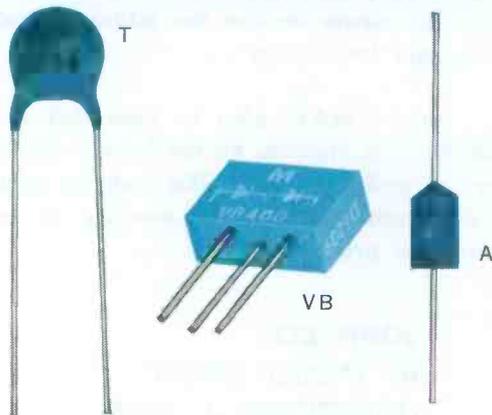
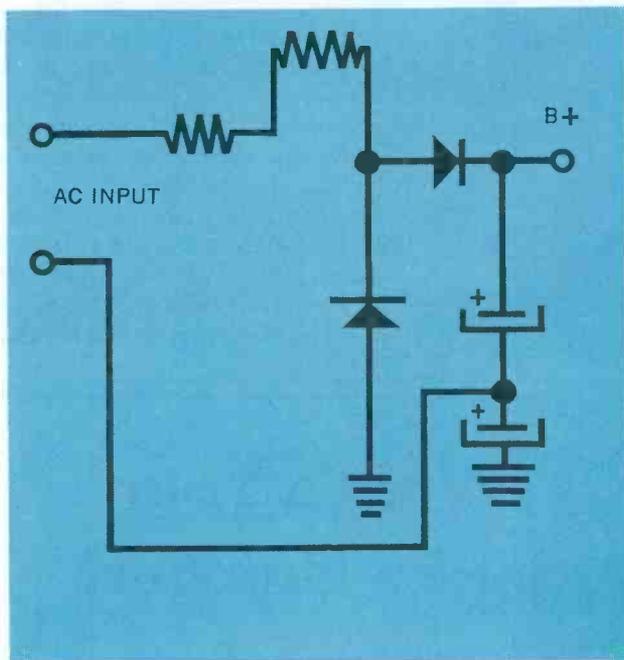
Be sure to let us know your new address at least 6 weeks in advance. And please enclose a complete address label from one of your recent issues.

### ELECTRONIC TECHNICIAN

OJIBWAY BLDG.

DULUTH, MINN.

## Replacing selenium with silicon rectifiers



Ever wonder about replacing those old selenium rectifiers with modern silicon rectifiers? Stop wondering. It's being done every day and you can do it too! Take a typical TV voltage doubler circuit for example.

1. You know the seleniums are bad or you wouldn't have started . . . right? Right.

2. Forget about the terrific size difference between the new silicons and those old seleniums. Silicons are smaller because they're *much* more efficient.

3. Remove the old seleniums and toss 'em in the trash can. Install the new silicon rectifiers **FOLLOWING POLARITY VERY VERY CAREFULLY**. The slick way is to use a Mallory VB500 (you'll have one less solder connection to make and the circuit is right on the rectifier). Or you could use a pair of 1N2095's or A500's. Either way those Mallory rectifiers will give you the *best* service you'll ever get.

4. Output voltage (B+) will *usually* be higher because silicon rectifiers are more efficient. So, you'll probably need a dropping resistor in series with the one already there. Turn the set on and check with a voltmeter. Suppose B+ reads 20 volts higher than the schematic calls for. Divide this increase by load current (perhaps 500 ma) to get the value of the resistor you'll need. (40 ohms in this case.) Now multiply the voltage increase by current to get wattage rating (10 watts in this case).

5. But suppose B+ voltage *isn't* higher. This is a clue that something's wrong with the filter capacitors. Check them out with a capacitance bridge or try this very simple deal. Parallel a good TC62 (10 mfd @ 350 WVDC) across each filter in turn. If you get a marked B+ increase you need some replacement electrolytics. We'd suggest a Mallory FP, WP, W, or TC of the proper rating.

6. If you'd like a lot more detail on this replacement arrangement, drop us a line and we'll send a folder by return mail. Meanwhile see your Franchised Mallory Distributor for all Precision Mallory Components . . . batteries, capacitors, controls, switches, resistors, semi-conductors and vibrators.

## NEW PRODUCTS



dialing any of the five patterns. Signal output is adequate to over-ride most local channels. Other low channels can be selected if desired by simple slug adjustment in rear. Stability is said to be insured by crystal controlled circuits, factory pre-aged vacuum tubes and standby position on the on-off switch. The CG126 weighs less than 10 lb. and measures only 11 x 8 x 6 in. providing portability for home or shop service. The CG126 color bar dot generator sells for \$99.50. Sencore.

## CRYSTAL TEST SET 219

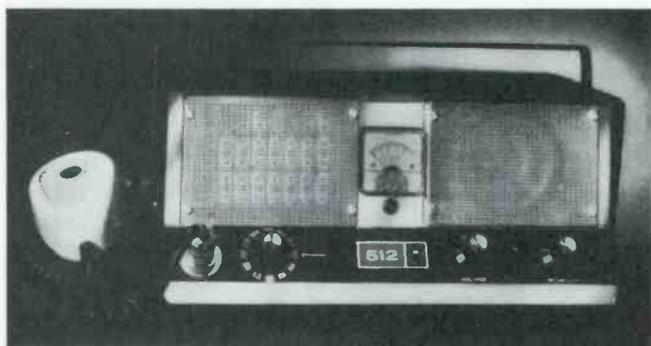
A two-way radio tester and combination crystal checker is called the Crystalign Meter Model 500A. The unit features accessories for in-circuit crystal testing and several field and current indications. As a crystal test set, the Model 500A tests 20-40 Mc overtone types, 1-20 Mc fundamental types and 400-500 kc low frequency IF types. A factory calibrated accessory is available for testing radio frequency output of crystals in-circuit. It indicates modulation, RF field strength,



audio output across voice coil, and beat note in RF comparisons. It will generate a crystal controlled RF signal with 400 cps tone modulation and will serve as a 0.05 v audio frequency signal source. It retails for \$48.95 net. Seco Electronics Inc.

## THIN COLUMN SPEAKERS 220

The name CALSTAR is said to denote Constant-Angle Lobe-Suppressed Twin-Array Reproducer. To maintain constant coverage angle at increasing frequencies a progressively shorter array is desired, according to the manufacturer. In a CALSTAR column an array of small woofers sets the desired angle and a separate and shorter array of tweeters in the same cabinet provides the first approximation. "Tailoring" the exact input signal distribution to each individual speaker unit in each of these two arrays provides the final shaping of the radiation pattern to achieve both objectives. Two models are being offered. Model 55 with five woofers and five tweeters,



List Price \$149.50

## HALLMARK 512

UNEXCELLED IN PERFORMANCE, STYLING  
AND RUGGED RELIABILITY!

Today's best selling CB from Hallmark features dual-power, 12 channel crystal-controlled, push to talk operation. Sensitivity better than 0.3 $\mu$ v for 10 db S/N ratio. Selectivity better than 30db. RF power over 3.2 watts. Audio power 3 watts. Top-quality components in rugged hand-wired chassis. 26.965 to 27.255 mc. High-level modulation, improved low-noise front end. "S" meter and neon modulation indicator standard.

### NOW FROM HALLMARK! NEWEST ADVANCE IN IMPROVED MULTI-PURPOSE TRANSCIVER TESTERS!

Price \$ 49.50



A precision instrument designed to assist the technician in installation and servicing of low power transceivers. Measures: RF power (absolute) 0-5 w.; 0-120% amplitude modulation; VSWR; Produces a 100mw carrier (with or without amplitude modulation of a 1000 cps tone) for checking receivers; Use as a field strength meter.



**HALLMARK INSTRUMENTS**  
6612 DENTON DRIVE, DALLAS 35, TEXAS

for more details circle 20 on post card

## What's Your Lucky Number?

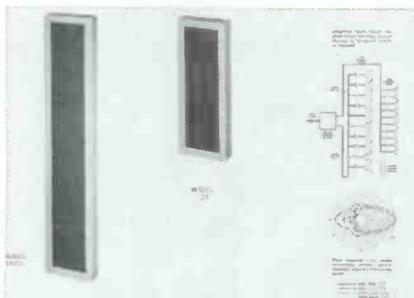
Whenever you write us about your subscription, please enclose the address label from your latest copy . . .

. . . or AT LEAST give us your address exactly as it appears on the label, including the code number. The code is your lucky number because it enables us to serve you promptly.

**JOHN DOE**  
67 MIDDLE STREET  
HOMETOWN 3, OHIO  
132-116-X-12XX9-14

## ELECTRONIC TECHNICIAN

Ojibway Building, Duluth 2, Minnesota



has vertical coverage angle of 60 deg and a power rating of 30 w. It is designed for the high ceiling multi-balcony type hall. The Model 1010 with a total of 20 units has vertical coverage angle of 30 deg and power rating of 60 w. Commercial Sound Products Dept., Jensen Mfg. Co.

#### TRUCKS AND WAGONS 221

A 25% more powerful engine for trucks and station wagons is said to provide increased versatility and



reserve power for those box-shaped vehicles. The new engine has 91.1 cu in. displacement and develops 50 horsepower compared with the 72.7 cu in. displacement and 40 horsepower of the standard engine. Both engines have four horizontally opposed air-cooled cylinders. Brakes on the more powerful trucks have been increased in size to provide safety margins at the higher speeds. Trucks line include standard panel delivery trucks with 1830 lb payload capacities and both single and double-cab pickup trucks. Station wagons include the Kombi which can be used either as a station wagon or panel truck and both standard and deluxe station wagons seating up to eight people and carrying payloads up to 1632 lb. Volkswagen of America.

#### TUNER KIT 222

Retailing for only \$109.95, this tuner kit includes "Time-Switching" multiplex circuitry, precision tuning indicator and separate level controls for perfect channel balancing, according to the manufacturer. This kit, called the model LT-111,

comes with a full color instruction book. The high conductivity copper RF front end is pre-wired and aligned at the factory. All wires are pre-cut and stripped. Usable sensitivity is 4.0  $\mu$ v, signal-to-noise ratio is 55 db, harmonic distortion is 0.8%, drift, 0.2%. Capture



ratio is 6 db, selectivity 32 db, IM distortion, 0.3% (CCIF) and separation is over 30 db. H.H. Scott Inc.

#### CB TRANSCEIVER 223

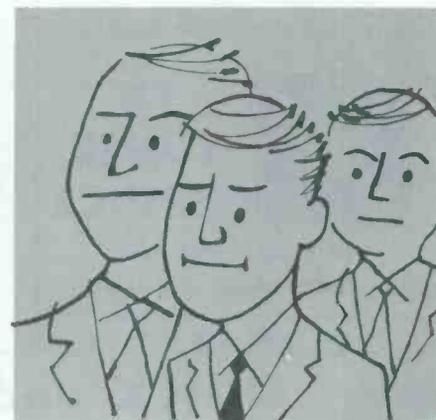
Designated the "Range Gain" Transceiver, this unit reportedly achieves coverage of up to four times that of other CB units. An exclusive "Double Side Band Reduced Carrier" feature is said to make the horizon a reasonable operating range for citizens band communication. The unit delivers maximum power within FCC re-

## There are 2 Kinds of Radio-TV Servicemen-

Those who use  
**QUAM**  
replacement loudspeakers



Those who use  
other brands of  
replacement loudspeakers



We're proud to say that  
this group is bigger\*

- \* According to the findings of Brand Name Surveys, Chicago, Illinois in March and April 1963, more servicemen prefer Quam speakers than all other replacement brands combined. Major reasons stated for the preference: Quality! Availability! Performance!

#### QUAM-NICHOLS COMPANY

226F E. Marquette Road, Chicago 37, Illinois

... for more details circle 32 on post card

## NEW PRODUCTS



gulations. All 23 citizens band channels can be selected with a single control for both transmit and receive. Equipped with a dual power supply the Range Grain unit can be either as a mobile or base station. It weighs 13 lb and is 11 in. wide

### A SIMPLE SOLUTION

That Solves All Your  
TV Tuner Problems

One Price **8.95** All Makes

P & H replaces all defective parts, (tubes and major parts extra) and aligns tuner to exact, original specifications.

Send us your defective tuner complete; include tubes, shield cover and any damaged parts with model number and complaint.

Try our service and prove to yourself you simply can't afford to handle your tuner problems any other way.

Your tuner will be overhauled and returned promptly, performance restored, aligned to original standards and warranted for 90 days.



## TV TUNER SERVICE

118 Third Street West  
TWIN FALLS, IDAHO

for more details circle 40 on post card

x 4½ in. high x 8¾ in. deep. Regency Electronics.

### CLEANING KIT 224

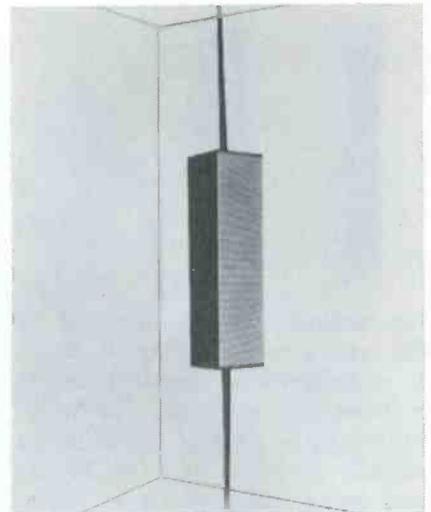
A kit for the preservation of all types of phonograph records is enclosed in a plastic package which measures approximately 13 x 13 in. The package is designed to fit any record browser made for 12 in. LPs and it is also holepunched for pegboard displays. Included in the kit are: 12 contour record covers, wiping pad, 45 rpm adaptors, "electro-wipe" cleaning cloth, needle cleaning brush, selecto-brush



(which hooks into tone arm), needle replacement screwdriver, mirror and a bottle of anti-static detergent. The kit is available for immediate delivery and retails for less than \$6. Duotone Co.

### SPEAKER ENCLOSURE 225

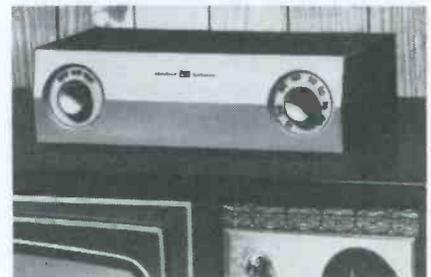
A high-fidelity speaker enclosure of unusual design is called the "Stereo Master." It is pole-mounted with a spring-loaded top section enabling it to fit all standard ceiling heights. It was designed to allow positioning for stereo, occupying a minimum of floor space, and for speaker placement where tables or shelves are not conveniently located. Enclosures are finished on



all four sides for use as a room divider. Internal capacity is in excess of 4620 cu in. and acoustic lining is employed to prevent bass reverberation. Enclosures are supplied with Jensen 8 in. extended range woofer, 3½ in. tweeter, and precision cross-over network. Dimensions of the enclosure are 40 in. high x 11 in. wide x 10¼ in. deep. Designated Model SM8-C the complete unit lists for \$66.90. Wald, Inc.

### UHF CONVERTER 226

A line of Ultra-High Frequency (UHF) portable converters that allow VHF color and black and white television sets to receive both UHF and VHF is being introduced in



6DZ4 oscillator tube, a 6DS4 Nuvistor IF amplifier tube and a IN82A mixer diode. Installation between TV and UHF antenna is simple. A built-in UHF-VHF coupler permits easy hook-up with existing antenna lead using only a screwdriver. The Model "A" converter is priced at \$39.95. The Model "B" which is similar to the Model "A" but omits the 6DS4 IF amplifier circuit sells for \$29.95. Standard Kollsman Industries, Inc.

### COUNTER TUBE TESTER 227

The Model 202-C Self-Service

## QUICK and LASTING

When You Use  
**HUSH®**

Chemically-Electronically, engineered for Tuners  
and Switching Mechanisms.

When New HUSH is applied it will wash-away that dirt, leaving clean and positive contacts protected by a lasting lubricant. New HUSH is made from the finest solvents and it contains Electro-Silicone oils.

6 oz. Spray can. Also available 2 oz., 8 oz., 32 oz. containers  
FREE 6" Plastic Extender With Every Can

### EVER-QUIET®

Since 1949

VOLUME CONTROL AND CONTACT RESTORER

EVER-QUIET is a free-flowing liquid that leaves no powder residue. Scientifically designed to seep around the shaft and penetrate the control or potentiometer, cleaning the contacts and leaving a safe protecting film. Harmless to metals, wire or carbon.

2 oz. Bottle & dispenser. Also available—6 oz. Spray can



CHEMICAL ELECTRONIC ENGINEERING, INC., Matawan, New Jersey

for more details circle 16 on post card

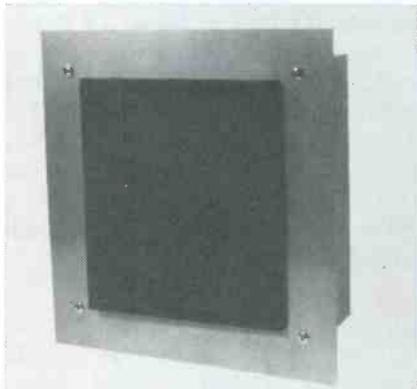
tube tester is for shops with limited floor space. It tests all tube types including Nuvistor, Novar, Compactron and 10 pin tubes. Provision is also made for the test of vibrators, fuses and pilot lights. A "quick flip" tube chart lists over 1200 different types. Charts listing new tube types are released periodically. A multi-color illuminated display sign tops the cabinet. Dimensions are 28 in. high x 20 in.



wide x 20 in. deep. User net price is \$129.95. Mercury Electronics Corp.

### LOUDSPEAKER BAFFLES 228

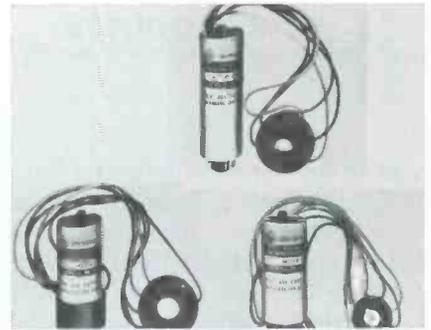
This group of loudspeaker baffles, the Series 80, are said to feature the "Total Dispersion" concept, a recent engineering development for which a patent has been applied. "Total Dispersion" provides a sound transmission factor of over 95% with a distribution pattern of 180° from the plane of the speaker. All baffles in the series are identical to the eye in both shape and color. The baffles are available for wall and ceiling locations, both recessed and surface installations and in the sloping front and bi-directional corridor configurations. The baffle plate is 12 x 12 in. for all models. Interiors of all Series



80 baffles are lined with an acoustical damping material and the baffles will accept any standard 8 in. loudspeaker. The Series 80 units are constructed of 18 gauge steel and are finished in hammertone over zinc chromate. Westlab, Inc.

"UNIVERSAL" BOOSTERS 229

TV technicians need now only carry three types of picture tube boosters for use on any TV set made, according to the producers of this product. The new boosters



are claimed to cover every tube made, regardless of size, circuit or TV set model. An advantage from the technician's point of view is

## Model 501 COMPONENT SUBSTITUTOR

...places a complete range of components at your fingertips

NEW



for fast substitution

only

**\$37<sup>50</sup>**

Slightly higher in the West

All hand wired...  
All American made

Will substitute up to 4 different components at the same time

A surge protector switch prevents arcing, sparking, or heating of electrolytics

Electrolytics are discharged automatically

The Model 501 provides all the substitutes for electronic components you want and need in your every day work... more than any other instrument of its type. No longer do you have to handle hard-to-manipulate crumpled parts... solder and unsolder components as you trouble shoot a set. With a twist of a knob and a flip of a switch you can set the 501 to any one of over 80 component values... substituting as many as four different components simultaneously. Smart, sturdy grey hammertone steel housing... handy storage compartment accommodates the insulated test leads provided with the instrument. Size: 10" wide x 6 1/4" high x 4 1/2" deep.

### SUBSTITUTES FOR:

#### CARBON RESISTORS

12 VALUES 1 watt: 10/18/33/56/100/180/330/560/1000/1800/3300/5600 ohms

12 VALUES 1/2 watt: 10,000/18,000/33,000/56,000/100,000/180,000/330,000/560,000/1,000,000/1,800,000/3,300,000/5,600,000 ohms

#### POWER RESISTORS (20 watt Wire Wound)

20 VALUES: 2.5/5/7.5/10/15/25/50/75/100/150/250/500/750/1,000/1,500/2,500/5,000/7,500/10,000/15,000 ohms

#### CAPACITORS (600 volts)

12 VALUES: .0001/.0005/.001/.0025/.005/.01/.015/.02/.05/1/22/5 mfd.

#### ELECTROLYTICS (450 volts)

17 VALUES: 4/8/10/12/14/18/20/28/30/40/50/70/80 130/150/200/230 mfd.

#### RECTIFIERS (Universal)

CRYSTAL DIODES—all general purpose low voltage types  
SELENIUM POWER RECTIFIERS—up to 500 ma., 800 PIV  
SILICON POWER RECTIFIERS—up to 750 ma., 800 PIV

See your electronics parts distributor or write for complete literature

**Mercury** ELECTRONICS CORPORATION  
manufacturers of quality electronic products

111 Roosevelt Avenue, Mineola, New York

## NEW PRODUCTS

said to be that they no longer have to tie up capital on numerous types of tube boosters. The three tube boosters are: Model CR-188: For Sylvania 110° tubes, for all voltages and currents, series or parallel circuits; Model CR-186: For all 70°-90° CRTs, for all voltages and currents, series or parallel circuits, and Model CR-187: For RCA 110° tubes, for all voltages and currents, series or parallel circuits. IEH Mfg. Co., Inc.

### STEREO TAPE RECORDER 230

Used as an independent recorder or to drive hi-fi system or separate speakers, this unit is completely



self-contained. Inside are stereo preamplifiers and power amplifiers for recording or playback purposes, plus speaker systems. Stereo inputs accommodate microphones stereo FM tuner (no preamp needed), stereo amplifier, or other sources (line inputs are automatically cut off when microphones are plugged in). Outputs are provided for the built-in speakers and for stereo headphones . . . also may be used to drive external speakers or a separate

stereo amplifier system. Kit AD-72 weighs 43 lb. and is priced at \$198. Heath Co.

### DISTORTION METER 231

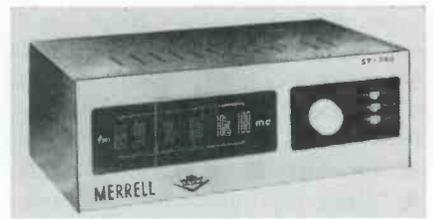
The model 902, Intermodulation/Harmonic Distortion Meter and ac VTVM is said to be a com-



plete audio tool combining IM and harmonic distortion meter, sensitive ac VTVM and db meter in one compact instrument. The 902 is equipped with a 4½ in. meter that provides full-scale pointer deflection for as little as 0.1% distortion or 10 mv ac rms voltage. A linear scale permits precise distortion readings as low as 0.01%, and to a low as 1 mv ac. There are 6 full-scale IM ranges to 30% distortion, 7 for harmonic distortion to 100%, and 10 for ac voltage to 300 v rms, with ±5% accuracy on distortion and ±4% accuracy on voltage. EICO Electronic Instrument Co.

### TUNER KIT 232

This FM Multiplex Tuner Kit features a pre-wired and pre-aligned "front end," Automatic Frequency Control (AFC), pre-wired and pre-aligned FM Multiplex and pre-aligned IF transformers, according to the manufacturer. The chassis and clean layout are claimed to assure



professional looking work. Included are step by step instructions, large pictorials, and schematic drawings. Specifications are: frequency response of 20 to 20,000 cps, ±0.5 db. Sensitivity: 1.4μv for 20 db quieting. Distortion: less than 1%. Hum: 6 db below 1 v. Output level: 2¼ v at 100% modulation. It is also available as FM tuner without multiplex. Price of the multiplex kit is \$54.90, without multiplex the kit is \$34.95. Merrell Electronics, Inc.

### STEREO AMPLIFIER 233

This stereo amplifier reportedly features high-fidelity performance and handsome styling. Finished in



gold and contrasting brown, it has standard headphone jack on front panel to accommodate most stereo phones. Output is 30 w, 15 w per channel. Frequency response is ±0.5 db 30 to 25,000 cps, and harmonic distortion is less than 1%. Tube compliment is 2 — 12AX7, 4 — 6BM8 and 1 — 6CA4. Size is 12¾ in. wide x 4¾ in high x 10½ deep. Price is \$69.95. Olson Electronics.

## ... 'TOUGH DOG'

*Continued from page 56*  
grid of the 6DQ6B — Zero! Tubes had been tried, of course, and plate voltages were high. A real head scratcher, I thought. Grid readings on the 6CG7 were weird. On the sync input the voltage would go up and down.

The dual selenium diode in this model plugs in. I removed it to check horizontal oscillator. When the diode was removed, a click was heard and the set played normally except for no horizontal hold. Replacing the diode returned the set to normal.—Leon De Sanzo, Hartford, Conn.

**DON'T** REPLACE CRYSTALLIZED RUBBER  
PHONOGRAPH DRIVE WHEELS UNNECESSARILY

brush on **NEW FONO-MAGIC\***

**eliminate slipping...dragging**  
**SAVES DRIVE WHEEL INVENTORY COSTS TOO!**

\* FONO-MAGIC is a NEW compound of special rubber and carbide particles. When FONO-MAGIC is brushed on metal drive surfaces, it forms a coat of live, pliable non-slipping rubber .000065 inches thick. Carbide particles imbedded in the rubber coating will scratch slipping rubber idler wheels, exposing live rubber and prolonging the life of the idler wheel. Just one bottle of FONO-MAGIC is equivalent to the replacement of 100 drive wheels. Only \$1.95 dealer net. Sold at Better Jobbers everywhere.

manufactured by R-COLUMBIA PRODUCTS CO., INC. Highland Park, Illinois

... for more details circle 33 on post card

# FREE LITERATURE

## VOLTAGE CONTROL HANDBOOK 300

A 40-page "handbook of Voltage Control with the Variac Autotransformer" include principles of autotransformers, descriptions and diagrams of many "Variac" circuits and information on the use of auto transformers. Over 80 circuit diagrams, charts and photographs are included. General Radio Co.

## POWER SUPPLIES 301

Specifications of a complete line of semiconductorized, precision power supplies are given in a short form catalog. The two-color catalog pictures the units and includes outline drawings of a variety of rack panel adapters. Power Designs, Inc.

## AUDIO EQUIPMENT 302

A catalog includes information on all models of the firm's loudspeakers and turntables. It also describes the books published by AR, and accessories such as needle force gauge and speaker stands. Acoustic Research, Inc.

## CALCULATING AIDS 303

This catalog is devoted entirely to special calculators, slide rules, selectors, punch cards and other devices used in business, industry, science and engineering. Many of the devices are standard special-purpose slide rules that have been in use for years, while others are entirely new. Dyna-Slide Co.

## SEMICONDUCTORS 304

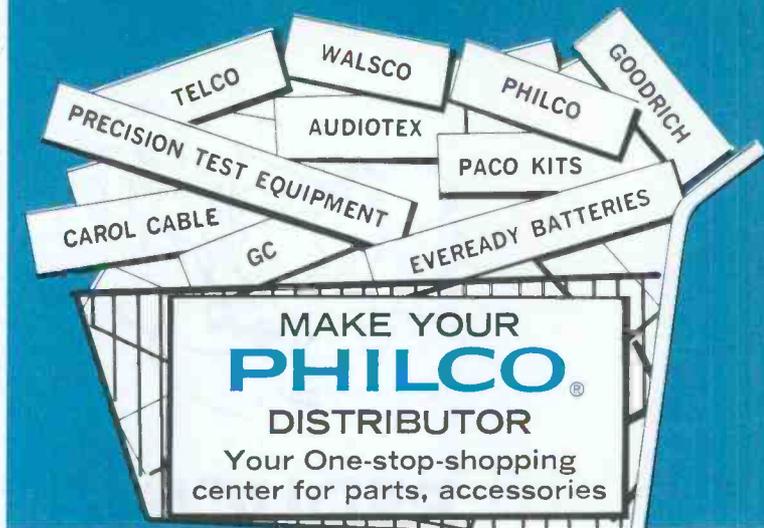
Over 3500 semiconductor devices, including glass zener diodes, silicon controlled rectifiers, silicon and selenium small power, medium power, high power and super power rectifiers, photocells and zener reference elements are included in this 24 page catalog. Ratings, characteristics and descriptive data of the devices are covered in a condensed tabular format. International Rectifier Corp.

## NEEDLE REFERENCE 305

The 1963 Wall Reference Chart lists replacement needles by manufacturer's cartridge number, shows illustration of needle replacement, the record speed and the needle number in either diamond, synthetic sapphire or osmium. Duotone Co.

## MICROPHONES 306

This catalog contains detailed application and specification information on a line of microphones and accessories. Included are sections on broadcast and professional microphones, units for high quality public address advanced amateur recording, industrial sound, mobile radio, language laboratory, as well as general purpose microphones. American Microphone Co.



### PHILCO DIODES

A complete selection of diodes for exact replacement, including IN34, IN64: and Dual Diodes P15, common cathode (replaces Fed. K1615 and IRCD4); P16 series connected (replaces Fed. K1616 and IRCD5) and P17 common anode (replaces Fed. K1617 and IRCD6).

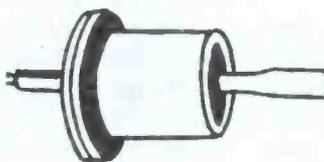
### HI-DENSITY 500 MIL

Selenium Rectifier and 500 MIL Silicon Cartridge Rectifier  
Top quality products, perfect replacements for original equipment.



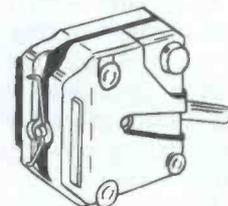
### GUARANTEED 500 MIL SILICON RECTIFIER

Ideal for general replacement and miniaturization purposes. Lower voltage drop gives more drive plus greater anode voltage.



### PHILCO POPULAR CARTRIDGE

Plays all speeds. Includes dual sapphire (synthetic) tip needle. Fits Philco changer models M20, 22, 24, 24A, 25, 26.



### 45 RPM SPINDLE

Quality made, low in price. For VM and Philco M40, 40A, 41. Also 45 RPM spindles for M60A and all BSR changers as well as other makes and models.



... for more details circle 31 on post card

## YOUR PHILCO DISTRIBUTOR

Features These Famous Brand Parts and Accessories

- PHILCO
- EVEREADY Batteries
- CAROL CABLES
- GOODRICH V-Belts
- GC Products
- AUDIOTEX
- WALSCO Products
- TELCO Antennas
- PRECISION Test Equipment
- PACO Kits



# REDUCING CUSTOMER COMPLAINTS

*by Ernest W. Fair*

■ A customer complaint can lead to loss of future business in a number of ways. And complaints can ultimately lead to increases in operating costs. Both mean profit reduction. Hence complaint elimination is well worth your effort.

Complete elimination of complaints is an impossibility, of course. But steps can be taken in day-to-day operations which will keep complaints at a relatively harmless minimum. Here are some basic musts for complaint reduction.

Make sure every repair part used is in proper working condition. Test all parts before installation.

Any electronic part which has been dropped or arrives in a damaged carton should be fully tested before using.

Never promise anything in ambiguously worded advertising or promotional material. Although service-dealers sometimes become carried away with their cleverly worded advertising blurbs, the customer is seldom affected in the same way. Fewer adjectives in advertising can lower chances for complaints. Tell them in simple every-day words what you have to offer.

Check periodically for misplaced

“look-alike” parts. It is easy to assume that a part conforms to certain specifications because the bin or container is labeled that way.

Make certain the customer is receiving the specific service requested. The surest way is to write it down in detail at the beginning and never leave details to memory.

Where a below-standard condition exists in a TV, radio or Hi Fi, it is best to inform the customer about it before proceeding with requested repairs.

Make certain that charges are correct every time; check and double check with each transaction. Nothing will make a customer more unhappy than an overcharge, even if it is accidental.

Never sell something damaged or below standard at a price reduction unless the customer clearly understands the conditions.

Be sure that fragile merchandise is properly wrapped or packaged before being handed or delivered to the customer. When breakage occurs enroute home you will be blamed for not packaging it properly.

Keep after the dust in easily overlooked corners. Dust can put many

customers in a complaint-finding frame of mind.

Never take a customer request for granted. Be sure you clearly understand what is desired.

Always be ready to fill a reasonable request for a small extra service. Customers see these as one-time requests — neither expensive nor inconvenient — even though you know it is both when multiplied many times during each business day. It will pay off in public relations benefits.

Where specific sales conditions exist, be sure the customer understands your definition of the conditions. More customer complaints arise from misunderstanding conditional definitions than for any other cause.

Know everything possible of the electronic units that customers may ask questions about. They expect you to know, and if you cannot answer their questions they become dissatisfied.

Make sure the customer understands limitations of guarantees. The word “guarantee” frequently has a different connotation to customers than implied by manufacturers.

When handling money, be sure no mistake occurs. And when a foreign coin turns up, pull it out for bank deposit. Don't pass it along to a customer.

Avoid selling an “old model” without pointing this out to the customer. Chances are that an advertised improvement in the item is what brought the customer in to make the purchase. He isn't going to be happy with the old model and will resent your having sold it to him.

Make it easy and convenient to do business with the shop. Inconveniences wear down the good nature of even the best customers and leads to complaints which would otherwise never arise.

Don't let sick employees work. Unfavorable impressions are left with customers.

Make it easy and convenient for a customer to contact the shop owner or manager. The easier the shop owner or manager can be contacted the simpler it is to turn a minor customer irritation aside and prevent a complaint developing. ■

## ... TECHNICAL DIGEST

Continued from page 30

### WESTINGHOUSE

#### V-2437-7 Chassis Tuner — Production Changes

Some of these chassis, used in models H-P3370/1-3 use a 470V070H04 tuner. This tuner is electrically similar to the 470V099H01 tuner (except for the low side coupling capacitor) found in the V-2416 chassis manual, TV1077. Tuner 470V099H01 is not adaptable for UHF but tuner 470V070H04 is adaptable.

### ... TIPS FOR REPAIRING PORTABLES

Continued from page 37

wise satisfactory, a rubber band may be used as shown in Fig. 1C.

If the clips have no room for a rubber band, a pair of rubber pads may be cemented behind the clips to provide more pressure on the battery, (Fig. 1D). If this cannot be done, it may be possible and practical to cut some clip-stiffeners from shim-stock brass which are then crimped in place over existing clips as shown in Fig. 1E. Battery leads should be soldered to the new clips.

Still another frequent cause of portable malfunction is the speaker. This is frequently caused by dropping the receiver in sand on the beach. When the speaker's magnetic gap is sand-jammed the sound is reduced tremendously and the voice coil cannot be moved up and down in the magnetic gap. If the shop has an air compressor it may be possible to blow the sand out with a blast of air from a small nozzle. ■



"There was a flash of light and then this terrible monster came out of the set and bit me on the neck."

JUNE 1963

PRODUCT  
NEWS from EPL

## Only 37¢ per watt output DC Power Supply

Unbeatable Performance and Price



D-612T... \$59<sup>95</sup>

#### ► Look at these exclusive features...

- Lowest price per watt output.
- Full 10 ampere rating on V-12 volt range.
- Surplus power on 0-16 volt range.
- Full year warranty.
- Superior filtering over entire output.
- Large, easy-to-read plastic meters.
- Heavy overload capacity.

#### ► Compare with others...

Brand	Voltage Output	Ampere Cont.	Output Interm.	Meters	Price/Watt Output**	Warranty	Terminals
EPL	0-8	10	20*	Large, clear plastic	.37	1 Year	Insulated binding posts
	0-16	10	20*				
A	6	10		Metal	.69	90 Days	Stud and wing nuts
	12	6					
C	0-8	10	20	Metal	.62	90 Days	Stud and wing nuts
	0-16	6	12				
E	0-8	10	20	Metal	.50	90 Days	Insulated binding posts
	0-16	6	10				
M	0-8	10	20	Metal	.62	1 Year	Stud and wing nuts
	0-16	6	14				
P	0-8	10	20	Metal	.68	90 Days	Metal binding posts
	0-16	6	12				

\*Best of all for operating signal seekers! \*\*Based on maximum continuous ratings.

18 Others from 6 to 125 VDC from \$19.95 up

Stocked at Your Electronic Distributor

FREE NEW CATALOG PS-562R on complete line



**ELECTRO PRODUCTS  
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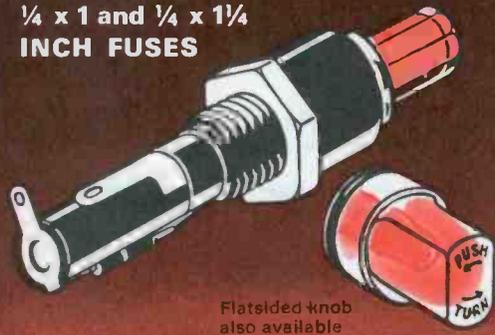
Canada: Atlas Radio Ltd., Toronto

Since 1936... Pioneers in Low Voltage DC Power Supplies

... for more details circle 17 on post card

# BUSS FUSEHOLDERS

- LAMP INDICATING SERIES HK AND HJ FOR  $\frac{1}{4}$  x 1 and  $\frac{1}{4}$  x  $1\frac{1}{4}$  INCH FUSES



Flatsided knob also available

Provides quick, positive visual identification of faulted circuit. Transparent knob permits indicating light to be readily seen.

Bayonet type knob-molded body-strong, coil spring provides positive contact on ends of fuse.

Fuseholder designed to withstand vibration such as occurs in aircraft applications. Terminals held mechanically as well as by solder.

Holder can be used in panels up to  $\frac{3}{16}$  inches thick.

# BUSS

Write for BUSS Bulletin SFB.

BUSSMANN MFG. DIVISION, McGraw-Edison Co., St. Louis 7, Mo.

... for more details circle 15 on last page

with a new low noise, shielded tuner with a planetary drive providing continuous, fine tuning. The tuner in the converters uses a 3-gang tuning element, eliminating sliding contacts from the main tuning circuits to add performance reliability and longer life. A new 6DZ4 oscillator tube, 6DS4 nuvistor IF amplifier tube and IN82A mixer diode is used. A built-in UHF-VHF coupler permits easy hook-up with existing antenna lead using only a screwdriver.

## Scott's Management Philosophy

National attention was recently focused on the unique management philosophies of H. H. Scott, Inc. of Maynard, Mass., in a feature article by BUSINESS WEEK. Spotlighting the company's success through application of unconventional management techniques, the article said that Scott has risen to the forefront of the hotly competitive quality Hi Fi components industry under the guidance of two men with sharply different management philosophies. Traditionalist president Hermon H. Scott is an exponent of old Yankee perfectionism, stressing engineering and product excellence. Modernist executive vice-president Victor H. Pomper is more concerned with employee morale and seeks to create a friendly atmosphere.

"Under Scott's and Pomper's conflicting philosophies, the company has roughly doubled its sales every two years, with the number of employees rising from 15 in 1950 to 300 today," BUSINESS WEEK said.

## BUSS: the complete line of fuses...

## NEWS OF THE INDUSTRY

### CB Radio for the Farm

Raytheon CB radios will be offered as accessories by International Harvester Company's 6600 truck and farm equipment dealers under terms of an agreement reached between the two firms recently.

The units also will be marketed to the construction industry through International Harvester's 200 construction equipment distributors.

### Breaks Color Price Barrier

Grand Rapids, Mich. television dealer recently advertised color TV sets at \$399.97. The only other price cut in color television pricing came in 1962 from a nationwide mail order house, according to RADIO & TELEVISION WEEKLY.

The S & S Television & Appliance of Grand Rapids claimed January color sales equalled the combined total of November and December as a result of the price break.

### Standard Kollsman Enters UHF Field

Standard Kollsman Industries, Inc. has developed two UHF portable converters. They are engineered

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(.197 x .769 INCHES,  
GLASS TUBE)

Designed for protection of miniaturized circuits or equipment. Commonly used in equipment of foreign make.

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mated provision for Federal income taxes of \$5,871,513. This represented a 7 percent increase over the previous record first quarter earnings reported in 1962 of \$4,728,794, or 52¢ per share.

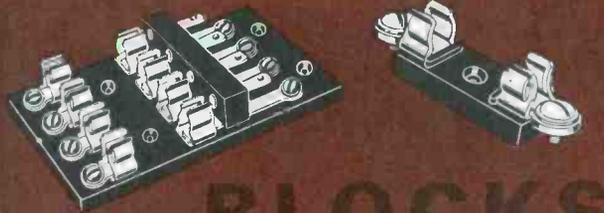
#### Amperex Contest Winners Announced

Ten major prize winners in the Amperex Telequiz Sweepstakes Contest have been announced. Each of the 10 winners in the first of four contests receives a Model 23K95 Motorola Console television set.

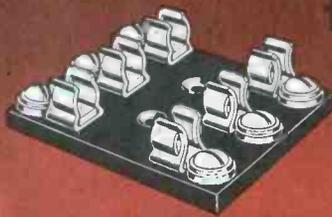
The 10 winners in contest number one, all electronic technicians and service dealers, are: Eric McLoughlin, Larchmont, N. Y.; Morris W. Hughey, Asheville, N. C.; Mike Kelly, South Point, Ohio; Robert A. Cheever, De Motte, Ind.; George W. Miller, Ellwood City, Pa.; James D. Emerine, Stockton, Calif.; A. J. Schiefelbein, Waycross, Ga.; Emerson W. Shaw, Woodland, Pa.; Charles G. Reames, Millbrook, Ala. and John Urbank, Gary, Ind.

#### Academy Award to Electro-Voice

Electro-Voice, Inc., was presented an award by the Academy of Motion Picture Arts and Sciences. Basis for the award was the firm's contribution to motion picture sound pickup, made by a highly-directional microphone which permits the simultaneous filming and pickup of action, even at considerable distances from the point of origin.



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Single pole, multiple pole, small base, full base, molded base, bakelite base, porcelain base for fuse from  $\frac{1}{4}$  x  $\frac{3}{8}$  inches up to  $\frac{1}{2}$  x 2 inches. Also signal fuse blocks and special blocks of all types.

Send us your requirements—we have the block you need or can engineer it for you.

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## ... of unquestioned high quality

Scott ranks high in its industry and has a reputation for quality and service," the magazine concluded, observing that the mutual efforts of Scott and Pomper prove that two differing management theories need not conflict but can equal one good approach.

#### Kierulff Sells Hi Fi Business

Kierulff Sound Corp., Los Angeles, has sold its entire inventory and the right to continue the retail Hi Fi business to Acorn-Arrow stores, a southern California Hi Fi component retailers chain.

Kierulff Sound Corp. stated: "This sales is in line with a decision to continue to build the growing Kierulff corporate image as an industrial electronic parts distributorship and retire the name from all activity in the retail Hi Fi market at this time. The name 'Kierulff' remains the exclusive property of the continuing industrial business.

#### Zenith Has Record First Quarter

Zenith Radio Corp. reported record first quarter sales and earnings. In addition to all-time high first quarter sales and earnings, the company also reported color television unit sales from distributors to dealers were approximately doubled from a year earlier. Black-and-white television unit sales were the highest of any quarter in its history.

Profits for the three months ended Mar. 31, 1963, amounted to \$5,062,980, or 56¢ per share, after esti-

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This is your assurance that when you sell or install BUSS fuses, you are safeguarded against complaints, call-backs and adjustments that might result from faulty fuses and eat away your profit.

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to sell fuses the BUSS way.

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## ... VISION PROBLEMS

Continued from page 51

ary bifocals are usually too strong for these jobs, and are often set so low in the lenses that awkward head-lifting is necessary to see at eye level or above.

### Solving the Problem

What is the solution for electronic technicians of bifocal age? First of all it depends upon you and your work, and of course upon your eyes. You should measure your prime working distances, determine how far it is from your eyes to the points where you must see, and also how high these areas are from the ground. Take this information with you when you have your vision examined. Here are some possible kinds of vocational lenses which could be used for your work:

**Bifocals:** The bifocal part (See Chart I) should be set high in the lens to minimize head tilt. It should be wide (it can cover the entire bottom of the lens) to provide a big near-vision area, if this is your primary need. The bifocal should be kept as "weak" as possible to supply a good outward range (such lenses may be too weak for fine work at 10 to 12 in.

**Trifocals:** Arm-length vision can be clear and easy through the middle section of a specially designed lens. The top is for distance seeing. The bottom is strong enough for precise near-vision — to do fine soldering, for example. Trifocals can be made in a variety of intermediate sizes and widths. They provide the only really adequate answer for many seeing problems which arise in a viewing range from 24 to 28 in. **Special Multifocals:** The top of bifocal lenses can be focused for arm-length seeing, the bottom for close

work, and these are handy on many jobs. Sometimes upside-down bifocals are used. These have a little window of distance-vision at the top with the rest of the lens for near work. Double bifocals are the ideal answer for whatever seeing distance is desired. When working near eye-level, it is easy to see through the top area, the remainder of the lens is an ordinary bifocal with sections for distance and near seeing.

Why should you know these things about your visual problems? Why not leave it up to the refractologist? For one thing, he will need to know about your individual habits and seeing demands. But more than that, successful fitting of occupational needs depends greatly upon your understanding of the problems, and acceptance of a solution to them — generally with a lens prescription tailor-made for your unique seeing demands.

Results? More comfortable seeing and a better day's work with glasses, like your tools, designed to fit the job. ■

## ... VTVM TOOL

Continued from page 48

drop across the load resistor in the circuit you want to check, note the resistor's value and use ohm's law:

$$I = \frac{E}{R}$$

Suppose you want to measure the total current being drawn by a 6BQ6 horizontal sweep amplifier. Measure the drop across the cathode resistor. If the resistor is 100 and the voltage reads 11, then the current is 110 ma — which would be reasonably close. You can find out how the screen circuit is doing in the same way.

## Handle with Care

Although VTVM design makes it an inherently rugged instrument, it should be treated with the same care and precautions as your VOM. Every experienced technician knows what these precautions are.

If you want to know that your meter is always accurate, you should calibrate it periodically for dc, ac and ohms accuracy. If you have a variable line transformer, reasonable accurate adjustments can be made by following the manufacturer's instructions on calibration. ■

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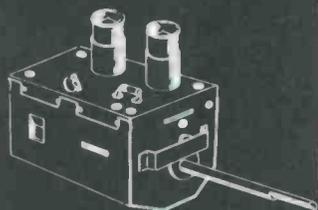
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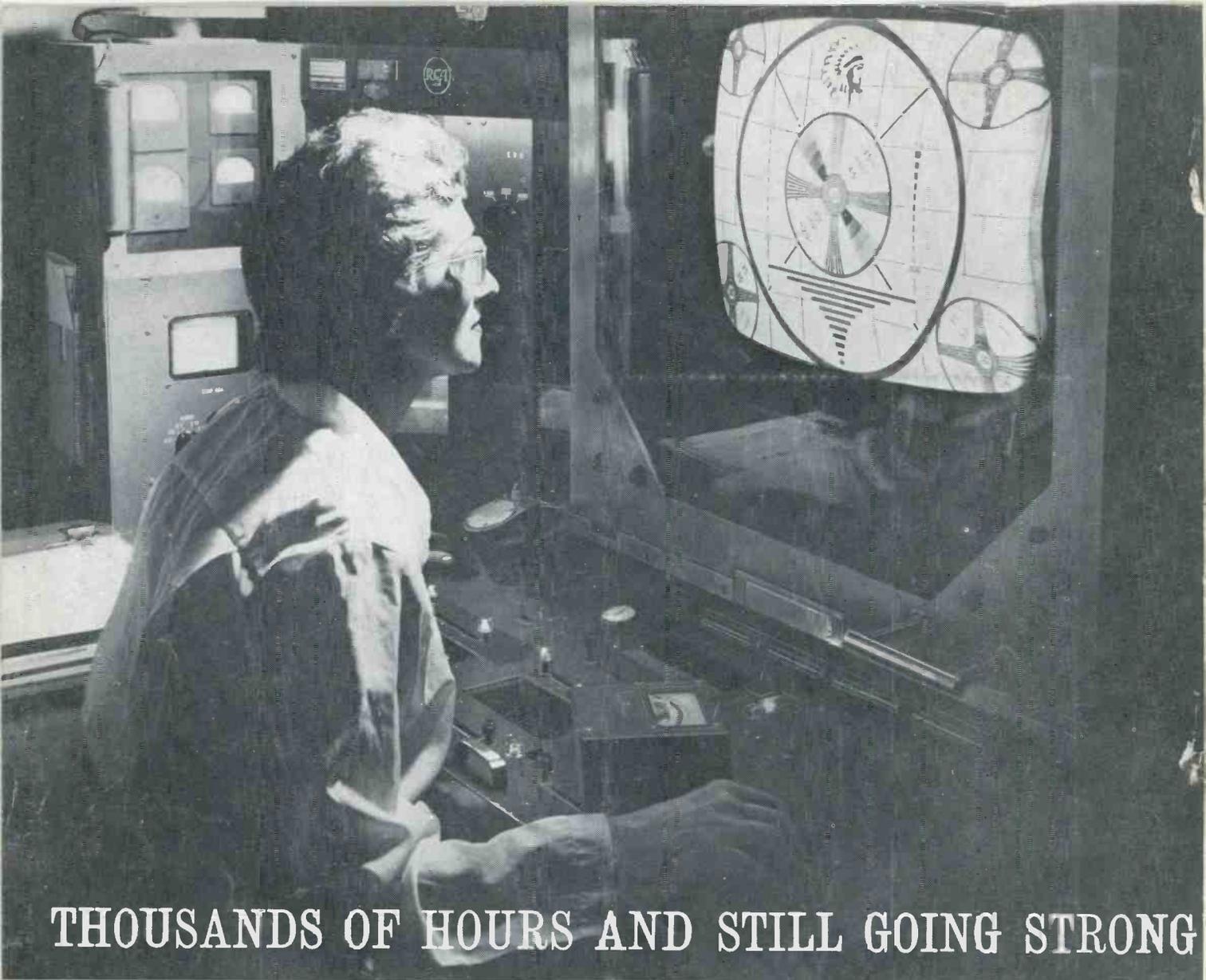


say Joseph Rocheleau and Frederick Wagner, partners, Able Appliance Repair Service, Newington, Conn. "We try to keep track of the source of each

job and ninety-nine times out of a hundred new customers tell us they saw our Yellow Pages ad. We've been in business only three years and we've already increased the size of our first ad and added a second one. Our Yellow Pages program is just about our livelihood. That's why we plan to have it grow as we grow."



**Call the Yellow Pages man at your Bell Telephone Business Office to plan your program.**



# THOUSANDS OF HOURS AND STILL GOING STRONG

## How RCA Assures Long Life in Silverama® Picture Tubes

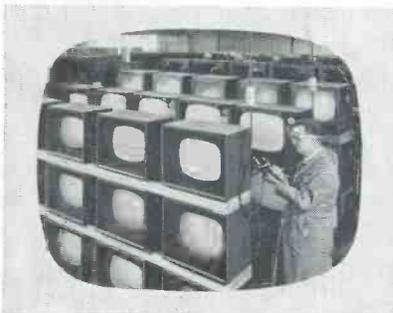
In the darkness of the Life Test Rating Lab at our Marion, Indiana picture tube plant, a skilled operator studies the performance of an RCA Silverama picture tube that has been in operation thousands of hours.

Life testing takes place in banks of actual TV receivers. After this gruelling life test, tubes are rated in a precision test unit for focus, brightness, resolution, emission, amount of leakage to all elements—every factor that affects performance—to determine the exact degree of deterioration produced during life testing. And this is but one of many different quality control checks to which

every run of Silverama picture tubes is subjected.

*What does this mean to your business?* It means long-term customer satisfaction with every Silverama you install. The wide consumer acceptance of Silverama picture tubes is your assurance that your customer will call you again when he needs to replace his picture tube.

Today's Silverama is made with an all-new electron gun, finest parts and materials, and a used envelope that has been completely scrubbed internally, polished, and rescreened to restore it to the peak of its optical capabilities.



**Picture Tube Life-Test Banks.** Here RCA determines how Silverama picture tubes perform in actual TV receivers of all makes, under actual operating conditions, for thousands of hours of continuous service.



**Precision Signal Generator** sends out the test pattern shown on the screen above. Fidelity of reproduction of this virtually perfect signal (resolution: up to 2,000 lines!) is an accurate index of the picture tube's performance after life testing.

RCA ELECTRON TUBE DIVISION, HARRISON, N. J.



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