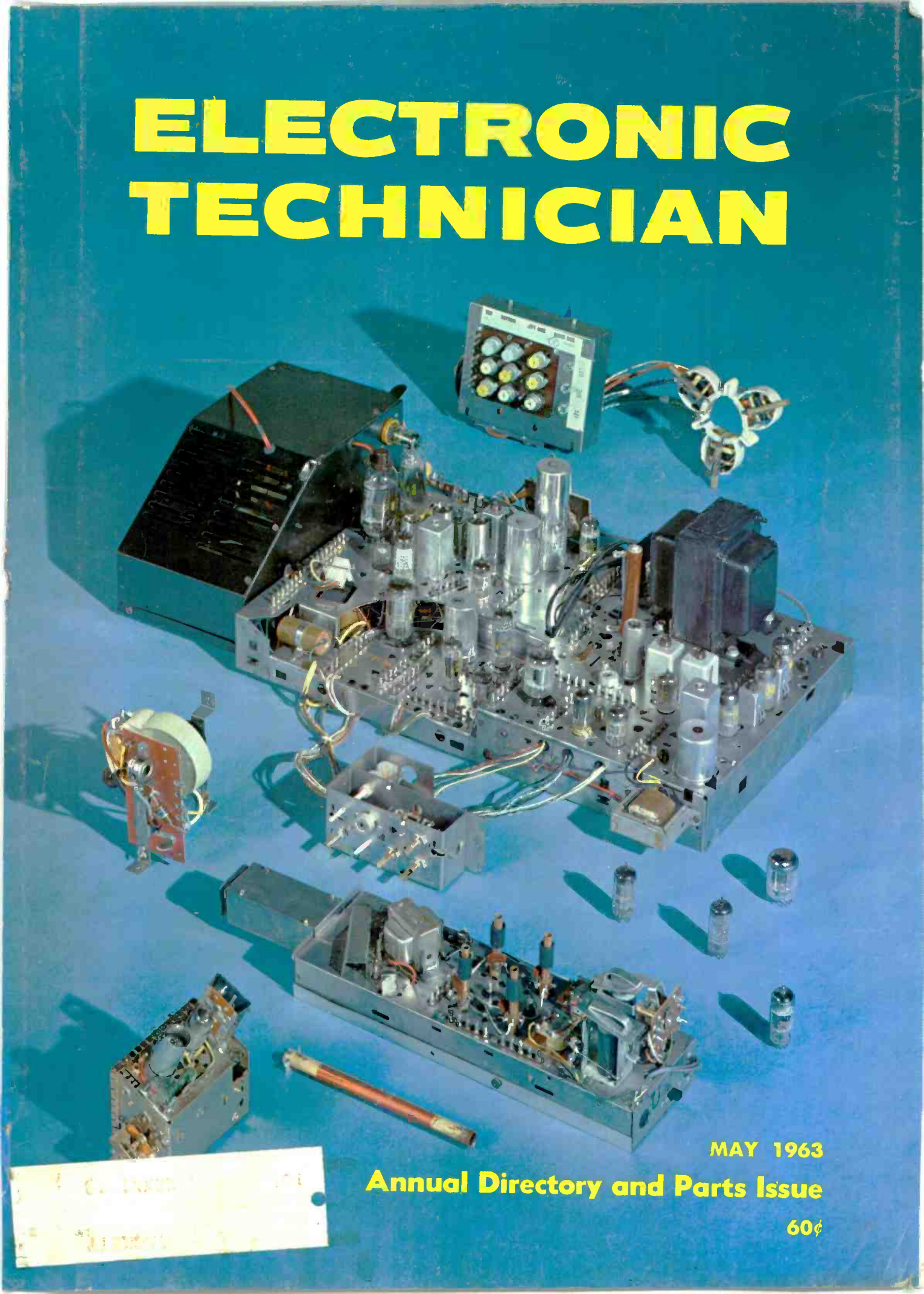
ELECTRONIC TECHNICIAN



MAY 1963

Annual Directory and Parts Issue

60¢

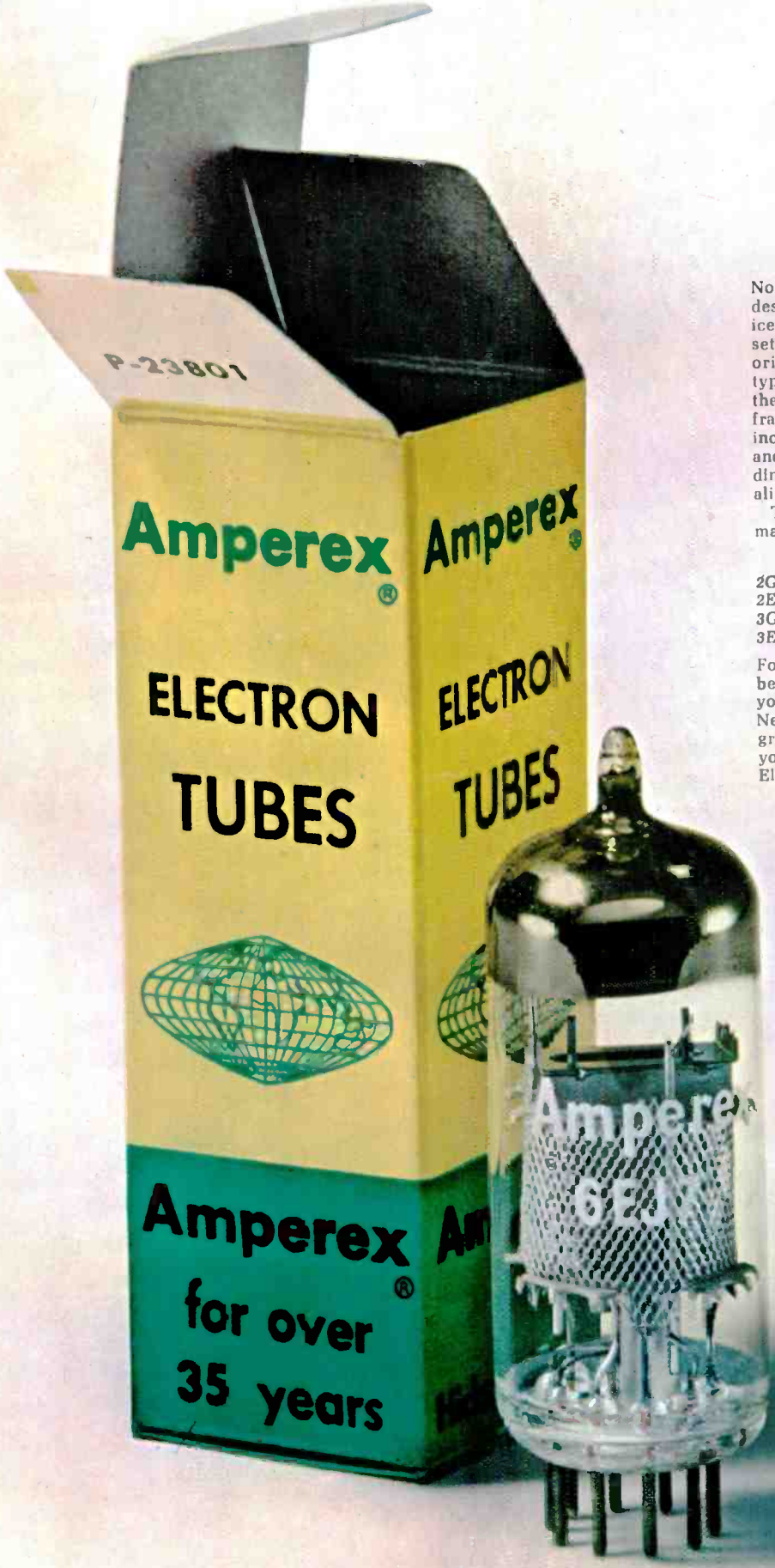
are you replacing top quality tubes with identical top quality tubes ?

Now you can carry the identical tubes that you find designed into most of the quality TV sets you service. Chances are, you were not aware that these TV sets were designed around special Frame Grid tubes originated by Amperex and that even more tube types originated by Amperex are being designed into the sets you'll be handling in the future. Amperex frame grid tubes provide 55% higher gain-bandwidth, increase TV set reliability by simplifying circuits and speed up your servicing because their extraordinary uniformity virtually eliminates need for realignment when you replace tubes.

Tubes introduced by Amperex, currently used by major TV set makers include:

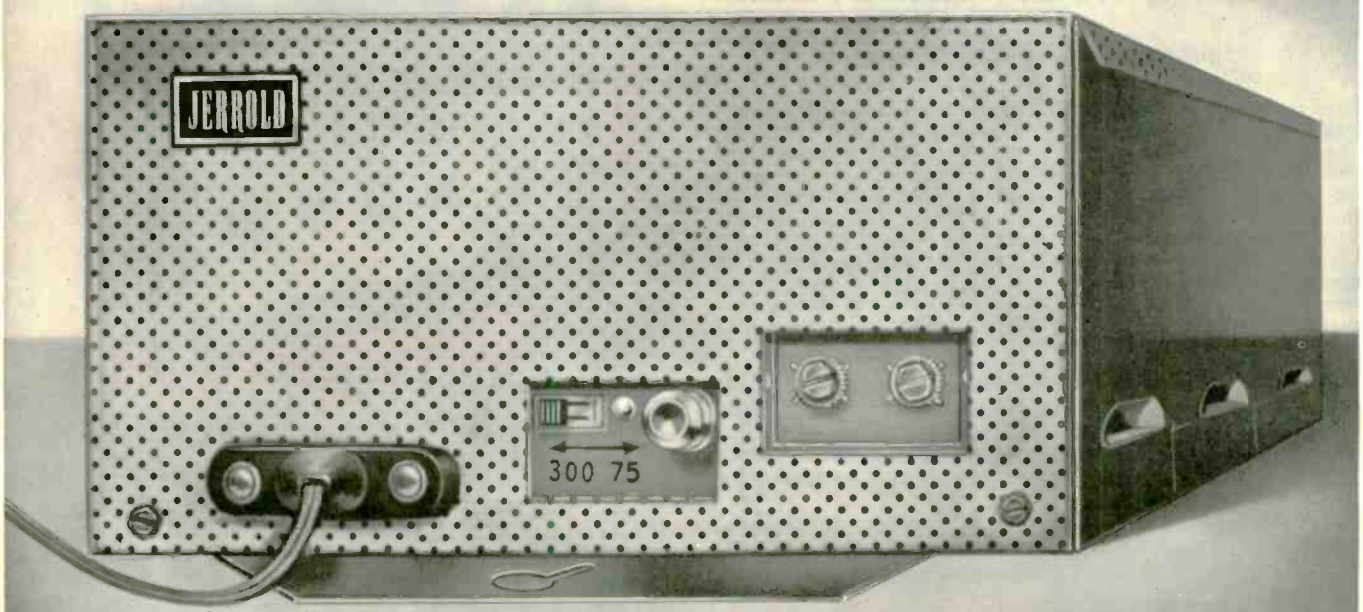
Frame Grid				*Others*	
2GK5	*4GK5*	*6GK5*	*6EH7*	*6AL3*	*9A8*
2ER5	*4EH7*	*6ES8*	*6EJ7*	*6BL8*	*15CW5*
3GK5	*4EJ7*	*6ER5*	*6HG8*	*6BQ5*	*16AQ3*
3EH7	*4ES8*	*6FY5*	*7HG8*	*12AX7*	*27GB5*

For optimum satisfaction for your customers and a better profit operation for yourself, make room in your caddy now for these matchless-quality tubes. Next time you visit your distributor, look for the green-and-yellow boxes and enjoy confidence in your work such as you never have before. Amperex Electronic Corporation, Hicksville, L. I., New York.



IN CANADA: PHILIPS ELECTRON DEVICES, LTD., TORONTO 17.

BIG-SYSTEM MUSCLE...



SMALL-SYSTEM PRICE!

NEW JERROLD *Challenger* TV DISTRIBUTION SYSTEM

ENGINEERED FOR THE NEW COLOR-TV ERA

- **Designed for TV shops, dealers' showrooms, small apartments and motels**
- **Feeds up to 32 TV and FM sets**
- **No controls or adjustments**
- **New "Quick-Disconnect" plug-in outlets**

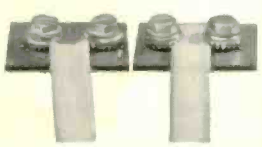
Here's the distribution system to sell to TV and FM dealers for their color-TV showrooms . . . perfect too for the small apartment building or motel that's been needing an antenna system but couldn't afford one before. It's also ideal for your own service shop.

The JERROLD "Challenger" Amplifier, Model ACL-200, delivers 20db minimum gain over the low band, 19db over the high band. Flat response—unique in a low-price amplifier, but necessary for good color TV. Easy to install, no controls to adjust. Famous JERROLD quality is built in to stay.

MODEL ACL-200, $38.97 Net.

See your JERROLD distributor or write Jerrold Electronics, Distributor Sales Division, Philadelphia 32, Pa.

New 4- and 8-way high-isolation networks.



New crown-washer screw terminals for stripped or unstripped twin lead.

Exclusive "Gamma" chassis fittings for quick disconnect of any set.

JERROLD ELECTRONICS

A subsidiary of THE JERROLD CORPORATION

- - - for more details circle 36 on post card

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 CRT 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**

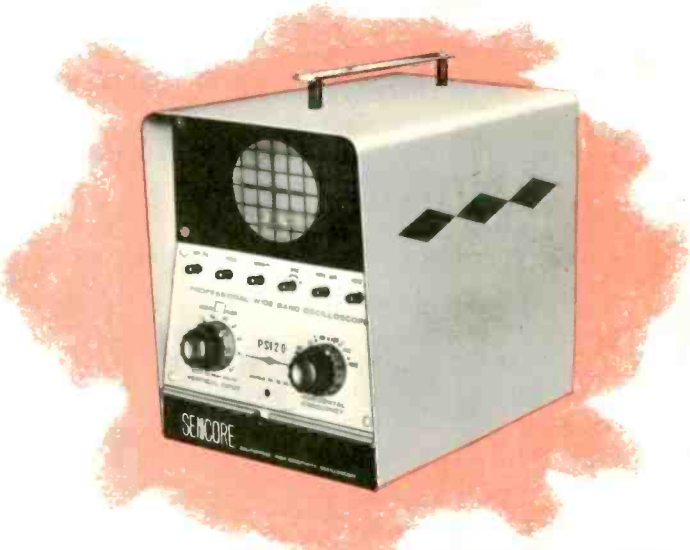
NEW! PS120 PROFESSIONAL WIDE BAND OSCILLOSCOPE

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. Sensitive 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 11¼"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 52 on post card

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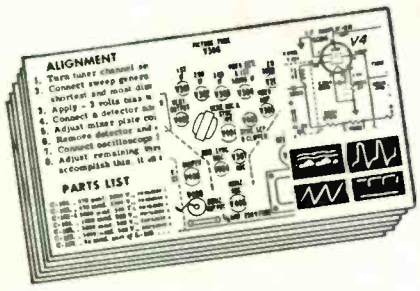
ELECTRONIC TECHNICIAN

May • 1963 Vol. 77 • No. 5

COVER: This issue's cover showing Zenith's color TV chassis was photographed by the Zenith Sales Corp. Key components are shown with the "400" remote control receiver and "Gold Video Guard Turret Tuner" in the foreground. This month, the industry's largest show, the 1963 Electronic Parts and Distributors Show, will be held in Chicago. In this issue you will find a disectory of the manufacturers with displays at the show as well as a complete directory of manufacturers in the industry.

CONTENTS

TEKFAX ..... 16 PAGES OF LATEST SCHEMATICS



AIRLINE: TV Chassis Models GTM1583A, 2583A

CORONADO: TV Chassis Model TV2-9442A

RCA: TV Chassis Models KCS 143 A & B

TRUETONE: TV Chassis 2DC1300C, -02C, 2DC1301C, -03C

ZENITH: Transistor Portable Radio Model Royal 50L, Chassis 6KT40Z1

ITT BATTERIES

ITT TUBES

GET EXTRA PROFIT MARGIN AND FULL CONSUMER ACCEPTANCE WITH THESE FOUR ITT LINES

ITT WIRE & CABLE

ITT TRANSISTOR RADIOS

"To remain competitive today, dealers must have access to worldwide sources of manufacture of many lines," says L. J. Battaglia, president of ITT Distributor Products Division.

You no longer have to make the choice between an extra profit margin and a brand name respected by your customers when buying tubes, batteries, wire and cable, and transistor radios.

Now, the worldwide facilities of ITT and your ITT Distributor bring you these four complete lines... each carrying the nationally-known ITT label... each priced to give you extra profit margin.

Each product line contains the *right* models and types and the *right* prices to give you maximum profit.

TUBES: a comprehensive receiving tube line for entertainment use. *Batteries:* penlites, C, D, and 9-volt miniatures, poly-packed in display box and pegboard assortments. *Wire and cable:* a complete line of wire and cable including twin-lead, coax, multi-conductor cable as well as most popular commercial and MIL-spec types from ITT-Royal and ITT-Surprenant facilities.

TRANSISTOR RADIOS: a full line from 6-transistor shirt pocket to AM-FM-SW long range models in regular step-ups.

Other ITT product lines—ITT capacitors, semiconductors, speakers, intercoms—also available. Still more will soon be added from ITT worldwide facilities and divisions and subsidiaries recently acquired in the United States.

Contact your ITT Distributor or write for full details. ITT Distributor Products Division, International Telephone and Telegraph Corporation, Box 99, Lodi, New Jersey.

- - - for more details circle 34 on post card

ITT

LETTERS TO THE EDITOR

LPV

Your story on the LPV antenna, appearing in the March issue, states that this antenna "is unique in that it maintains essentially constant impedance across the full band width of the antenna."

We would like to point out that this statement is not correct. This feature is not unique to this antenna and — as a matter of fact — did not even originate with it.

Constant impedance across the VHF band made its first commercial appearance in the TW Antenna introduced by Channel Master in 1956. Our technical literature for that antenna stated, among other things, "the patented Traveling Wave principle provides equal flow of current in all dipoles and optimum impedance on all channels." This claim was supported by a detailed technical explanation including Smith charts on which impedance characteristics were plotted.

This quality was refined still further in our Crossfire antenna, introduced in 1961. The great popularity of the TW Antenna, followed in turn by the newer Crossfire models, attests to the high level of their performance.

HAROLD HARRIS, VICE PRES.
Sales and Engineering
Channel Master Corp.
Ellenville, N. Y.

• *See the clarification of the LPV article on page 36.—Ed.*

Don't Take Chances

A few days ago I received a bulletin through the mail from (company name withheld). They have some fantastic savings on tubes. I was showing this to a friend of mine and he told me that their tubes were factory seconds or rejects. They do not state that these tubes are seconds or rejects. To quote their statement: "All tubes are commercial grade, tested and guaranteed for 15 months against all defects except breakage and filament burnout."

I would like to know if this company actually sells first line tubes

the HIDDEN 600*

PRESENT 5 WORLD FAMOUS PERFORMERS 5

*The "Hidden 600" are Sprague's behind-the-scenes staff of 600 experienced researchers who man the largest research organization in the electronic component industry and who back up the efforts of some 8,500 Sprague employees in 26 plants.

DIFILM® BLACK BEAUTY®
MOLDED TUBULAR CAPACITORS

The world's most humidity-resistant molded capacitors. Dual dielectric—polyester film and special capacitor tissue—combines best features of both. Exclusive HCX® solid impregnant produces rock-hard section—nothing to leak, or drip. Tough case of non-flammable phenolic—cannot be damaged in handling.

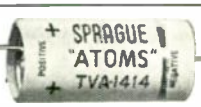
DIFILM ORANGE DROP® DIPPED TUBULAR CAPACITORS

Especially made for exact, original replacement of radial-lead tubulars. Ideally suited for printed wiring boards. Dual dielectric combines the best features of both polyester film and special capacitor tissue. Exclusive HCX® solid impregnant—no oil to leak, no wax to drip. Double dipped in bright orange epoxy resin to beat heat and humidity.

TWIST-LOK® ELECTROLYTIC CAPACITORS

The most dependable capacitors of their type. Built to "take it" under torrid 185°F (85°C) temperatures—in crowded TV chassis, sizzling auto radios, portable and ac-dc table radios, radio-phono combinations, etc. Hermetically sealed in aluminum cases for exceptionally long life. Withstand high surge voltages. Ideal for high ripple selenium rectifier circuits.

ATOM® ELECTROLYTIC CAPACITORS



The smallest dependable electrolytics designed for 85°C operation in voltages to 450 WVDC. Small enough to fit anywhere, work anywhere. Low leakage and long shelf life. Will withstand high temperatures, high ripple currents, high surge voltages. Metal case construction with Kraftboard insulating sleeve.

CERA-MITE® CERAMIC CAPACITORS

Tiny, tough, dependable in practically every application. Low self-inductance of silvered flat-plate design gives improved by-pass action in TV r-f circuits. Higher self-resonant frequency than tubular ceramics or micas. Tough moisture-proof coating. Designed for 85°C operation.

NOW APPEARING DAILY AT YOUR FAVORITE SPRAGUE DISTRIBUTOR!

For a permanent reference to this world-renowned galaxy of star performers, ask your Distributor for a copy of Sprague's handy Hanging Wall Catalog C-457, or write Sprague Products Company, 65 Marshall Street, North Adams, Massachusetts.

65-370

- - - for more details circle 54 on post card

LETTERS TO THE EDITOR

or not. If they do not I would like to know what it is they sell. I think a lot of service technicians would be interested in their line if they sell top quality merchandise.

MARVIS H. GORE
Silsbee, Tex.

• *We suggest that you buy from well established companies such as those advertising in* ELECTRONIC TECHNICIAN. *A well established company can't risk selling second rate merchandise. — Ed.*

Flat Rate House Call

After reading the letter from Mr. O. R. Hays of Sunnyvale, Calif. in the Jan. issue of ELECTRONIC TECHNICIAN, I was amused, irritated and frustrated—all at one time. He mentions quite a few subjects but fails to cover any one item thoroughly. Mr. Hayes mentions the Distributor who sells to your retail customer, the Super-Market or Chain Drug Store that peddle tubes via the DIY checker. Certainly, these do skim most of the cream from our operations but Mr. Hays is not compelled to patronize any of these operators and would be very foolish indeed if he did.

Mr. Hays makes quite a to-do regarding his $5.00 charge on TV calls. He says, *"Sometimes, though, a man spends quite a bit of time on a call and gets $5.00. What has he made? He must sell some tubes to come out even."* That sounds like Mr. Hays has a one-track mind and is operating in the $5.00 groove. Does Mr. Hays' time, whether it be 15 minutes or 1 hour and 15 minutes, cost the same? I would be inclinded to believe that his original Home Call charge for one half an hour or less, in the home, is about $1.95 too low. Isn't it about time Technicians began to make a legitimate charge for their time and not depend on parts to make up the profits?

Mr. Hays says he does not *"believe in service associations, they usually end up discriminating against the little man. They would be all right if run properly."* Oh, Brother!

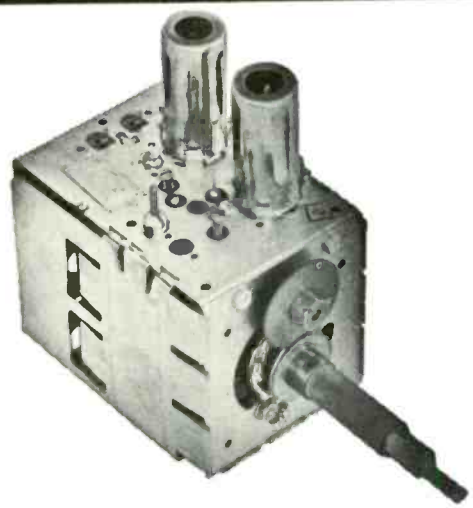
Prices effective January 1, 1963

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

ONLY $9.50 INCLUDING

ALL PARTS (except tubes) and LABOR

24-HOUR SERVICE
1-YEAR WARRANTY



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.

SARKES TARZIAN, INC.
Bloomington, Indiana

MANUFACTURERS OF TUNERS . . . SEMICONDUCTORS . . . AIR TRIMMERS . . . FM RADIOS . . . AM/FM RADIOS . . . AUDIO TAPE . . . BROADCAST EQUIPMENT

TWO SERVICE CENTERS TO SERVE YOU BETTER

See your distributor, or use the address nearest you for fast factory repair service

537 South Walnut St. Bloomington, Indiana Tel: 332-6055	10654 Magnolia Blvd. North Hollywood, Calif. Tel: 769-2720

LETTERS TO THE EDITOR

I just love these people that think they know it all! He is like a great many others that stand on the outside and claim to know just what is going on but don't have the intestinal fortitude to get on the inside and lend his support in helping to make this a better industry. I wonder if he applied for membership but could not make the grade?

All in all, Mr. Hays sounds a bit like these people that become Television Experts (?) at 4:30 in the afternoon.

(MR.) CONNIE JENKINS

Seattle, Wash.

Try IEEM

Just received a subscription card for ET. I'd like to make a general suggestion on your publication; I hope it does some good.

It was a fairly good electronics information source when it was the general combined technicians' magazine. When you split it up into "Industrial" and the other "Tech" you split the product and squeezed two eggs per laying-period out of the Golden Goose (know the fable?).

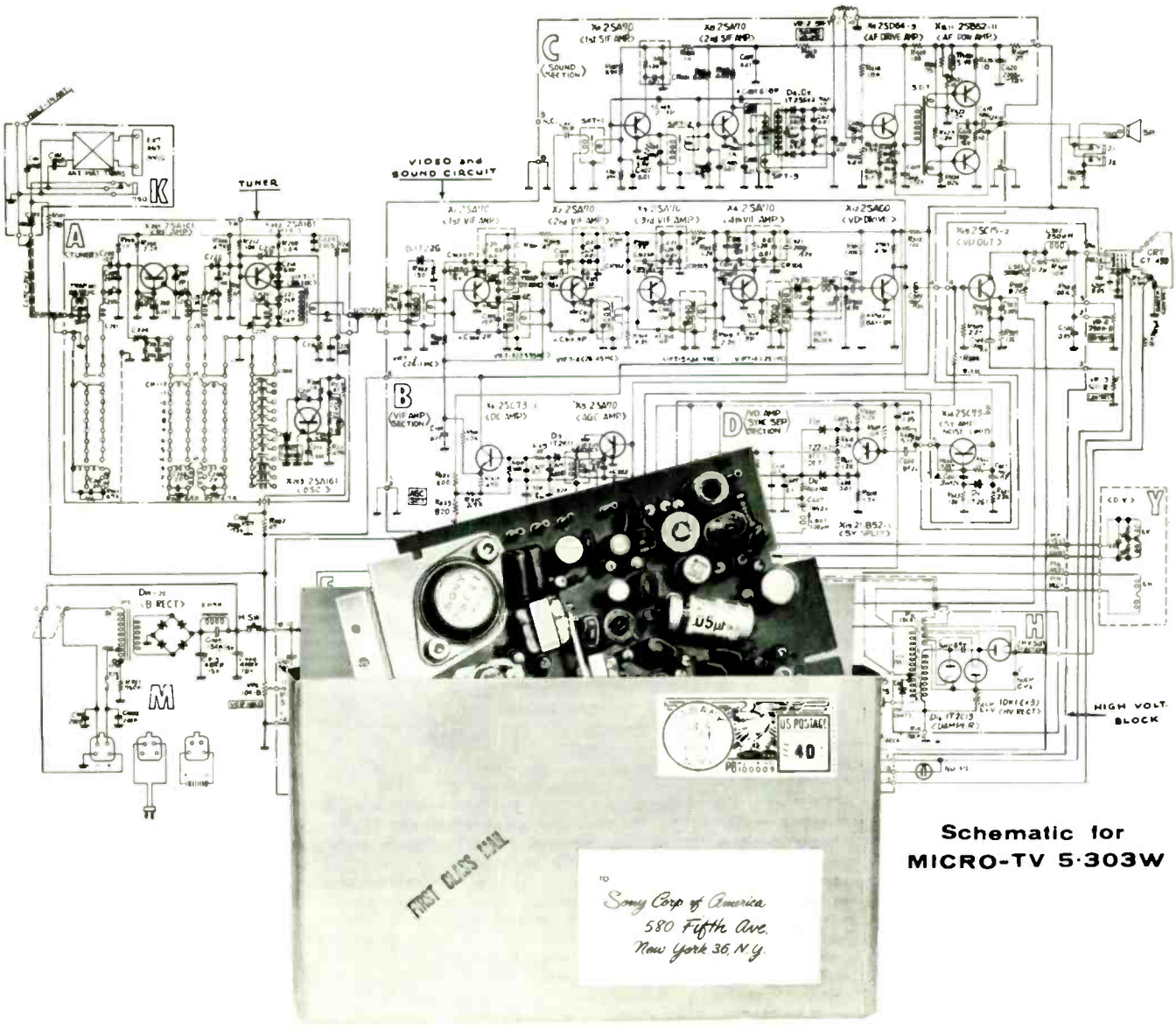
You are now competing with two newstand magazines. This leaves the main reason for subscribing to your magazine over the others to the schematics. (And the others are starting that, too).

Right now there is a need for a magazine for electronic techs (there *are* some for tinkers).

ROD FERREIRA

Long Beach, Calif.

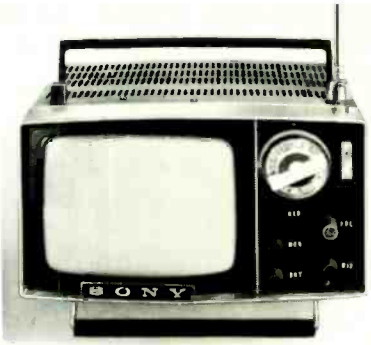
• *We feel that both TV and closely allied electronics work can best be covered by itself. All articles in ET are directed at the professional TV-audio service-dealer. ET has no competition in this very specialized area. All other magazines attempt to cover the field by diluting their product through inclusion of side-line information. Our sister publication,* INDUSTRIAL ELECTRONIC ENGINEERING & MAINTENANCE *is designed specifically for the industrial technician. — Ed.*



Schematic for MICRO-TV 5-303W

Easiest way to service a TV!

Standard trouble shooting procedure and the schematic will pinpoint any faulty component of the remarkable SONY Micro-TV, the Television of the Future. The circuit boards, on which most components are mounted, will snap out to permit you to replace the part easily. But that's only part of the service picture. Should you not be able to do your own repairs, or if you do not care to stock a full selection of parts, assistance is as close as your nearest mail box. Simply pack the board at fault (there are only 2, by the way) and send it off to your nearest SONY Service Station.



Stations are located in principal cities all over the country. In remarkably short time the board will be returned, in perfect operating condition, and at a cost that will permit you a full and fair markup. SONY Micro-TV, 8 lbs. and with 25 transistors, operates on its own rechargeable battery, 12v auto/boat power and AC. New price is only **$189.95.** Rechargeable battery, accessories are extra.

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Dear Sony:
Please rush me full details on the fabulous Micro-TV.

Name_____

Firm_____

Address_____

City_____ Zone____ State_____

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

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't ain't so

(a G-E "SG" picture tube *never* gets trapped)

G-E "SG" *straight gun* picture tubes* don't *need* ion traps. Their rugged guns fire electrons with uncanny precision straight at the aluminized phosphor screens —assuring sharply resolved pictures up to *80%* brighter. No fuss, no call-backs. 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.

MORE "ACCENT ON VALUE" FROM YOUR
G-E *ELECTRONICS* DISTRIBUTOR

GET THIS "ACCENT ON VALUE" BONUS TODAY

This 16" x 12" x ½" polyurethane foam bench pad neatly protects the picture tube from marks and scratches. The handy pad's yours with the purchase of a G-E SG-21FLP4 Service-Designed "straight shooter." Your reliable General Electric distributor is waiting for your order now. Call him today.

**All new parts and material in a reused envelope.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

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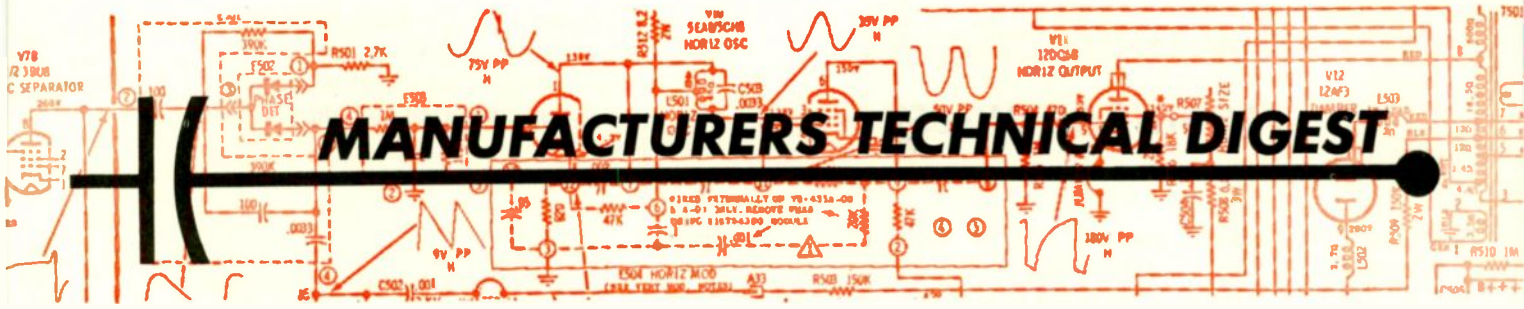
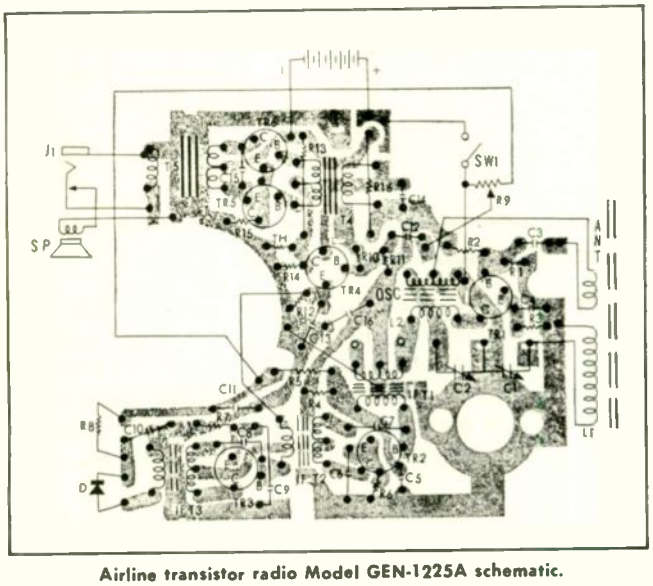


MANUFACTURERS TECHNICAL DIGEST

AIRLINE

Transistor Portable Radio Model GEN-1225A—Production Changes

Radios bearing production code dates 2292 or later contain the following changes: R10 is 5.6K instead of 5K. C14 is .01 instead of .005. R1, R2, R3, R6, R7,



Airline transistor radio Model GEN-1225A schematic.

R10, R11, R13, are 10% instead of 20%. R10 alternate values are 5.6K, 4.7K. The printed board connections for R8, C10, C11 are revised. See layout.

GENERAL ELECTRIC

Chassis "MW"—Production Changes

1. To increase picture tube beam current the value of resistor R176 in the picture tube cathode circuit was changed from 180,000 to 150,000 Ω in all 23 in. receivers coded 117MW and above.

2. In chassis bearing code 125MW and above, the high voltage rectifier tube was changed from a 1J3 to a 3A3. This change necessitated the use of an additional two turns of filament winding on the horizontal sweep transformer and an additional series resistor in the filament circuit. The resistor (R268) value is 3.6 Ω, ½ w, wire wound. This change provided controlled warm-up of the high voltage.

3. To reduce picture top bend, a 100 pf, capacitor (C266) was added from Pin 7 of the horizontal output transformer to the junction of R263-R264 in the 6DQ6B grid circuit. The 6DQ6B was mounted on the sweep circuit board. This change was incorporated in 23 in. chassis bearing code 125MW and above and in 19 in. chassis bearing code 127MW and above.

4. In chassis bearing code 128MW and above, the value of resistor R263 was changed from 820,000 Ω to 560,000 Ω. This change was made to avoid over dissipation of the 6DQ6 (V13) grid.

Chassis M579—Production Changes

"W" Code: Separate schematics drawn for 23 in. and 19 in. models. Minor circuit value changes. Refer to "W" Code chassis diagram for 19 in. or 23 in. as required. **"V" Code:** Rectifier Y251A, Y251B changed from dual selenium type (Cat. # R3057) to a single silicon type Cat. # R5931—2 used. This change also requires a change of capacitor C252 from 68 pf (Cat. # R4090). Otherwise refer to "W" Code chassis diagram for 19 or 23 in. as required. **"U" Code:** On 23 in. models only the tuner was changed to a cascode type Cat. # R5963. This change also required deletion of R180 and R181 was changed to 4.7K 4 w. On 19 in models no change was made and "U" code 19 in. chassis are the same as "V" Code 18 in. chassis. **"T" Code:** On 19 in. models the tuner was changed to a cascode type Cat. # R5963. This change also required deletion of R180 and R181 was changed to 4.7K 4 w.

MOTOROLA

Stero-Phono Models HK & SK—Production Changes

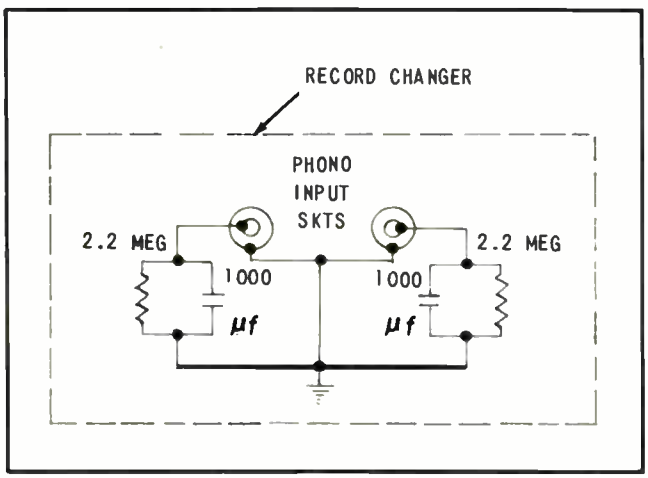
Chassis Code HS-961B: To reduce spurious audio oscillations add R27 (22K 10% ½ w) from grid of vibrasonic pre-amp (pin 7 of V-2) to ground . . . . **HS-969A-2:** Same as HS-969B . . . . . **HS-969B:** To reduce regeneration, R29 (220K) changed to 100K; C62 (56 pf) is changed to .001 μf; C68 (100 pf) added; capacitor C69 (10 pf) moved from power amplifier chassis to pre-amp chassis . . . . **HS-969C:** To increase FM sensitivity change FM limiter tube (6BA6) and 1st FM tube (6BA6) to 6AU6 . . . . **HS-969D:** To reduce possibility of audio distortion when tuned to a strong AM signal, R64 (6800 10% 2 w) was added; AM RF and converter stages rewired; C38 (.01 μf) changed to .05 μf . . . . **HS-997B:** To increase FM sensitivity, FM

limiter tube (6BA6) and 1st FM IF tube (6BA6) changed to 6AU6 . . . . **HS-997C:** To reduce possibility of audio distortion when tuned to a strong AM signal, R37 (6800 10% 1 w) added; AM RF and converter stages rewired . . . . **HS-1012:** To eliminate AM audio feed thru when selector switch is in phono position (on some early models), selector switch was changed. New switch removes B+ from AM converter tube. If feed thru problem occurs, replace selector switch. Order part no. 40C61199A01.

PACKARD BELL

Radio-Phono Models RPC-193, -20S, -21S and FM-Stero Multiplex decoder MPX-2—Production Changes

Model RPC-20S: Two resistors 2.2 Mohms (73065) and two capacitors, 1000 pf (23965) added to record changer. They are connected to the audio input to the



Packard Bell production changes in RPC-20s record changer.

changer as shown. In decoder MPX-2, coil 29763A becomes issue "B" (1-101 & 102).

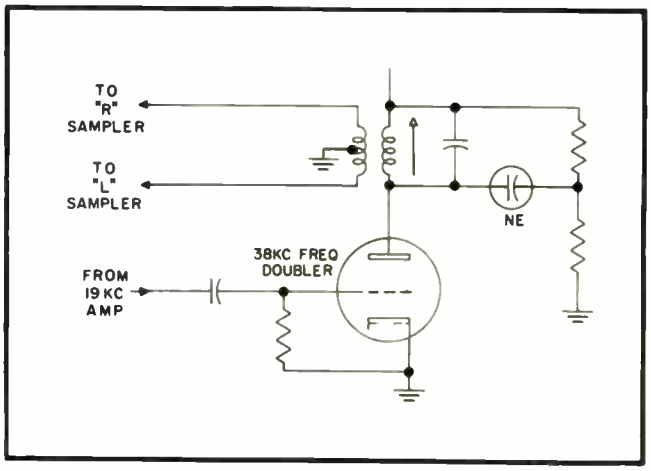
In the 6TU1/7TU9 tuner, capacitor C-6.1, 220 pf (PB-23915) was added. Purpose: to decrease possible tweet at 910kc.

In multiplex decoder MPX-2, coil L-103 (19 kc tank coil) was changed from part number 29798 to part number 29827. Coil 29798 may be used if a 10,000 Ω resistor is connected as indicated in the MPX-2 schematic.

PHILCO

"L" Line Consoles—Multiplex Indicator Lamp

As shown, the stereo indicator lamp is a neon type NE-2AS biased just off by the two resistors in the divider circuit. When a multiplex program is tuned



Philco "L" line multiplex indicator lamp circuit.

in, the 19 kc pilot carrier will be present. This carrier, when separated, amplified, and doubled appears at the plate of the doubler as a 38 kc signal. This signal, which also appears on one side of the neon lamp, is sufficient to increase the voltage across the neon on signal peaks, defeating the bias, and causing the neon to glow.

When the function switch is in any position other than multiplex, the B plus is removed from the doubler stage and the neon is inoperative.

Line Cord Antennas — All Stereo Models

Philco radios and consoles include either a built-in dipole aerial or line-cord antenna. Although convenient, experience shows that multiplex FM stereo reception is improved by an external directional antenna. When a customer asks if outdoor antennas are needed for FM stereo — the answer is always "yes."

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  - 30 types of front shafts for dual concentrics
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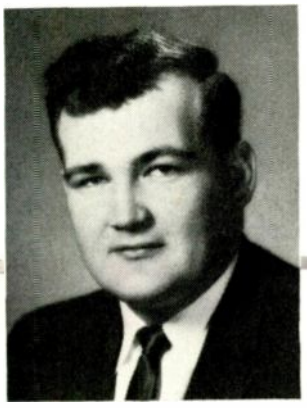
EDITOR'S VIEWPOINT



Columnist Assails Technicians

In a recent issue of AUDIO magazine columnist Edward Tatnal Canby unleashed a bitter and uncalled for attack on technicians. A portion of this tirade, widely read by your customers, is reproduced here.

" . . . in component repair, (there) is the local serviceman, the neighborhood radio and TV man. The less said the better about him. My advice still to all who ask is to stay away . . .

"Nowadays, your local serviceman will take on any old job you want, with greedy anticipation. The more complex the Hi Fi, the better he likes it. After all, these things all work mostly alike. An amplifier is an amplifier, isn't it, whether it's a Philvox or a Zenico. They all work the same. And the same goes for radios—uh, er—tuners, I should say. Tuner doesn't work? Simple. Just pull out that diagram for last year's Magnificent Magnarola. Tells you how to align the Magnarola super-combined FM AM-Multiplex-TV circuit. Just do the same thing on the component tuner—it can't do any harm. Might come out OK. And so the component tuner goes merrily off to the repair shop and comes back a few days later; unaccountably, it still doesn't receive that local good music station, though the bill for repair was $28.50. When it was brand new, you got the station loud and clear . . .

.."As things stand now, I hesitate to recommend to my friends any Hi Fi repair dealer or the like without knowing a lot about him ahead of time. The chances are more than good, I'd suggest, that the component customer will get the royal runaround, big repair bills, and little satis action. As I say, anybody can be a Hi Fi repairman, and often is.

There was no reason behind this harangue. It was written, as far as I can tell, because the family tuner was not prope ly repaired by a local service shop. He said that the cost for the repair was $18. It is difficult to say whether or not this is true, however, since the TV was repaired at the same time, and a single check stub was his only evidence.

Most of us who feel we are cheated when paying for a service or a product return and ask for additional service or demand our money back. Not Canby! The tuner was sent to the factory, some new tubes were installed and the set was aligned. The cost was about $30 including shipping charges. The charge per hour was $7.50.

Canby feels this is fair enough and tells his component-owner audience that they should all send their equipment to the factory and be prepared to pay as much as $12 an hour.

Even if the technician who worked on this particular tuner is incompetent, contrary to popular beliefs, one rotten apple will not spoil the whole barrel. But let's assume for a moment that the local technician is competent and read between the lines, to see more clearly what probably happened:

Canby's mother called the local service technician to have the TV repaired. While he was there she suggested that he take a look at the tuner too. To quote Canby once more, "Working conditions (of the set) for my father meant two things. One, he had to get his morning news of the world on the radio along with his coffee. Two, there was the seven o'clock dinner commentary by his favorite news analyst. If these two were audible, more or less, he was happy. He didn't mind the extraneous noise, the distorted voice quality —" etc. I strongly suspect that Mrs. Canby asked for the set to be put into "working condition!"

The faulty tubes which were replaced were described as follows: A 6AU6 had very low emmission. (If the technician did not intend to "put a lot into the tuner" he may have substituted tubes. This may not have shown up in the tuner's output and the only problem may have been the tube's relatively short life.) A 6BQ7 had a cathode to grid short. (Quite common with this close-spaced element tube. I wonder if it couldn't have been shorted in transportation to the factory.) A 5Y3 had low emission. (Again indicating short life, perhaps not affecting B+ delivered to the set.) And a 6U5 was very dim. (This being an indicator tube, would not affect the sensitivity, selectivity or response of the unit).

In addition, the set was said to be "badly misaligned," which Canby blamed on every technician who ever touched the set. (Canby doesn't really know how many, if any other technicians worked on the unit.)

Tampering to be sure, is the quickest way to misalign any tuned circuit. But there are many other ways sets become misaligned. Drifting. he asserts, is not possible; it was too far out. But let's try a couple

Continued on page 94

Prevent return of 'unusable' components by reviewing replacement literature more closely

■ When service technicians order sweep components from their suppliers, it is safe to assume that most chassis requiring the parts are already in the shop or partly disassembled in the analysis phase. Components can generally be classified, therefore, as "demand" items needed on an "off the shelf" basis, only after the requirement is established.

Unless a service technician is located within a very few miles of the original receiver manufacturer's warehouse, he will rely heavily on his independent parts supplier for his needs.

Within a given area, the independent distributors may be able to supply original parts in two or three brands, but a major portion of service technicians' requirements will be furnished by replacement parts manufacturers.

Nationally distributed replacement transformer lines will include up to two hundred and fifty flyback items, but from fifty to one hundred of these will tend to be inactive. How does the service technician fare when he may find any one of more than *four thousand* different part numbered flybacks in the receiver under repair?

The answer is not simple, because several factors control the demand. Some flyback types have a low failure rate, some flyback failures cause the receiver to be junked, and to mention another extreme, more than thirty different part numbers under many different brand names may appear for one type flyback. Some distributors will estimate their requirement coverage to be approximately as follows:

More than 50 percent of requirements can be filled "off the shelf" by items requiring no mechanical or electrical changes.

An additional 30 percent can be filled with items requiring relatively simple changes.

This leaves something more than 10 percent of requirements having no convenient replacements.

The last group can have a serious effect on service technicians' income and customer relations, and replacement parts manufacturers are employing continuous market survey work to eliminate this bottleneck.

Parts distributors are already carrying up to a hundred items at a very poor turnover figure, and it is estimated they would have to carry an additional two hundred items to reduce the 10 percent figure to 5 percent or less.

Problem Solution

Since it appears that the number of flybacks available to service technicians will tend to be limited by shelf and distributor capital requirements, a solution is limited to two major possibilities:

By careful design and planning parts manufacturers can substantially increase coverage per item carried by the distributor. This can be understood when it is explained

March LPV Article in Error

The LPV Antenna article on page 49 of the March issue of ELECTRONIC TECHNICIAN contained several errors and erroneous implications. Three typographical errors may have caused some readers trouble. First, the upper limit of the VHF TV band is, of course, 216 Mc. Second, the Greek letter sigma should be shown as σ. Third, the value of sigma for the antenna discussed is approximately 0.085. In addition, information supplied to ET by the manufacturer of the "LPV" was incomplete and in error.

The statement that the performance of the LPV is relatively independent of frequency should be clarified by pointing out that the LPV is a multiband antenna. Response between bands is low and characterized by complex pattern lobeing. The major difference between the LPV and the older log-periodic antennas employed in many military applications is this multiband characteristic. On a conventional log-periodic, the longest elements determine the low frequency cutoff while the shortest elements specify the maximum frequency. Response between these points is nearly flat and continuous. Since many applications call for performance in discrete bands, the log-periodic results in an unnecessarily long antenna.

The LPV, by contrast, operates in harmonically related bands. In the lowest band, it acts as a log-periodic, but higher bands operate as odd harmonics of this primary frequency range. For TV use the 3/2 wavelength mode is used to cover the high band. The complex lobeing characteristic of the 3/2 λ mode is the cause of the veeing which gives the antenna its distinctive name.

Basic work on the LPV was performed under USAF contract and development of a TV model was financed by a grant from the University of Illinois Foundation. As far as can be determined by the editors, no TV antennas built according to the theory outlined are available commercially.

TV FLYBACK REPLACEMENT PROBLEMS

by Irv Tjomsland
Stancor Electronics

that each flyback added to the line is an identical replacement for, preferably, the item most in demand, which is considered the "Primary Application." From this point the design engineer studies flybacks of the same electrical and mechanical family. He may find that a tap or tie-point can be added in a way that it will not confuse or complicate its use in a "Primary Application," and will provide an "easy-to-use" secondary application.

The key to the "Secondary Application" is found in using an improved type instruction sheet packed with the part. If all information covering Secondary Application use is included, service technicians will be more confident and find their work simplified. They may even refer to the item as an "Exact" replacement for the secondary application even though some may have made a terminal change.

Other Problems

Acceptance and success of the "Secondary Application" principle will be determined by accuracy of the recommendation and the skill applied to the design of the component to limit the amount of change necessary to install the part. Service technicians tend to have long memories concerning early recommendations of flybacks which could be installed if seven hours of bench-time were allowed for all necessary modifications.

Most service technicians now specify the following minimial requirements.

1. Replacement flybacks should be identical to the original, and require no drilling or metal modification.
2. Replacement flybacks should be identical electrically, as far as resulting boost, horizontal scan, high voltage, and operating temperature are concerned. Units with no terminal number changes are greatly preferred.

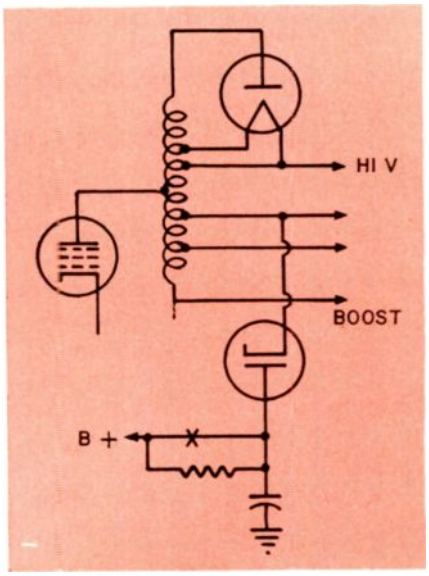
Some manufacturers believe that technicians can contribute a great deal to solving the problem by:

Making use of catalog and instruction material which would simplify their work. Prevent return of "unusable" flybacks reviewing replacement literature more closely. A few moments spent checking a footnote in the replacement guide or a suggestion on the instruction sheet can save hours of hard work.

Technical Problems

Excessive B+ can create sweep problems. It is generally caused by high line voltage, high efficiency rectifiers or incorrect power transformer replacement. If the B+ output is even 10 percent high, results in the sweep circuit are apt to be troublesome.

As a broad "rule of thumb," service technicians should expect horizontal current output to increase 1 ma for each excess B+ volt. An excess of 20 v can cause an extra 20 ma to flow which is almost certain to destroy the flyback and output tube.



Premature failure and poor operation can often be blamed on too much B+. This voltage can be reduced by inserting 100Ω of resistance in the damper tube's plate circuit, for every 10 v of excessive B+. The resistor should then be by passed with a suitable capacitor.

Service technicians can correct this problem by using dropping resistors, either in the damper plate circuit (in the case of autoformer flyback circuits) or by correcting B+.

Use about 100 Ω for every 10 v of excess B+ at the damper plate and bypass this with any size capacitor between .1 to 10 μf with suitable voltage. The resistor can be 10 w for up to 50 v (500 Ω). Many service technicians will be surprised to find that width and high voltage

TV FLYBACK Continued

occasionally improve when such corrections are made.

Excess Screen Dissipation

Horizontal output tube screen dissipation must be maintained at or below the permissible tube rating. Maximum ratings range from 2.5 w for the 6BQ6, to 3 w for the 6CD6.

To determine screen dissipation divide the voltage appearing across the screen resistor, by the actual resistance (measured). The answer will be the screen current in milliamperes. Multiply this ma value by the voltage from the screen to B— and the answer will be the screen dissipation in watts.

For example in a receiver employ a 6BQ6:

Divide	130	(volts across screen resistor)
by	8200	(measured resistance)
equals	15.8	(milliamperes, ma)
multiply by	120	(volts screen to B—)
equals	1.9	(watts screen dissipation)

In this instance the dissipation is safe and no trouble should be encountered.

However if the 8200 Ω screen resistor has changed value and actually measures 5600 Ω, the situation can be more dangerous:

Screen voltage 125+5600= 22.3 ma x 125 (screen to B—)= 2.8 w which is almost sure to cause 6BQ6 failure.

In general, flybacks will usually give good service if the resulting plate current, boost, high voltage, and width are similar to the specifications for the original part.

The Unavailable or Unknown

If the service technician would expand test equipment use to include some ac factors rather than limit himself to such dc measurements as resistance checks, for instance, he would find that he could remove much of the mystery which tends to surround the flyback subject. If he would familiarize himself with simple impedance bridges, he would find that he could make valuable defective flyback measurements. By measuring the inductance between taps, it is possible to check out prospective replacements, either by reference to manufacturer's inductance specifications or by comparison measurements of possible substitutes.

While measurements are being made on difficult units he would find that most flybacks tend to follow certain family relationships: For instance, the flyback section in parallel with the yoke will tend to range from six to fifteen times the inductance of the yoke. If the yoke is in the 12 mh family, the section of the flyback in parallel will be from 60 to 150 mh. He might also find that the section between the damper cathode and the tube plate will have definite relation to the type of output tube and the B + voltage applied to the sweep circuit. For the 125 to 150 v circuit this inductance would range from 15 to 35 mh, in the 250 v circuit the section would range from 30 to 100 mh.

A single shorted turn in a flyback can hardly be detected with an ohmmeter, but the inductance might register a drop of 80 or 90 percent. As the service technician becomes more familiar with such measurements and reactions, he will tend to have a much better understanding of his sweep problems.

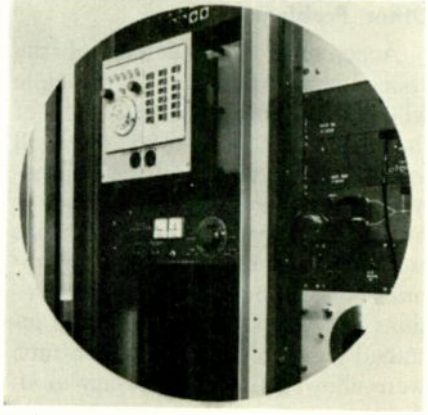
Manufacturers, distributors, and service technicians have a common goal in solving this problem generating lost time, low sales and poor profits. ■

FM on Telstar

■ Results of a special FM reception test from the Telstar satellite orbiting in outer space was announced by Bell System engineers recently. In this test, FM signals were sent to Telstar where they were rebroadcast to the "Earth Station for Communciating by Satellite" at Andover, Me. An FM broadcast monitor tuner (rack-mounted) was used for this successful project.

In describing this unique breakthrough in communications technology, the engineers told how FM signals were relayed from the Telstar satellite orbiting the Earth at 16,000 miles per hour at altitudes varying from 500 to 3000 nautical miles. Signals from the satellite were received back in Andover by a giant horn antenna 180 ft long and 95 ft high.

The same tuner is used high atop Mount Washington, N. H. to pick up FM signals from Boston for rebroadcast throughout New England and Canada. This installation established long distance records. ■



Rack-mounted FM broadcast monitor tuner used in Telstar tests.

Stereo generates new problems in controls

REPLACEMENT CONTROLS

■ Replacement controls for volume, brightness, contrast and a variety of Hi Fi and other applications are presently available from several manufacturers. These controls should not be selected blindly, however. Information included in some parts lists is inaccurate or incomplete. And certain applications require a knowledge of taper, wattage, and with dual controls, tracking.

Often, a replacement is required when no parts information is available. Yet, in most cases, a control meeting the requirements can be assembled from manufacturers' replacement kits. Your distributor has information to help you assemble these kits or may assemble them for you.

Stereo Controls

The common volume control has become a sophisticated component in stereo equipment using dual pots. The stereo volume control looks very much like a conventional dual volume control externally; both control sections being adjusted simultaneously by turning the single shaft. From a manufacturing and performance standpoint, however, the stereo control differs from the conventional volume control. Extremely close tolerances, both electrical and mechanical, must be held, which require different manufacturing techniques. It is therefore extremely important, from a replacement standpoint, that stereo controls be used to achieve the high degree of matching specified by the original set manufacturer.

Fig. 1 shows the standard volume control attenuation vs. rotational curve. The mis-matching between channels A and B is as much as 27 db. Of course this is an illustrative curve; in some instances the standard volume controls would exhibit better characteristics, and in other cases the mis-match might even be worse. Fig. 2 illustrates the mis-match in stereo controls. The degree of matching results in the consumer being unable to hear the difference between channel outputs.

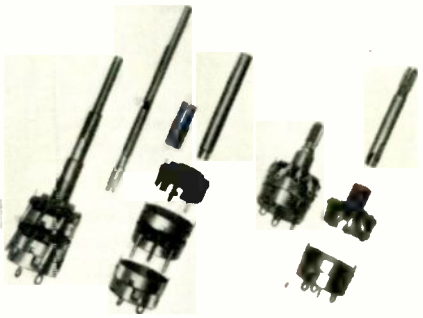
With standard controls, when the user turns the volume control to a low listening level, one speaker might still be playing, and the other speaker might be completely dead, thus losing the stereo effect. This example illustrates most clearly the difference between a standard versus stereo matched control. Of course, the standard control may also give unsatisfactory results throughout the listening level, causing customer dissatisfaction.

In stereo controls, the composition resistance elements must be held to close resistance tolerances, and the resistance taper must be closely matched by checking various points of rotation. Even with perfectly matched resistance elements, mechanical tolerances are critical.

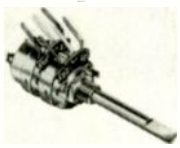
Taper

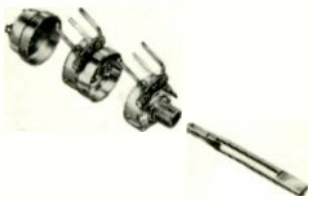
This principle does not just apply to volume controls, of course. Bass, treble and loudness controls must also be matched. In most of these controls a certain taper is required. If the taper isn't known, or if it is necessary to check it out, a simple procedure can be employed.

In most service work, a few tapers are all that is necessary: The

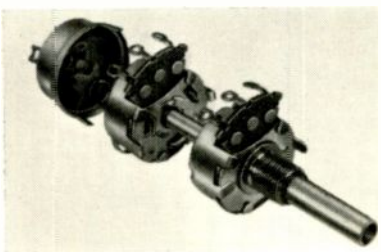


CTS-IRC replacement control kit.

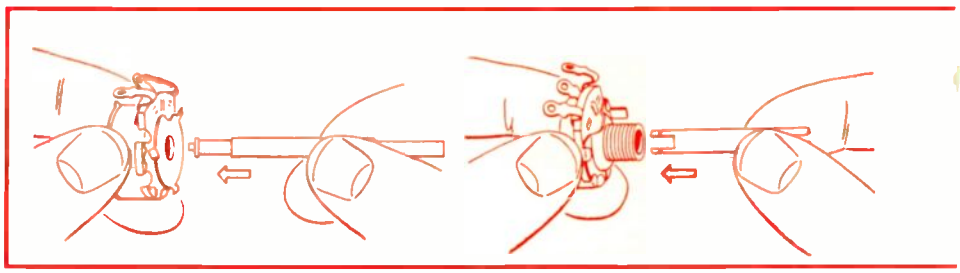




Centralab replacement control kit.



Clarostats dual concentric control.



Sequence of construction for Mallory dual switched controls.

CHART I

Type	Description	Use
Linear	Uniform resistance change from either end	Hor. & Vert. Centering, Hor. & Vert. Hold, Hor. Drive, Vert. Linearity, Focus, Brightness, Height. Contrast
Semi-log	(audio) 10% resistance center	Volume or Tone
Right-hand semi-log	Reverse of Semi-log. Decreases with clockwise rotation.	
Modified log	20% resistance, center rotation	Principally as Volume Control, also as Tone Control.
Right-hand Modified-log	20% resistance center rotation. Reverse of Modified log. Decreases with clockwise rotation.	
Symmetrical-straight line	Slow resistance change at either end.	Tone Control

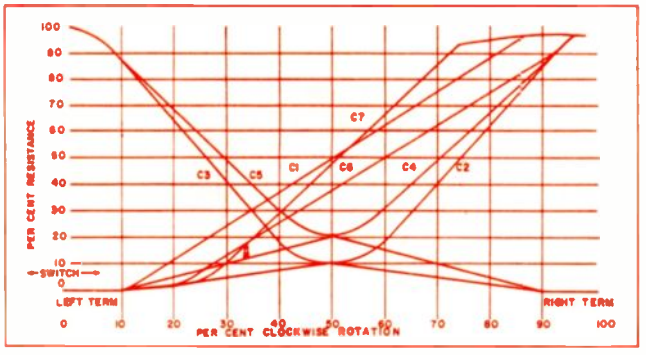


Fig. 3 — Curves for tapers commonly used by technicians: Linear, semi-log, right-hand semi-log, modified log with 20% center, right hand modified log with 20% center, modified log with 40% center and symmetrical-straight line. Courtesy of Centralab.

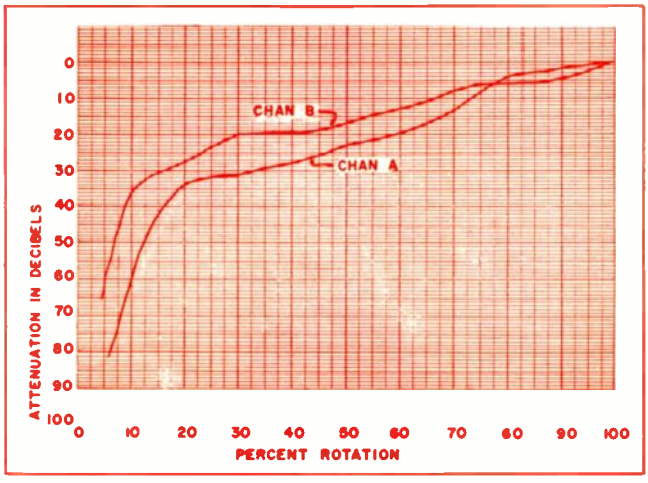


Fig. 1—Unmatched controls plotted to show variation of resistance.

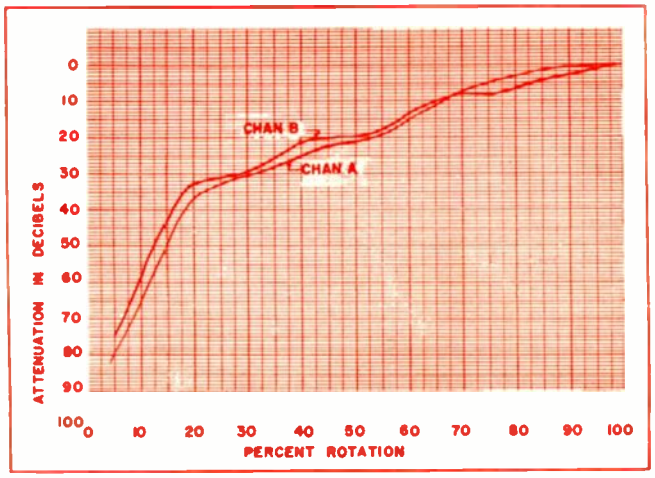


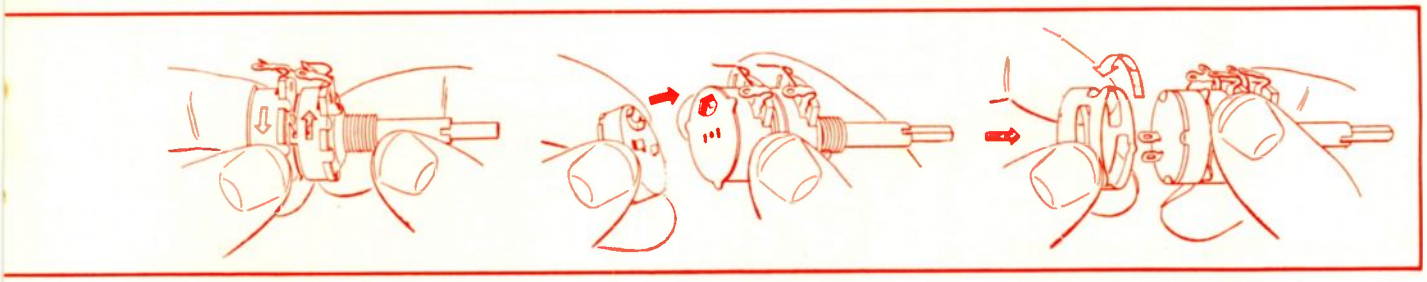
Fig. 2—Matched controls maintain less than 6 db deviation. Courtesy of CTS.

standard or linear taper, the audio log taper and the semi-log taper. In addition, these may be found in the configurations with reversed or left hand tapers. These and other tapers are shown in Fig. 3.

To check these tapers, some graph paper and an ohmmeter are all that is required. Plot the curve by taking about eight readings while turning the control from minimum to maximum in equal increments. The plot should be made against 100 percent rotation and 100 percent resistance.

Curves for common tapers are shown in Fig. 4. Chart I shows uses for most common tapers you might encounter. Although most potentiometers could be replaced with a control of a different taper, in many cases adjustment of these controls might be difficult or impossible.

Where tapped controls are used, the taper must be accurate since the tap is specified in degrees from beginning or end of rotation. A pot with incorrect taper would, of course, provide the tap with a major difference in resistance to either leg



of the control. This could be as much as 50 percent of the total resistance. Tapped pots are most frequently used in audio tone compensating networks.

Replacement

There are almost 50,000 different controls presently being used in consumer type electronic equipment. Obviously, neither you nor your distributor can stock every type you might need for replacement. Most control manufacturers, therefore, market a line of controls which are assembled from the basic elements. That is, separate resistance elements, housings, bushings, and shafts or complexes of these.

A knowledge of the physical and electrical requirements of a given potentiometer then allows the unit to be "built" from standard parts.

Typical units are shown in the accompanying photographs.

Wattage, Breakdown and Cleaning

Control wattage is of course, very important to potentiometer life. Often the technician is confused about the wattage rating, however. In most cases, the rating is given as the dissipation of the entire element. In other words, if the pot is a 2w unit, and 2w are dissipated across the wiper to one leg, the pot will undoubtably fail prematurely.

But wattage is not the only limiting factor in selecting a pot to withstand the electrical abuse it will be subjected to. Voltage breakdown, or arc-over between any given elements must also be considered. These voltages may vary from

Continued on page 96

Transistorized UHF TV Tuner

■ A new transistorized UHF TV tuner is reported to have a noise figure of 7 to 9 db, typical, over the entire 470 to 890 Mc band, and conversion gain of 3 db at 470 Mc, ranging to 8-9 db at 890 Mc.

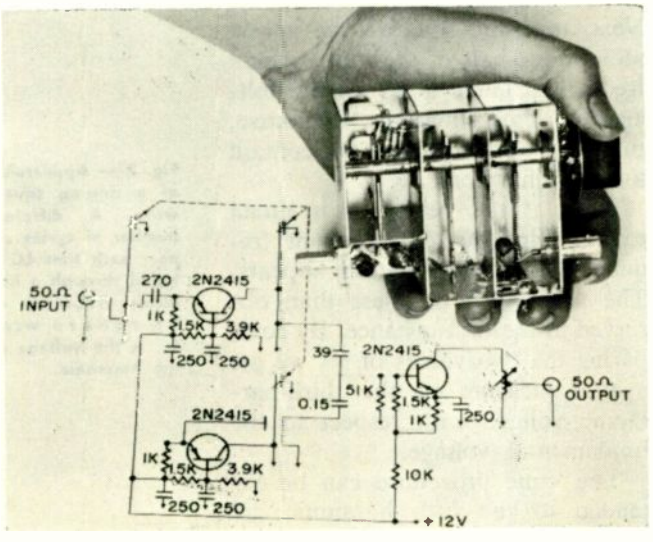
The design project was undertaken to show the practicality of such transistorized circuitry. Full information on the design is being offered to interested manufacturers.

Company representatives expect considerable interest in the tuner, because of Federal regulations requiring set manufacturers to equip all new TV receivers to tune the UHF channels from 14 through 83.

Direct comparisons of the transistorized design indicate its performance superiority over comparable vacuum tube oscillator-diode mixer units, the company said. Vacuum tube circuits show a typical noise figure in the 10 to 12 db area, compared to the transistorized tuner's 7 to 9 db. Comparable vacuum tube circuits usually show a conversion loss of about 6 db as opposed to the transistorized design's gain of 3 to 9 db. Transistors require a power supply of 12 v at 18 ma, where a similar vacuum tube circuit needs both filament supplies and high-voltage with a total drain from 225 to 250 ma.

A transmission-line approach was taken in designing the circuit. Three stages are used, with the first stage an RF amplifier with tuned input and output, using transmission line circuits. The second stage uses the tuning capacitors of the transmission line to provide a 45 Mc IF output. The third stage is a transistorized mixer.

The design was undertaken only to show feasibility of building a transistorized UHF TV tuner. ■



Schematic and prototype transistorized UHF TV tuner designed by Texas Instruments.

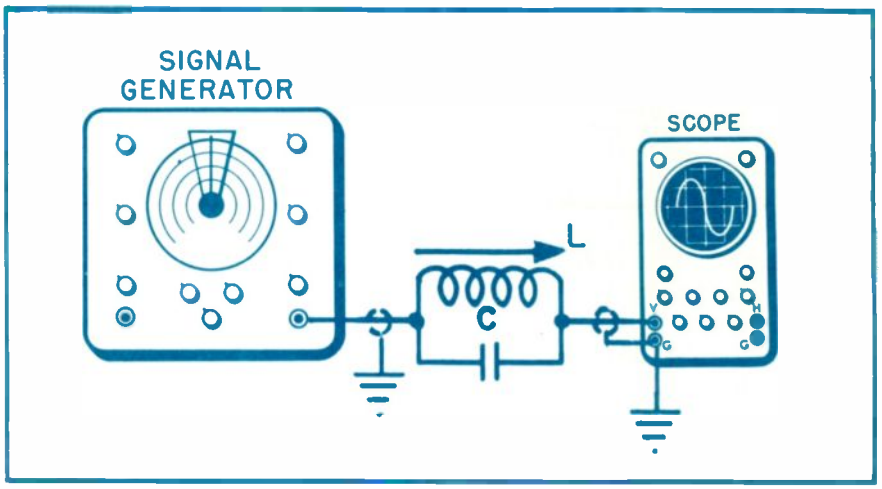


Fig. 1 — A simple ringing circuit for measuring the relative voltages of harmonics in a waveform.

Harmonic Voltages in Complex Waveforms

by Robert Middleton

■ A square wave, like most complex waves, has many harmonics which decrease in voltage as their frequency increases. The relative voltages of harmonics in a square wave are easily measured with the use of an LC ringing circuit, as shown in Fig. 1.

As the slug in the inductor is tuned through successive harmonic frequencies, we see that the harmonic voltage V_h (Fig. 2) is less as each of the higher harmonics is tuned in. This is a general method of demonstrating the basic fact.

In practice however, this is not the easiest method of measuring the relative harmonic voltages in the waveform. The reason is that the inductor's Q changes as the slug is turned. Accurate measurement requires an unchanging and high Q at each frequency of test.

Hence, it is better to vary the frequency of the square-wave generator. In this manner, we take advantage of the fact that the generator has a constant square-wave output voltage at different frequencies. The LC circuit is left tuned to the same frequency, and accordingly we work with a constant Q in each measurement.

Consider the generator output when the square-wave fundamental corresponds to the resonant frequency of the LC circuit. A certain amplitude V_h (Fig. 2) is observed. Next, tune the square-wave generator to one-half of the LC resonant frequency. There is no ringing voltage V_h. This shows us, of course, that a square wave does not contain a second harmonic.

Next, if the generator is tuned to one-third the LC resonant frequency, a ringing pattern appears. The value of V_h is less than observed in the first instance. By comparing the two values of V_h we get a true measure of the third-harmonic voltage with respect to the fundamental voltage.

The same procedure can be extended to the fifth harmonic, by tuning the square-wave generator to one-fifth the resonant frequency of the LC circuit. Likewise, we can check the voltage of the seventh, ninth, etc. harmonics.

Of course, this test method is not limited to square waves. It can be used with any complex waveform. For example, suppose we have an audio oscillator with a somewhat distorted output. As the oscillator is tuned, the scope pattern will display a superimposed harmonic voltage at corresponding frequencies, in the same general manner as for a square wave. ■

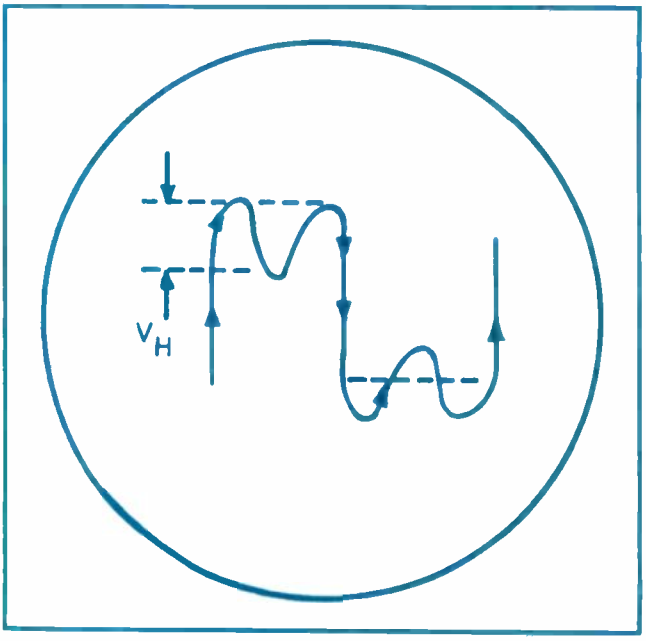


Fig. 2 — Appearance of a ringing square wave. A different number of cycles appear each time LC is tuned through a harmonic frequency of the square wave. V_h is the voltage of the harmonic.

TV B+ PROBLEMS

Logical analysis leads to rapid location of parts breakdown

by E. M. Frickert

■ Many technicians are most familiar with the B+ system in TV receivers. This cannot be entirely explained by its simplicity. The average technician's familiarity may, in fact, come from working in this section, since many TV malfunctions occur in this general area.

Although it is not usually necessary, going completely over an average TV's B+ section, will impress many of you with its complexity. Most circuits in a receiver are confined to a relatively small area; a single input and a single output.

Although having only a single input, a B+ system may have an output for every tube in the set, however. Each output being in some way related to every other output. In some cases one stage may depend on its B+ entirely through operation of another stage.

Stop and think about the headaches you've had with some B+ malfunctions and you may agree that some times it's not as easy as it looks. A review of some typical systems and problems may save you some time on your next B+ dog.

B+ Distribution

Several different methods are commonly used for B+ distribution in present-day TV receivers. A typical distribution system is shown in Fig. 1. This is the parallel type hookup most commonly employed in both transformer and non-transformer powered sets.

A less common type is shown in Fig. 2. This particular system is used in a Motorola chassis. It is employed to eliminate the power loss encountered in voltage divider type circuits.

A voltage divider distribution system employes a series string of resistors to ground. Various voltage requirements throughout the set are then tapped off the string. Most all other variations are from within the power supply itself.

The most common power supply is shown in Fig. 3. This is a full wave rectifier, transformer powered. The rectifier is usually a vacuum tube though silicon or selenium

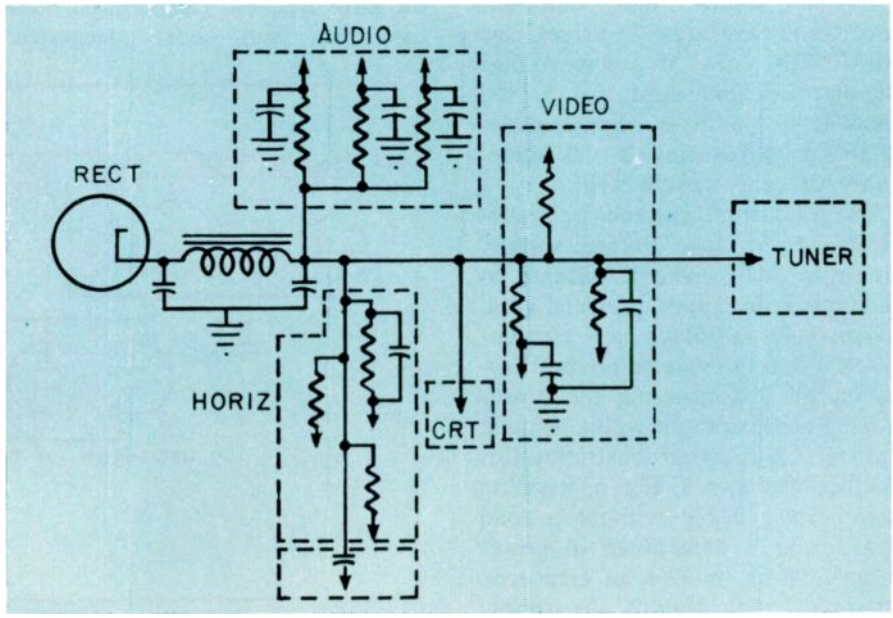


Fig. 1—Distribution of B+ in a typical TV receiver.

units may also be employed.

Some sets which require a negative voltage capable of several ma have a resistor in the return leg of the transformer which can normally supply up to 20 v bias at various points throughout the set. This resistor is sometimes used as a surge protector when the "output" is not filtered. This circuit is shown in Fig. 4.

Transformerless sets usually employ a voltage doubler circuit to counteract the lack of a step-up obtained with transformer powered sets. Silicon or selenium rectifiers are used almost exclusively when no transformer is employed because of their low voltage drop and because rectifier filaments are often hard to match with other tubes in a series string. The series string is always used in transformerless sets, since there is no other way to supply the proper voltage to each of the tubes. A typical voltage doubler circuit is shown in Fig. 5.

Troubleshooting

Technicians should be particularly aware in troubleshooting B+ systems that all possibilities are taken into consideration. Frequently a technician will pull tubes in order to isolate the problem. If he is thoroughly familiar with the B+ distribution, this is fine. But haphazard tube pulling may only lead to more confusion.

When several usually unassociated problems arise in a set, the most likely cause is a low voltage supply problem. And this is the most logical area to begin troubleshooting. Measuring B+ is sometimes the only requirement.

Heavy current demands or breakdown of the low voltage supply, however, may make it difficult to determine the exact problem area. When such problems are encountered it is often wise to attempt isolation by disconnecting the power supply and loading it with a suitable resistor. A diagram illustrating this method is shown in Fig. 6. Running the power supply without a load may cause a breakdown of power supply filters or give an erroneous "normal" indication if the supply is breaking down only under load. Since isolating the trouble to a specific area of the receiver is the biggest problem in most repairs, this is often a very important step.

When the power supply performs normally with a substitute load installed, the malfunction is obviously in one (or possibly more) of the other circuits in the set. Isolating the stage at fault can be very time consuming if a logical step by step procedure is not employed. Before any troubleshooting is begun, of course, it is understood that there is a logical reason to assume the B+ system is at fault. In other words, that line voltage is reaching the set, that the filaments are all lit, etc.

Once it is determined that the trouble is not in the low voltage supply itself but is in some other portion of the set, the breakdown of each area of the set should begin. In cases where a heavy current drain makes troubleshooting a "hot" set impossible, it may be necessary to disconnect major feed wires from the power supply and reconnect them one at a time until the current drain again becomes excessive. The best method to monitor the drain while using this technique is by inserting a milliammeter in series with the main power supply lead. (This assumes, of course, that resistance measurements could not conclusively pin down the trouble.)

Electrolytic filters are probably the most frequent offenders in both the open and short categories. Shorted capacitors may only show up when a high voltage is applied and open or partially open capacitors may not respond to shunting techniques if more than one unit is bad.

Other non-electrolytic capacitors used in bypass circuits are also frequent offenders. Small ceramic units in the IF and RF sections as well as paper and molded foil capacitors in the audio and sweep sections fall into this category.

The most difficult receivers to repair are those which "couldn't be a tube." Don't overlook this possibility; a tube can cause almost any malfunction that another component can. Check tubes first.

Changing Rectifier Types

Sometimes, because of an unavailable part or other reason, technicians find it desirable to change selenium or tube type rectifiers with silicons or vice versa. In some cases, this is acceptable. In other cases it is dangerous without certain precautions or a poor choice for best set performance will result.

Changing from silicon to tube or selenium units is generally not a wise thing to do. The set designed for silicon rectifiers would probably suffer from the higher voltage drop encountered in either of the other types.

Similarly, changing from seleniums to tubes is not usually done because of mechanical problems, physical limitations, and the addi-

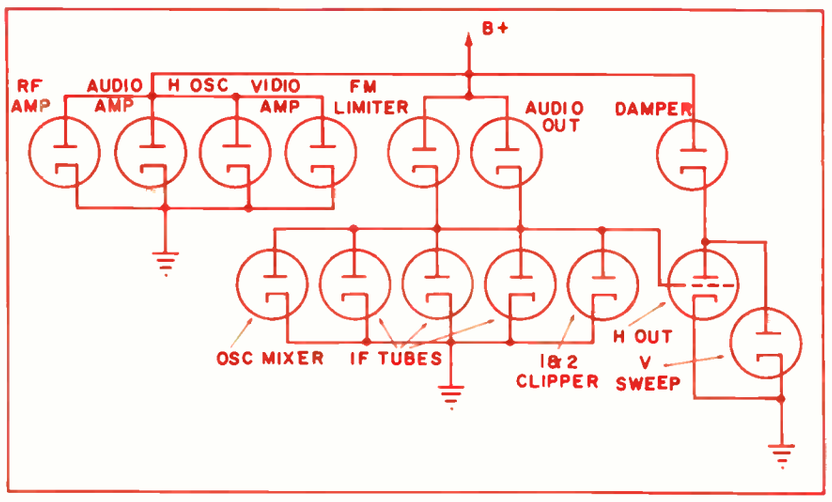


Fig. 2—Series parallel distribution of B+ to provide proper voltage to each stage. Malfunction in any stage can cause B+ variation.

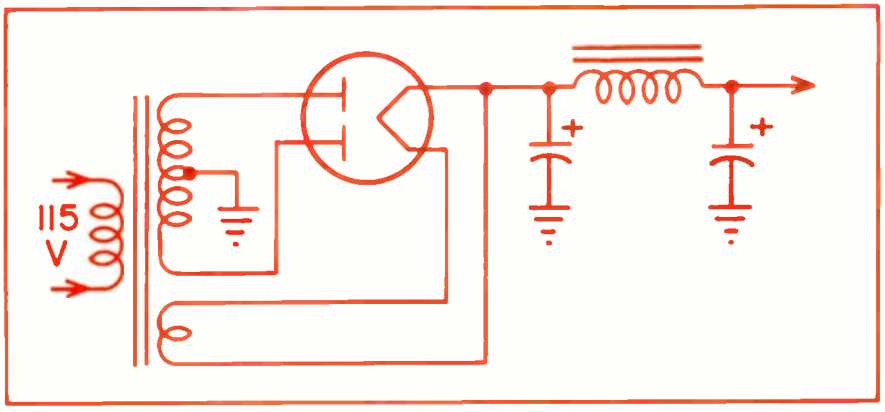


Fig. 3—Full wave rectifier circuit most frequently found in transformer powered sets.

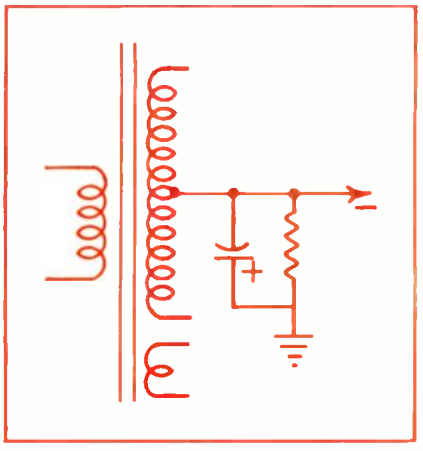


Fig 4—A resistor in the ground return of a power transformer is sometimes used to develop a small negative voltage.

tional filament requirements for these units.

Replacing the tube with a selenium unit is the least troublesome switch. Surges encountered when turning the set on are easily absorbed by the selenium without difficulty. And the voltage drop of the selenium is similar to the drop across the vaccum tube.

Silicons, however, require additional protection. High surge currents shorten the life of silicon rectifiers drastically. Additionally, the increase in voltage from these units can cause a higher failure rate for other compoents in the receiver—particularly electrolytics. To prevent this from happening a surge limiting resistor should be installed in series with the B+ line. Since the voltage drop across these units is relatively low, the drop across the resistor is easily compensated for.

The easiest method to protect the set is with a combination resistor and fuse. You are familiar with these and should stock several values. If a fuse function is not desired, or if a fuse is to be installed separately, a simple resistor with sufficient wattage may be installed. In some cases, where the voltage increase is of particular importance, a resistor, in addition to the fusistor, may be necessary.

In almost every case, one of the larger fusistors should be used with the replacement. A 10-ohm unit, for example, only drops 2 v if the set's B+ draws 200 ma. The increase in voltage caused by the change may be 20 v or more. On sets where the width has become critical because of component deterioration, this may be desirable. ■

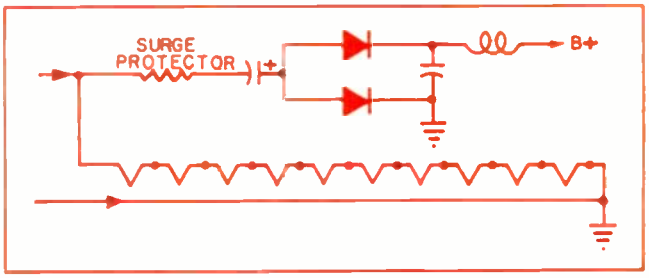


Fig. 5—Voltage Doubler Circuit used in many transformerless TV sets.

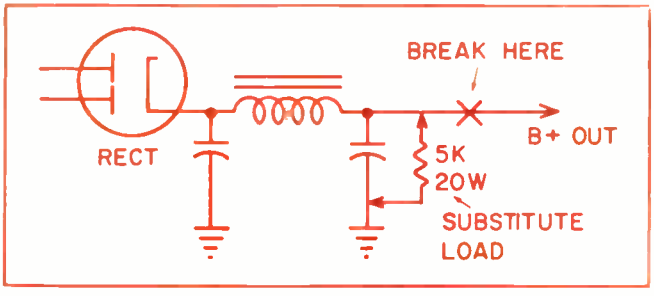


Fig. 6 — Isolating a problem to the power supply or other circuits in a TV is best accomplished by disconnecting the supply and loading it with a suitable resistor.

New concept facilitates troubleshooting and repair

COLOR CODED Service Literature

by Bob Cornell
Colorgrams, Inc.

■ TV receivers have become smaller, more compact, and service technicians find they have to move up closer to their work. They are finding it necessary to revise troubleshooting and repair techniques too. Some technicians have indicated that they are beginning to feel like watchmakers.

Fortunately, servicing a complex TV circuit becomes a simple job if you are able to quickly isolate the trouble area and concentrate on that area.

If you have a sound problem, for example, there's no sense in wasting time in the video or in the sync section. If you have a video problem, your first area of interest then, is video. This doesn't mean that there aren't times when interaction and a defect in the sound section won't cause trouble elsewhere. But these are exceptions that we will be living with for a long time.

Service technicians have been taught to troubleshoot *symptomatically,* to listen to customers' complaints and to examine the way the set behaves. Even before turning on the set or taking it apart, most technicians can get a pretty good idea where the trouble lies. No literature has been able to provide technicians with this kind of prior knowledge.

New Approach

The aforementioned deficiency in service literature has led to the development of a color-coded circuit system to simplify TV repairs. Called *Colorgrams,* the system consists of a color-coded schematic, a set of cards showing the set's printed circuit or wiring, component layout, and a rapid service manual.

Various conductors on printed circuit boards are shown exactly as they appear. Shape, size, relative positions and the components connected to these conductors are also shown. If a PC board is used in a set, a card is used for each section on that board. That is, only the audio on one card, video on another, etc. Circuitry applying to that particular area is color coded. Ground paths are shown in yellow on all cards. Actual circuitry is also drawn in schematically on the card. In addition, most information that normally appears on the schematic; waveforms, resistances —everything that the manufacturer considers important to that circuit —is also shown on this card. In most cases the technician no longer has to refer to the schematic to locate the receiver trouble.

This rapid troubleshooting system is rounded out by a special service manual. The manual calls attention to modifications, production changes, specific and important information that pertains only to a specific set. If the set has an unusual horizontal oscillator circuit, an unusual sync or AGC circuit, for example, an explanation is included. Information of a more general nature, known by all professional technicians, is not included. Technicians are not told, for instance, that a TV's back has to be removed before it can be serviced; that eight screws have to be removed to take off the back, or that a technician should keep one hand in a trouser pocket or behind him to prevent getting shocked.

If a complex method is used to suspend the CRT, however, or if removing certain screws would cause a section of the set to fall apart or cause damage, this is carefully pointed out. Hidden screws in some TVs frequently enable removal of the front glass for CRT cleaning or removal. Information of this type is included — when furnished by the manufacturer.

The rapid repair manual has a parts list based on information furnished by the manufacturer.

Color Cards

The video card shows the common IF strip from the video detector to CRT. At the detector, purple video changes into blue video. The IF in this example is purple and the video is blue. The opposite side of the card begins with the video signal at the detector up to the point of sound take-off and then it breaks into red which represents the TV set's audio circuitry throughout.

Here again signal flow is shown through components.

Instead of having notes on the card showing "volume control," for example, and then another note saying "from volume control," the volume control is drawn in. Loudspeakers and CRTs are also shown. This does not leave the card with a series of dead-ends. The card also shows tubes and pin numbers. Voltages or any other pertinent information can also be found on the card, all shown in their own distinctive color.

Since the entire ground circuit is printed in yellow, this pictorial feature enables you to use almost an infinite number of points around the set for clipping test equipment ground leads. This visual aid alone contributes greatly to time saved.

The entire chassis is grounded in hand-wired sets and is shown in yellow. When only a portion of a chassis is of interest it is "blown up" for maximum clarity. This gives a larger visual presentation of the set.

Additional Aids

When single purpose components appear in sequence you are able to follow them. But in an oscillator circuit when we have a circulatory effect, components vital to the oscillator are "pulled out."

Not infrequently a tube will have two sections, for example. Perhaps a triode section for the sync separator stage and a pentode section for AGC. The triode section, used for sync separation, may have a "built-in diode." The grid of this sync amplifier is used as a plate; the cathode is common to both. In other words you have the cathode, a grid and a plate.

This tube section is located between the sync take-off point and the vertical integrator and appears to be serving like a normal triode. But, when driven positive, the grid is used as a plate—a diode to develop AGC for the set. It takes a pretty sharp technician to identify that this particular half of one tube is being used as a diode and then as a triode. We are able to show this with color. AGC is "pulled out" in its own distinctive color. Only the lower portion of the tube, from the grid down to the cathode portion, is colored. The plate portion appears completely out of the circuit.

When this particular triode is shown as a vertical amplifier, however, the entire triode is printed in another color. To convey this much information without color would take paragraphs of explanation and this would require time to read and digest.

Take-off Points

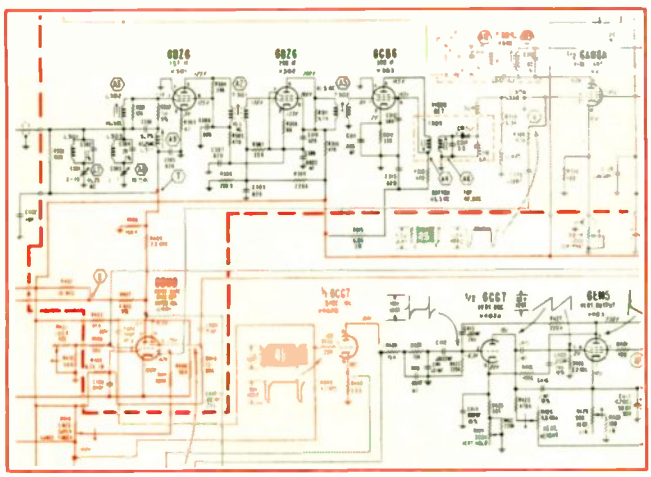
Color is also used to indicate take-off points. Take-off points are easily identified. Sometimes two or three lines will appear in a chassis running into a take-off point. Three different lines, for example, from the video amplifier. One of these lines will actually be the prime sync take-off point. The other line may be used for noise inversion. The third may be a common B+ line which looks like it is a conductor carrying signal from the video amplifier line into this sync section. By using color we are able to identify the sync take-off—with no question about it. And B+, because it is shown in black, leaves no chance for a mistake.

Chassis Identification

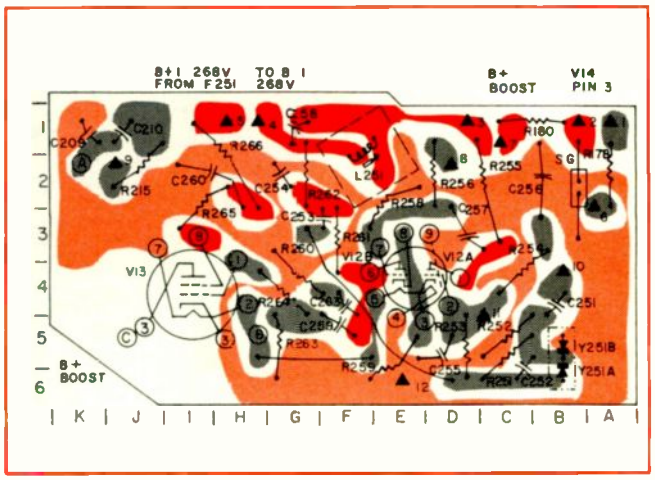
A very simple system is used to quickly identify all chassis. The first two letters of the manufacturer's name is followed by a sequence number. For example, General Electric is GE-1, GE-2, etc. Admiral is AD-1, AD-2, etc. Now, in addition to the chassis itself, if the set has a remote control, this is also indicated in color. If more than one tuner is used, the tuner is likewise colored. This information is included in the manual. All chassis and model numbers are also cross-referenced in an index.

Parts Cross Reference

An expensive IBM - prepared cross reference parts replacement guide, designed to satisfy TV technicians' practical needs, is furnished free of charge to technicians who use this service. The guide includes an original independent compilation of the most up-to-date data available from parts replacement manufacturers. All cross-reference data is keyed to manufacturers' original parts numbers. ■



A portion of a typical schematic used in Colorgrams. As many as seven colors may be used on a single schematic to show the various sections of a receiver.



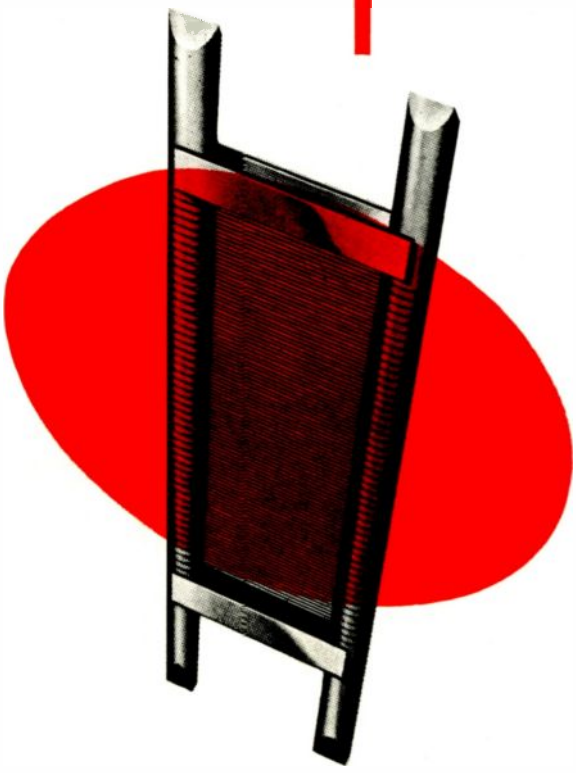
A small portion of a card contained in the colorgram package. The color scheme found on the schematic is carried on the PC card and throughout each set.

WHY SO MANY NEW TUBES?

Consumer demands for better equipment provides incentive to design new tubes

by Arthur Overstrom

Application Engineering
Westinghouse Electric



■ The so-called obsolete vacuum tube is still very much with us—despite transistors, silicon rectifiers and molecular blocks. Because of new manufacturing techniques and new materials the tube is still an important component in the electronics field.

Why do new tube types appear on the market consistently? And why do tube manufacturers make so many different tube types when some of the older types may do the same job? We can also ask, why are the new tubes better than the older types?

Tubes made today, even some older types, use materials and parts which were never dreamed of a few years ago. The incentive to use new materials and processes has evolved from customer demands for better equipment. Consumer demands have resulted in increased reliability, lower prices, smaller size and more convenience. This is reflected in the circuit designer's application of new tubes. And the tube manufacturer finds it necessary to take advantage of new materials and processes to satisfy the designer's demands for higher gain, increased voltage and power handling capability, greater reliability, smaller size, etc. And as new tube types are developed they must be properly identified with different designations. The new tubes cannot be used in place of the old tube types because circuits were not designed to handle them. But old types do benefit from many of these developments, particularly in the area of improved reliability.

Triodes

Although triodes were one of the first tube types to be developed, they still find many applications in our latest electronic products. Triodes are used, for example, in TV tuners.

Since the triode has less active elements, it will develop less inherent tube noise. This is extremely important since noise developed in the tuner will be amplified through the set. Gain is also important in this stage and is proportional to the tube's Gm.

To get higher tube Gm, it was

necessary to develop new tube types having frame grid construction. Frame grid construction permits closer grid-to-cathode spacing which results in higher Gm. This is fine for increased tube gain, but it also has its shortcomings—the effective grid area has become larger because of the larger number of grid lateral turns necessary for increasing Gm. From basic theory, as the area increases the capacity increases. In short, the grid-to-plate capacity increases to a point where stage neutralization may become a problem. Poor neutralization causes feedback which makes the stage unstable.

Grid-to-plate capacity can be reduced by placing a shield with a smaller opening between the grid-to-plate spacing; thus making the effective area smaller. A tube type that uses the frame grid and shield is the 6GK5. The cold grid-to-plate capacity is decreased about 65 percent. The net result of this tube design is higher circuit gain and less inherent noise. Your customer benefits with a clearer and sharper picture with less snow. The 6BN4 is a similar tube that does not have the frame grid and the shield.

Now that the TV UHF operation is becoming very popular, the triode is again coming into its own. It provides the low noise figure needed and the frame grid provides additional gain.

Twin Triodes

Twin triode tubes find many applications in TV receivers. A common application is in vertical multivibrator circuits. In the past, types like the 6SN7, 12AU7 and others were used quite commonly. One section served as oscillator and the other as the output tube. This output section is connected to the vertical output transformer which will drive the yoke to give vertical deflection. With larger picture tubes, however, vertical deflection requires more power. New tubes have been developed to provide this power. An example is the 6EM7.

In order to get additional power from the tube, it is necessary to change the tube's design. Tube designers made the output section larger. Thus, you will find the 6EM7 is larger on one side than on the other. The smaller side is used as the oscillator section.

This sounds very simple, but other problems developed. One problem was how to obtain exact Gm and plate current to meet power requirements. The tube now had more requirements imposed on it. New requirements, for example, meant that the Gm could only vary between 1500 to 2500 mhos for a constant plate current of 13 ma. This means more rigid control of tube design characteristics.

Another major problem was that of arcing. Now, the tube is subjected to very high peak voltages from the vertical transformer. The arcing was eliminated by making sure that the tube parts were very clean. Thus, another quality control was established for this operation. Controls cost money but the customer benefits.

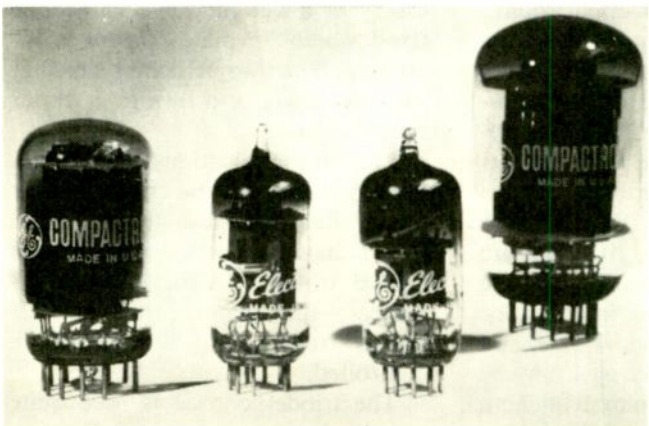
Pentodes

Pentodes also have many uses in the electronics field. For example, the pentode can be used as an IF amplifier, audio amplifier, RF amplifier, voltage amplifier and other special applications. Each application requirement presents different problems to the pentode. Suppose we look at several applications and see what must be done to make the tube fit specific requirements.

In the IF amplifier design, it is important to have low input capacitance, high input resistance and high gain. The frame grid construction provides the high gain requirement. The conventional grid offers lower capacitance and higher input resistance. However, with the frame grid construction, the capacitance is very close to the wound grid value of capacitance. Here the set designer must decide which design he prefers.

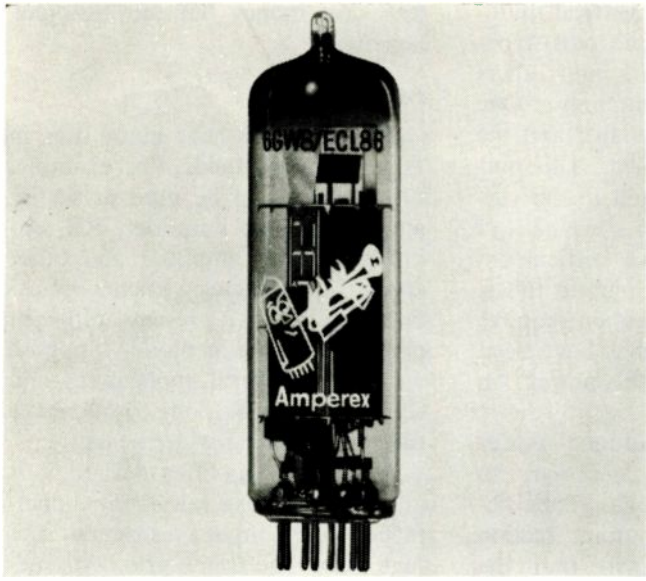
The low input capacitance means that the tube does not control the input tuned circuit. It also means that the set designer is free to use different coil and IF transformer designs if he pleases.

In the IF and RF range, the input capacitance must be measured while the tube is operating and at the frequency the tube is to operate. The true capacity will be less under operating conditions or approximately two-thirds of the cold capacitance value.

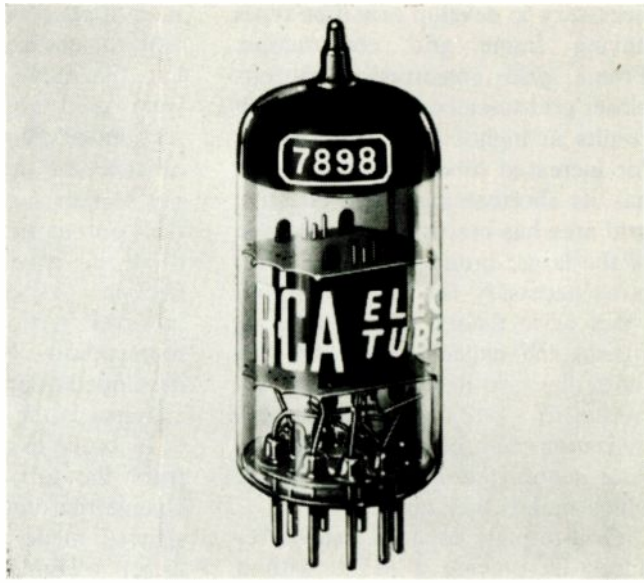


G-E compactron-type tubes for low power communications transmitters allows compact 2-way mobile equipment design.

A group of Raytheon horizontal damper and horizontal deflection amplifier tubes.



Amperex 6GW8/ECL 86 triode-pentode.



RCA's 7898 is a ruggedized twin triode for 2-way mobile equipment.

It is possible to obtain an IF gain from two frame grid tubes equal to that of three regular IF tubes. In other words, the three tube IF stages using regular tubes has a gain of approximately 62 db, while the two tube frame grid IF stage has approximately 56 db gain. The increased Gm of the frame grid tube makes possible the increased circuit gain.

In the audio amplifier, power output is one of the main design criteria. This, of course, is a function of the tube design. In Hi-Fi applications, it is desirable to keep harmonic distortion at a minimum. High power output and the minimum distortion can be obtained by proper tube grid design. Plate current characteristic curves will have to be spaced linearily so that a change in grid voltage will give the same reproduction in the plate circuit output—not distorted.

All of today's power output tubes are basically the same as those designed years ago except for improved reliability obtained from modern materials. The grid siderods are made of higher conductivity materials and the grid laterals are made of materials that provide low grid emission. New plate material is copper-core steel that distributes heat — to eliminate plate hot spots.

Triode-Pentodes

Triode-pentodes are relatively new in design and are very common in TV receivers today. Triode-pentode applications are quite varied. Some applications are: oscillator-mixer, video amplifier and sync separator, AGC, limiter and a multitude of others. The pentode section of the triode-pentode is used as the video amplifier and is changed to satisfy the set designer. The basic design remains about the same, however. The triode section is usually employed in less critical applications.

The one usual requirement from this tube is increased circuit gain. With this increased gain, it is possible to offer the public a TV receiver at a lower cost yet with excellent picture quality.

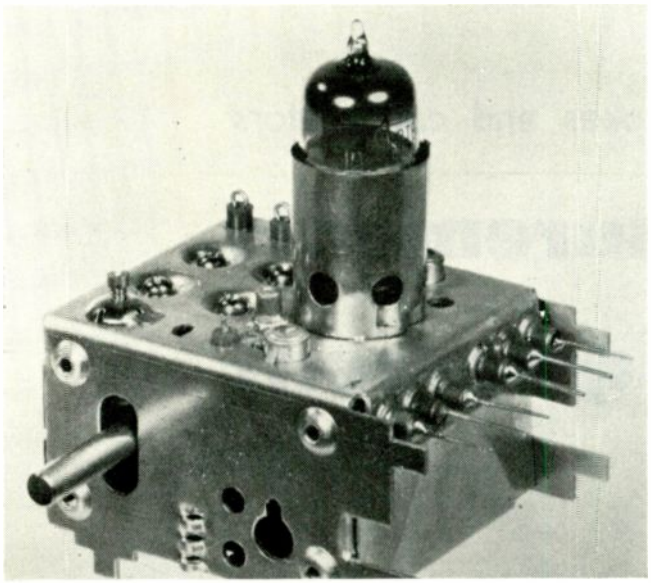
To be certain that the tube does not exceed its ratings, life tests are performed. If the tube fails the life test then the material in the tube parts must be changed. For example, the screen grid material may be changed from nickel to molybdenum material which will stand the higher heat. Of course, material changes cost more and makes the ultimate cost to the consumer higher.

Another recent trend in tube making is to go to the larger glass bulb. This change will aid in cooling the tube by providing a large heat dissipating area.

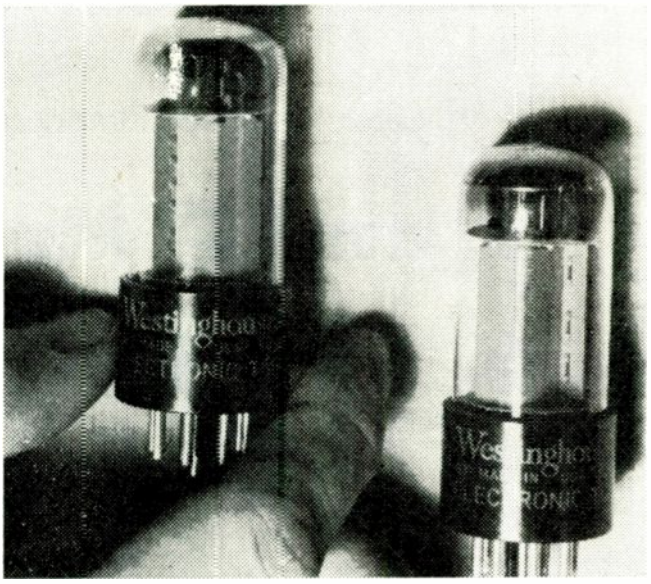
Another method of obtaining a larger video output signal is to shift the plate current characteristic curve knee. When the plate current alone is increased, the knee voltage increases also. In the low B+ sets. however, increasing the plate current alone will actually lower the output voltage swing across the load resistance because the knee voltage shifts higher. In this case, it is necessary to lower the knee or keep it fixed when the plate current is increased. This can be done by changing the grids and using a closer spaced plate.

In some applications, the triode-pentode tube must be controlled for other characteristics. It has been found that intersection leakage has caused trouble. Also, in some instances, the plate current cutoff causes trouble and needed to be controlled.

The triode-pentode is used quite commonly in tuner application. Again the interelectrode capacitance



Waller Corporation FM tuner front end uses high-mu twin triode 12DT8, 6DT8 or 6AQ8.



Westinghouse 7591 beam-power pentodes for Hi Fi amplifiers deliver up to 45 w with low distortion.

must be controlled. A variation in capacitance could make the set inoperative. The tuner is a place where wrong tube substitutions could change a set's original performance.

Diodes

Diode design, as in other tubes, changes constantly to fulfill application needs. The diode is the simplest tube of the receiving tube line and is limited to rectifier and detector applications.

At first glance, you will probably ask, "What can be changed in this simple tube?" True, the design is simple but this tube can cause trouble in many applications.

A basic requirement of the diode is that it have sufficient emission to give satisfactory performance in its assigned duty. Assuming that the cathode coating is the proper mixture and applied properly, tube cathode processing becomes a large part of the proper emission story. The carbonate coating must be broken down to an oxide and then to the proper emissive surface. This process can be done fairly easy but the know-how must be there.

Over the years, an improved cathode coating was devised. This coating has the conventional coating ingredients but a powder-nickel has been added. This was done to make a better bond between the cathode sleeve and coating which allows the cathode to heat up more evenly. Even cathode heat will minimize hot spots and arcing.

Carbonates are reduced to oxides during the degassing period. After the tube is sealed, it is aged to obtain a desired emission level. The level is generally specified as a lower emission limit. Remember that application problems can still be present even when the emission level conforms to original specifications.

One major diode problem is arcing, particularly in the damper diodes. This tube is subjected to very high voltages. Any leakage paths between elements or back emission from plate to cathode can cause arcing. Care must be taken to eliminate the cause of potential arcing. Heater-to-cathode arcing is also possible because of close proximity of these elements and because of the high heater-to-cathode voltage. This problem can be defeated by placing the heater inside an insulated sleeve or spiral to separate the heater from the cathode.

Heater failures are always a problem. The latest practice is to change the heater wire from tungsten to rhenium-tungsten alloy. The tungsten has a tendency to elongate and recrystalize during usage to make it brittle. Rhenium-tungsten material is expensive but tests have shown that it makes a more reliable heater.

Another recent development is the dark heater. By darkening the heater coating, heat transfer efficiency from the heater to the cathode is improved. This means that the heater wire itself can be operated at a lower temperature to give the same heat to the cathode. The heater wire will not have a tendency to recrystalize, thus it will not become brittle. The rhenium tungsten and dark heater give approximately the same results.

The chain of receiving tube developments are continuous and endless. Improvements are frequently not noticed by service technicians and the consumer but they are there. The end result of the product will determine if the design is worthwhile. In other words, if your customer is content with his set performance, then the tube design is worthwhile. ■

Measure those unmarked chokes and capacitators

L and C Measurements with Standard Equipment

by Joseph Calpino

■ Unknown-value capacitors and choke coils can be measured to a relatively high degree of accuracy by a simple method. All you need is a VTVM filament transformer and a handful of resistors ranging from 50 to 6000 Ω. For greatest accuracy a standard resistance box may be used instead of the resistors.

Components are connected in a series arrangement as shown in Fig. 1. The same method is used for measuring both choke and capacitors. The method calls for adding the amount of resistance necessary to obtain the same voltage reading across the unknown as the resistor combination.

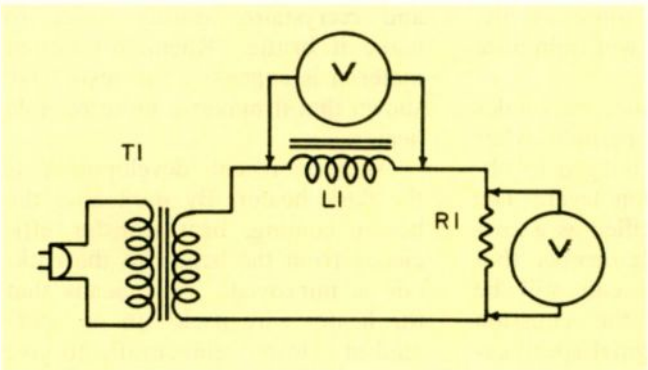


Fig. 1—Schematic of components connected in series for determining choke inductance.

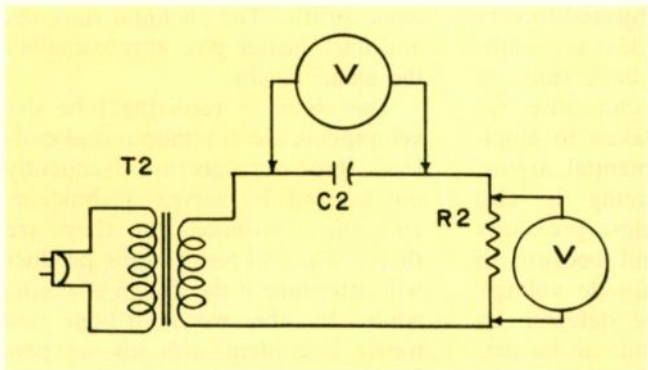


Fig. 2—Circuit arrangement for determining value of an unknown capacitance.

The total resistance of the resistor combination is known as inductive or capacitive reactance. Reactance is the resistive property of coils and capacitors. Reactance is symbolized by the letter X.

To find the actual value of inductance the following formula is used:

$$L = \frac{X_L}{\omega}$$

Inductance L, is in henries. The symbol X_L is equal to the value of resistance needed in the circuits to obtain equal voltage readings across the choke as across the resistors.

The value of ω, angular velocity, is equal to 6.28 times the frequency. The frequency is always equal to 60 here because the 60 cps frequency is obtained from the filament transformer. Capacitance is found by the following formula:

$$C = \frac{.159}{fX_C}$$

C is capacitance in farads. The constant .159 is the reciprocal of 6.28. The capacitive reactance X_C, is equal to the value of resistance needed in the circuit to obtain voltage readings across the resistor combinations equal to that of the capacitor.

A simple problem will tend to illustrate the procedure more clearly. To find the value of an unknown choke coil, the circuit is connected as shown in Fig. 1. Resistance is added at R1 until the voltage reading is the same across R1 as across L1. Assume the resistance comes to 5420 Ω. Insert these values into the inductance formula.

$$L = \frac{X_L}{6.28f} = \frac{5420}{6.28 \times 60} = \frac{5420}{376} = 14.4 \text{ h.}$$

Hence the choke's value is 14.4 h.

To find the value of an unknown capacitor, connect the components as shown in Fig. 2. Assume we find a value of 254 Ω is required to balance the voltage readings across the unknown and the resistor combination. Insert these values into the capacitance formula.

$$C = \frac{.159}{fX_C} = \frac{.159}{15240} = .00001043 \text{ farads}$$

Hence the value of the capacitor is 10.43 μf. ■

Picture Tube Identification and Interchangeability

by Les Hukins

■ Technicians are frequently required to identify an unmarked picture tube for replacement purposes. Selecting a suitable substitute for a given picture tube can also be a problem.

You are dealing principally with the older Duodecal-based CRTs, since later types are more likely to be legibly marked, and less apt to have practical interchangable counterparts.

It has long been a standard system to indicate the CRT screen size with a number preceding the letters in the tube type nomenclature. The remaining letters and numbers differentiate between the various tubes of the same screen size. On all home entertainment picture tubes, the end-number designation is P4. This is the designation for the screen phosphor with a color and persistency particularly suited to television viewing.

CRT Classification

Tubes can be broadly divided into several classifications by sight, even when a tube has no identifying markings. The easiest check is the method of focus. In nearly all cases, if the tube has five pins, it is a magnetic focus type and requires an external magnetic force, either an electromagnet type focus coil, or a permanent-magnet; sometimes a combination of these two types are used. If the CRT is a six-pin base, the extra "off by itself" is the focus element pin, and can be identified as the electrostatic focus type.

To be positive in all cases, look at the neck of the tube and see that an internal element is connected to the focus pin. When the physical placement of the focus element and lead has been well established by experience, it is possible to identify those rare five pin tubes which tie the focus element to another element internally. If the picture tube is still in the set, the identification is easier still; for the presence or absence of the focus coil will indicate focus method.

Deflection angle can generally be determined at a glance after looking at several types and checking them against a tube chart. Normally physical depth of the tub's bell will be the tip-off. In short tubes, the deflection angle must be wider to sweep the screen. Deflection angles are broadly classified as 60, 70, 90 and 110 degrees, although actual deflection may vary from 50 to 114 degrees.

The screen size may be determined by diagonal measurement. In most cases, a 21 in. tube won't measure quite 21 in., and a 17 in. tube won't be quite 17 in. The only tough ones to separate are the 20 and 21 in. types. The 20 in. tubes are always less than 20 in. diagonal measurement, while the 21 in. tubes are always more than 20 in. diagonal measurement.

Be sure to measure from the outside of the glass envelope, and not just screen material. You can expect variations in physical measurement of the various tubes even in the same numerical designation.

Many technicians have difficulty with the differences between the 16KP4, 17BP4 and the 17HP4 in many old sets. The 16KP/RP/TP4 is flat on all four sides when viewed from the front, while the 17BP4 is gently curved on all four sides when viewed from the front. The 17HP4 is identical to the 17BP4 except it is a six pin (electrostatic) CRT.

Virtually all picture tubes except the 21EP4, 21FP4, 17LP4 and 17QP4 have an oval, or gently rounded face. The four types above have cylindrical faces. The latter also have quite a pronounced lip at the top and bottom of the face which can be seen and felt.

Continued on page 96

CHART I

MAGNETIC FOCUS TYPE	ELECTROSTATIC FOCUS TYPE
14CP4	14HP4
17BP4	17HP4
17CP4	17GP4
17QP4	17LP4
20CP4	20HP4
21AP4	21AP4
21AMP4	21ALP4
21AWP4	21AUP4
21EP4	21FP4
21WP4	21XP4
21ZP4	21YP4
24CP4	24DP4

These types may be substituted either way, using the method outlined in the text. Early tubes such as the 10BP4, 12LP4, 16KP4, 16WP4 and 16LP4 had no electrostatic focus counter parts.

CHART II

METAL TYPE	GLASS TYPE
17CP4	17BP4
17GP4	17HP4
21AP4	21ZP4
21MP4	21XP4

Nearest glass counterparts for common metal tubes.

SHOP HINTS

SERVICE TIPS FOR THE PROFESSIONAL TECHNICIAN

AC Cleans Speaker Gap

Several extension receiver-transmitter speakers gave no response or output in our large Civic Center Garage. These pm speakers were connected to a "master" amplifier intercom unit. I restored all of the units to operation by connecting each one individually to a 4½ volt buzzer after removing the speaker from the circuit.

I "flashed" the buzzer leads across the voice coil until a buzzing was heard from the speaker. On 2 of the units I used a 5 volt filament transformer. Upon reconnecting the units in the circuits they all functioned properly.

The steady pulsations of the voice coil with buzzer or transformer input removed dust or air-borne dirt which may have clogged the gap between magnet and voice coil. — *John F. Cullen, San Francisco, Calif.*

Quick Series Filament Check

A problem encountered in series string sets is locating an open filament without pulling and testing each tube individually. Referring to the accompanying drawing, V6 is removed from the center of the filament string. Check V6 heater (pin 4 to 5 for continuity. If heater is open, insert a new tube. If V6 heater is good, then lay the tube aside. Place a jumper across the set's interlock and turn the on/off switch to "on." Check from V6 socket lug 4 to ground. Check from V6 socket lug 5 to ground. This procedure will quickly isolate half of the heater string in which the defective tube is located. —*Noble C. Travis, Sheridan, Ky.*

Holding Small Screws

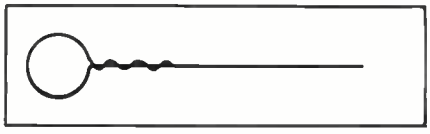
I have found that the tiny phillips head screws in the new, smaller than ever, transistor radios are very difficult to replace after fixing the radio. But I have solved this problem by simply rubbing the head of the screw back and forth across a piece of paraffin wax, filling the slots completely. This enables the screw to stick to the blade of the screwdriver, making it much easier to place the screw back in its small spot among the other parts of the radio. — *Dennis Buhrmann, Long Beach, Calif.*

Scratches In Plastic Safety Glass

In your Nov. 1962 edition an item was written in which I have found not to work to my satisfaction at all. This item was on how to clean a plastic safety glass. If the scratches are deep, you may have to repeat the operation until they cannot be seen. Also use sandpaper and steel wool in a circular motion. Use a piece of four hundred sandpaper on all the scratches until they can barely be seen. Then use fine steel wool until marks are gone. Rub in a circular motion. Then clean the glass with a plastic glass cleaner. Let dry a few minutes. Now use a buffer on a quarter in. drill on the plastic. Buff until finish is clear.—*Elio J. Cavalet, Akron, Ohio.*

PC Hole Cleaner

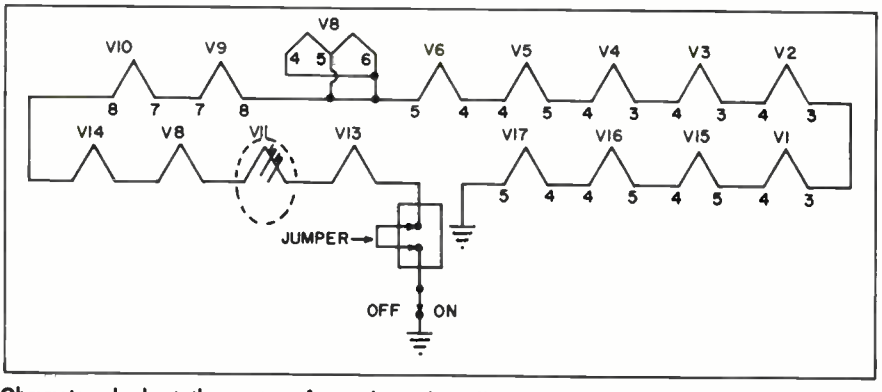
A piece of nichrome wire is ideal for cleaning out the holes in a printed circuit board. Solder does not readily adhere to nichrome. The wire can be shaped as shown in the accompanying drawing for easy handling.—*Laf Kisor, Beauerton, Ore.*



Nichrome wire with a formed handle makes good tool to remove solder from PC holes.

Test CRT for Troubleshooting

I find on high voltage troubles when I have a high voltage, but not enough to brighten my picture tube, an 8 in. test CRT often functions. The picture usually blooms but by varying the brightness control I get in a picture. Several times I have found a keystone effect, narrowing down my trouble to the yoke. Oscillator, HOT and other troubles are sometimes more easily identified in this manner.—*Al Malakoff, Commack, L. I., N.Y.*



Ohmmeter check at the center of a series string eliminates half of the string from suspicion.

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.

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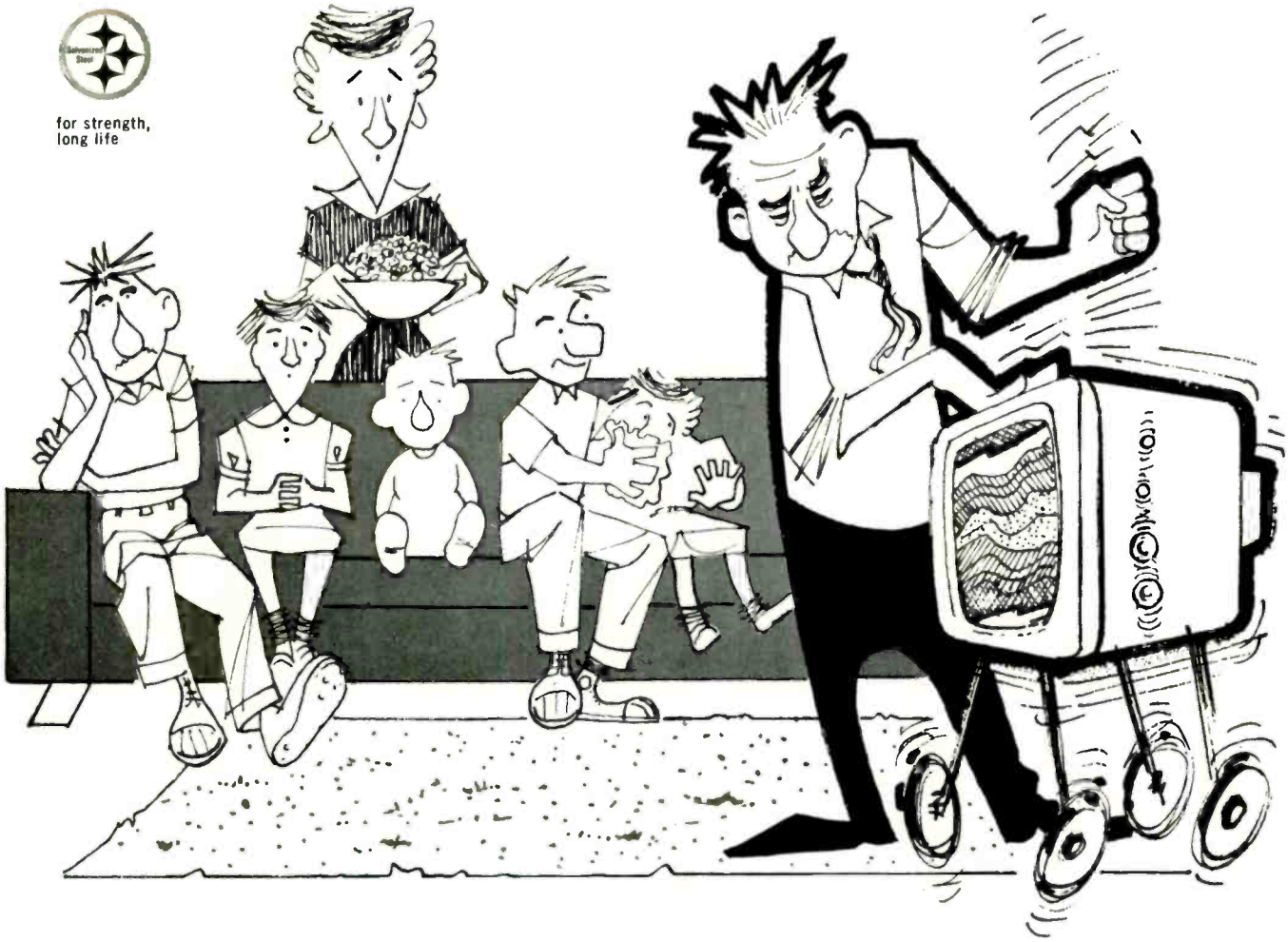
for strength,
long life



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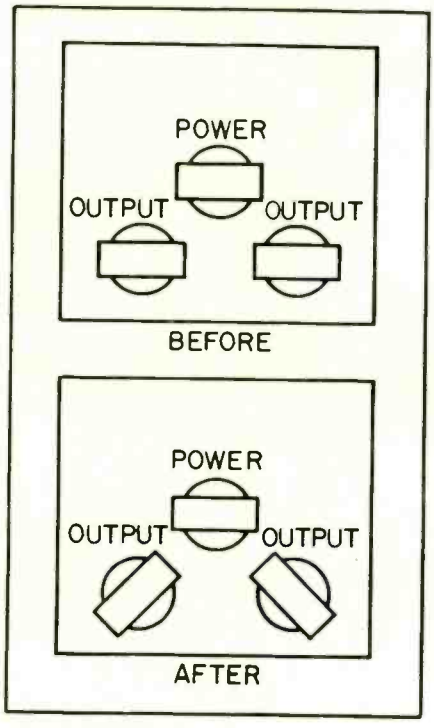
TOUGH DOG CORNER

Difficult Service Jobs Described by Readers

Close Coupling

A few weeks ago a customer brought a stereo in for service (model 1548). This unit had hum



as if one of the filters were leaking too much. These were changed with no results. I then pulled each of the tubes until all the tubes were out but the hum was still present at the speaker. After several hours of trial and error I finally eliminated the hum.

The hum was coming from the coupling between the power transformer and the output transformers. I turned the output transformers 45° to the power transformers ended the hum.—*Homer H. Whitehead, Maryville, Tenn.*

Pull and Bounce

After winning a battle with a Magnavox chassis 111/350 series, I was still left baffled after the smoke had cleared.

A call came in complaining of a "bouncy picture." At the home the receiver was found to have bad vertical jitter and a severe "pull." After a few minutes the picture would go completely negative too. When a new set of tubes failed to help, the chassis was brought to the shop.

Symptoms had all the earmarks of a defective AGC, so I clipped in an external AGC voltage to be sure. The picture was considerably improved. I checked around the AGC amplifier tube circuit looking for a faulty component, but couldn't find anything wrong. I checked through the IF strip and tuner voltages but discovered nothing.

I went back to the AGC amplifier and checked more carefully. On the second time around I began to suspect that the screen voltage was somewhat low—down to 375 from the 530 v called for on the schematic. And yet, how could I suspect anything wrong here? This voltage was derived from the boost supply and anything amiss there would show up in other ways, either in poor horizontal sweep or poor vertical sweep or both. In spite of the negative picture I still had a full screen with plenty of brightness.

Nevertheless, for want of anywhere else to turn, I decided to track down the low boost voltage problem. It soon took me to the vertical oscillator tube where I found a badly charred resistor in the plate circuit. I checked with the VOM and found the resistor down to 10K. It should have read 270K. Still believing I was on the wrong track, I changed the resistor knowing that I would have to change it later anyway. To my surprise when I next turned the receiver on the picture was perfect. Still being the disbeliever I jumped in the old resistor and the negative picture returned.

Of course, with the discovery of the trouble, certain things became apparent. The new resistor did raise the boost voltage which in turn gave me much more brightness. Also, with that much more resistance in the vertical oscillator plate, the vertical sweep was greatly reduced and needed readjusting. What puzzled me was the fact that of all the circuits depending on the boost supply, the AGC circuit was the first to fail.—*Frank A. Salerno, Long Island City, N.Y.*

Broken Slug

A Motorola VTS 569 Chassis came into shop with complaint of picture smear. A new 6GK6 video tube was needed, but made the smear even more pronounced. Video alignment appeared to be in order. This seemed to bring about the desired results, good picture, no smear; that is, until the set was moved to another location, then the smear returned. A touch up of L13, a 4.5 mc trap, cleared up the smear but it returned if the set was moved or vibrated. A check of the iron slug in L13 showed it to be split in half and breaking up at bottom. A new slug returned this set to normal. It was tough because the trouble was intermittent and the picture pattern indicated oscillator drift. —*Howard Keilholtz, Ellicott City, Md.*

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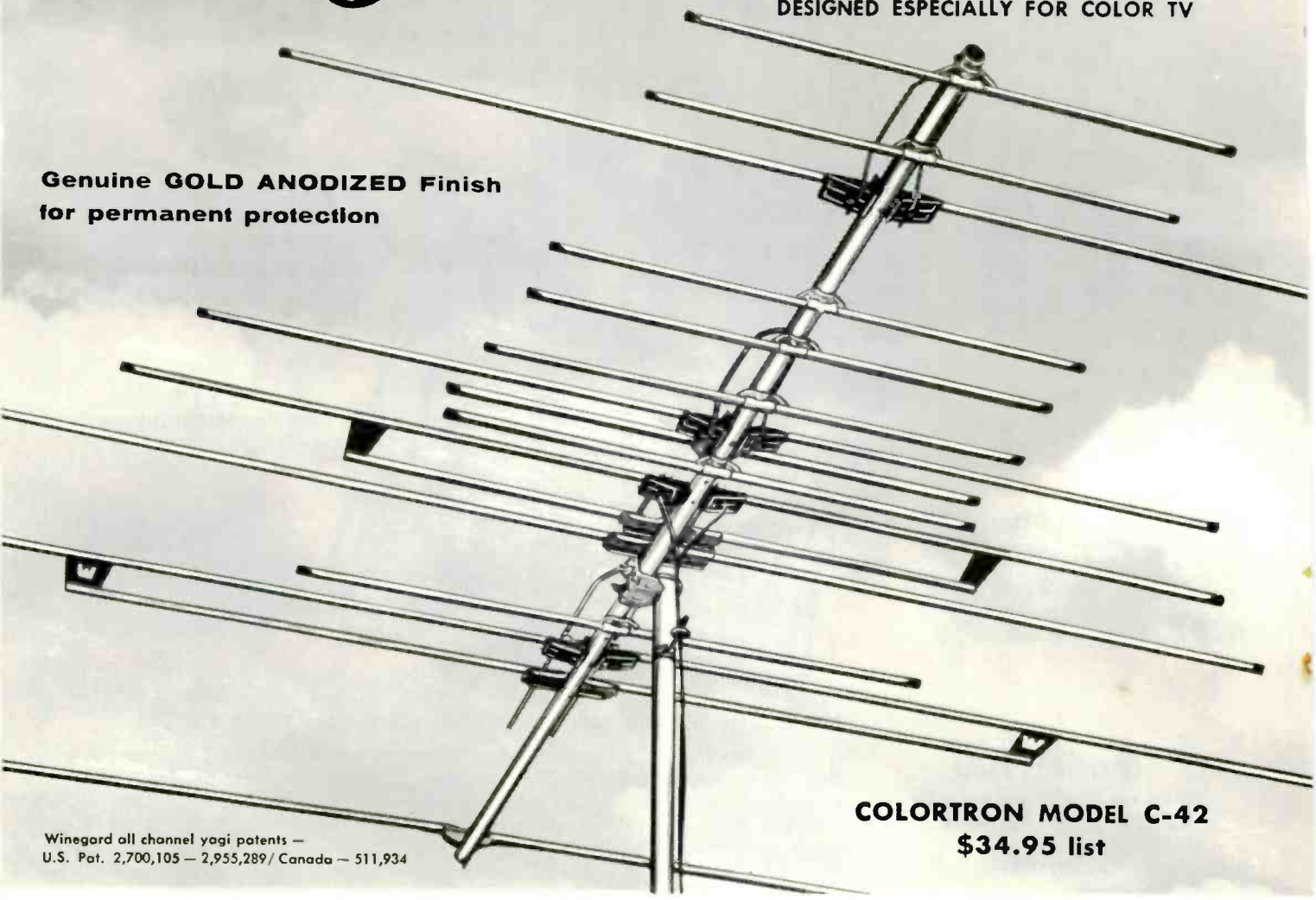

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HERE'S WHY COLORTRON IS BEST

1. A perfect all channel, high gain TV antenna would have the following characteristics:

—the sensitivity of a well-engineered cut channel yagi of equal physical length on each of the 12 channels.

—sharp directivity. A single frontal lobe and absolutely no pick-up of signal from back or sides on any channel.

—it would have an exact 300 ohm non-reactive impedance on every VHF channel 2 through 13.

2. There are several basic designs for high gain, all channel TV antennas. For practical reasons, only two of these are used today.

Ⓐ The *all channel yagi* that incorporates only 2 driven elements—but *many* directors. This design was invented by John R. Winegard in 1954. Until then, the high efficiency of the yagi was limited to single channel antennas.

Ⓑ The all channel antenna that incorporates a *multiplicity of driven elements* in a single plane. These are *End-Fire* arrays.

This basic design was first used for TV in 1952. Some end-fire antennas are called "log periodic".

IT IS A SCIENTIFIC FACT that a single ½ wave director element* will absorb 4 times more signal energy from a TV wave than a ½ wave driven element**. Because of this indisputable fact, the Winegard Colortron all channel yagi uses multiple *directors* to get its gain—*not* multiple driven elements.

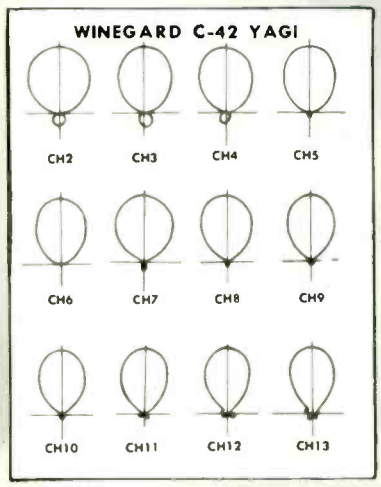
To obtain a near perfect impedance match across the entire VHF TV band, it takes only two driven elements. More than two driven elements will not improve the match any more than extra wheels would improve a car. The only purpose of driven elements on a TV antenna is to transfer the signal energy to the line.

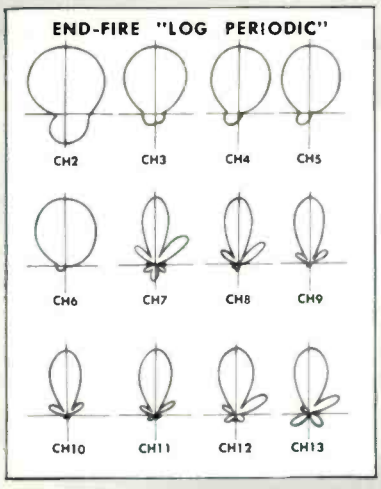
As every antenna engineer knows, a well-engineered cut-to-channel *yagi* (with but *one* driven element and *many* directors) is superior to any other design when peak performance is desired on a single channel. The same fact holds true for best results in all channel reception . . . the yagi design is the most efficient, sensitive ever created on a size for size basis.

*Directors are elements connected electromagnetically (not by means of phasing lines) to the driven elements.

**Driven elements are connected together with phasing lines and the transmission line is attached to these elements.

Antenna is World's BEST





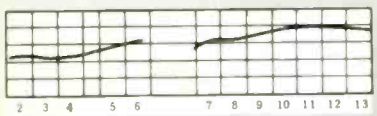
COMPARE POLAR PATTERNS

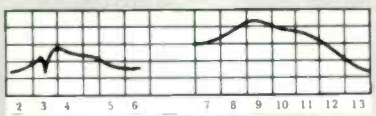
WINEGARD C-42 YAGI. Polar potterns from Polar coordinate Recorder Speedomax Type G.

NOTE uniform directivity potterns and high uniform front-to-back ratio on all channels. NOTE absence of spurious lobes and total absence of side pick-up.

END-FIRE "LOG PERIODIC" model comparable with C-42. Polar potterns taken from same recorder.

NOTE large variation between directivity from channel to channel. NOTE reduced front-to-back ratio from C-42. NOTE spurious lobes (especially on high bond) which pick up interference. Also has undesirable side pick-up on low bond.





COMPARE FREQUENCY RESPONSE CURVES

WINEGARD C-42 YAGI shows consistent sensitivity across all channels. No roll-off on ends of bands, no suck-outs to ruin color reception.

END-FIRE "LOG PERIODIC" (in same price range) shows varying sensitivity across the bonds. Peaks in middle of bonds with sharp roll-offs on ends. Serious suck-out in middle of channel 3.

PERFECT PARTNER TO THE COLORTRON ANTENNA . . . THE TWIN NUVISTOR COLORTRON AMPLIFIER

Winegard's revolutionary new circuit, employing 2 nuvistors, enables the Colortron to overcome the service problems and limitations of other antenna amplifiers. Colortron will not oscillate, overload or cross modulate because it takes up to 400,000 microvolts of signal input. This is 20 times better than any single transistor amplifier.

The Colorton amplifier will deliver clean, clear, color pictures or black and white, sharp and bright without smear. It can be used with any good TV antenna but will deliver unsurpassed reception when used with a Colortron antenna.

Nothing on the amplifier is exposed to the elements—even the terminals are protected. A rubber boot over the twin-lead keeps moisture out. Colortron comes complete with an all AC power supply with built-in 2 set coupler. Colortron model AP-200N 300 ohm input and output $39.95 list. Model AP-275 300 ohm input 75 ohm output $44.95 list.

NOW WHAT ARE THE BASIC DIFFERENCES BETWEEN THESE TWO TYPES OF ALL CHANNEL ANTENNAS?

One big difference is in SENSITIVITY. The Winegard Colortron patented yagi with multiple *directors* has far more ability to absorb signal power from a TV wave than multiple driven element antennas. In fact, *all* fringe-type antennas with multiple driven elements have *one or more* directors out front. Why add directors if the multiple driven elements are supposed to be so efficient? The reason is obvious . . . directors are added to get the gain they can't get with extra driven elements.

Another big difference is in DIRECTIVITY. The Winegard Colortron patented yagi has far better directivity characteristics than multiple driven element antennas and the *directivity pattern is essentially the same on every channel.* The Colortron has *no* signal pick-up from the sides (as you can see above). It offers no receiving surface to side signals and has no complex phasing problems to cause extra pick-up lobes. It has *minimum* pick-up from the back.

On the other hand, multiple driven element antennas have large side lobes because the driven elements are always out of phase at some frequencies in the TV band—particularly on the high band.

The Winegard Colortron excels, too, by having the *best 300-ohm match in the industry*—an average VSWR of better than 1.5 to 1 across both bands.

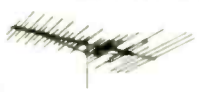
In addition to its performance superiority, the Winegard Colortron has the finest quality construction and *permanent gold* anodizing for weather protection. A personal examination of a Colortron tells this quality story far better than words.

(The polar patterns and frequency response curves above have been illustrated to give you a basis of comparison between Winegard's popular Colortron Mod. C-42 and a highly advertised multiple driven element antenna which we have tested (along with other models in this line.) Constant testing of *all* new outdoor TV antennas proves to our satisfaction that no other design equals or excels the Winegard Colortron in quality or performance. We are so positive of this performance superiority that we put a written guarantee on it.

For technical data sheets write today!

Nationally advertised month after month. ADVERTISED IN LIFE

There's an Extra Bonus of Quality and Performance in Every Winegard Product



COLORTRON ANTENNA
Model C-44—Gold Anodized
$64.95

COLORTRON ANTENNA
Model C-43—Gold Anodized
$51.90

COLORTRON ANTENNA
Model C-42—Gold Anodized
$34.95

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$24.95

Winegard
ANTENNA SYSTEMS

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1963
Parts Show Preview
Latest Products Go On Display

Show Sponsors

For the 25th consecutive year the annual Electronic Parts Distributors Show will serve as the market place for manufacturers to show their wares to distributors from all parts of the country. These distributors will carry product data from approximately 300 exhibitors back to their offices, informing service technician customers of the latest components and equipment.

The Parts Show will be held in Chicago's Conrad Hilton Hotel, May 20-22. Registration is in advance of the Show, and admission is by badge only, issued in the following categories:

Commercial Sound, High-Fidelity, Sales Reps, Government Personnel, Advertising and Export Agency Personnel and Electronic Parts Distributors.

The five trade associations sponsoring the non-profit operator of the Show, the Electronic Industry Show Corp., are:

Western Electronic Manufacturers Association (WEMA)

National Electronic Distributors Association (NEDA)

Association of Electronic Parts and Equipment Manufacturers, Inc. (EP&EM)

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Electronic Industries Association. (EIA)

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Hurst Mfg. Corp.	3120	
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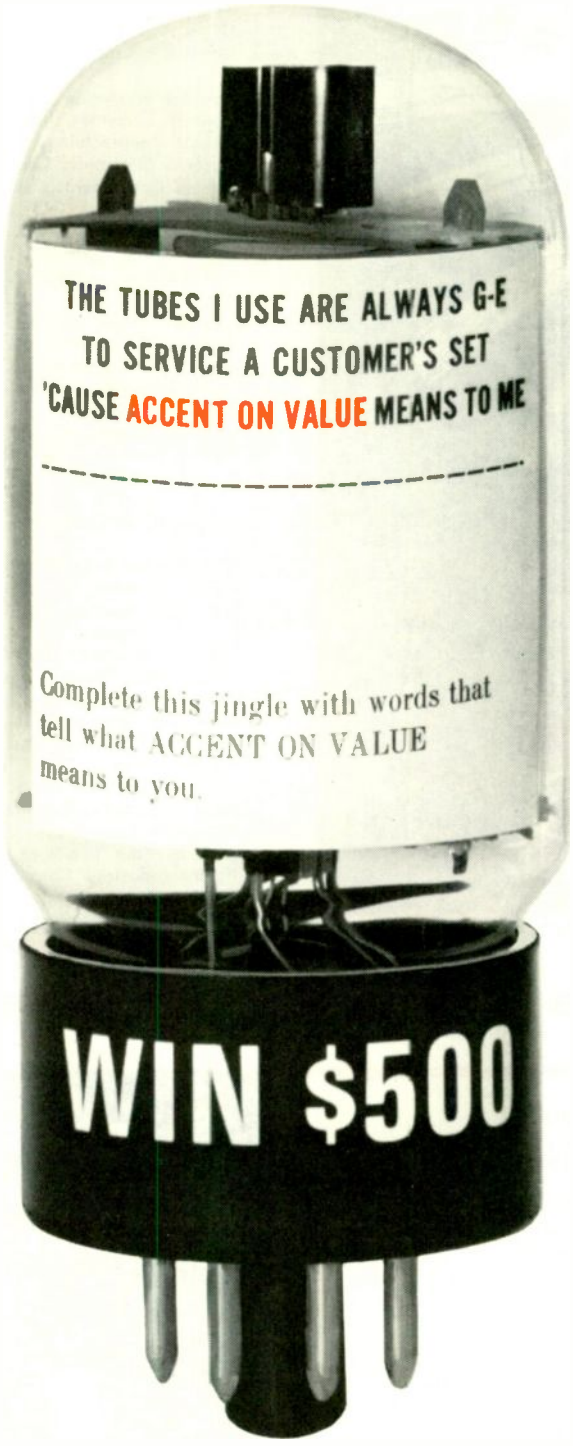

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Get this book FREE with the purchase of G-E tubes. Here's *101 Tele-Clues* to help make TV repair easier and more profitable for you. Your General Electric tube distributor will give it to you free in appreciation of your purchase of G-E tubes and electronic equipment. Enter the ONE-O-ONE Contest. Get *101 Tele-Clues*. See your General Electric Distributor today.

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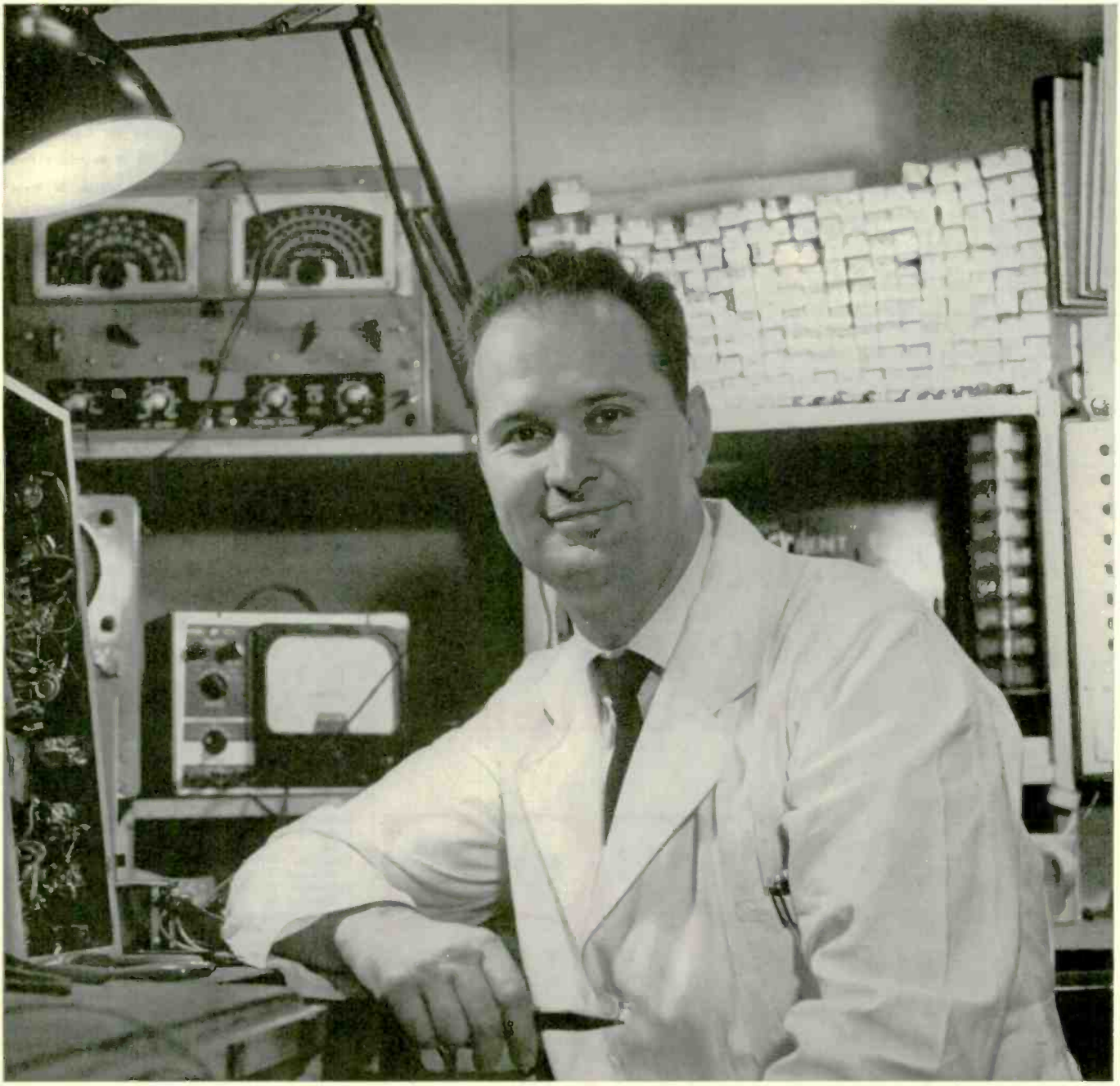
Bud Radio 2118 E 55 St Cleveland O
Budelman Electronics 375 Fairfield Stamford Conn
Buggie Inc HH Route 795 & Lemoyne Toledo O
Bulldog Electric Prods 7610 Joseph Campeau Ave Detroit Mich
Bulova Watch Electronics Div 40-01 61 St Woodside NY
Burgess Battery Exchange St Freeport Ill
Burndy Eng'g Norwalk Conn
Burnell & Co Pelham NY



"At least ten people a week tell us they found us through the Yellow Pages!" says Dale Sanford, proprietor, Dale Sanford Television Service, Berkeley, Calif. "And I find that the detailed listing of all our repair services in our Yellow Pages display ads is what pulls in most of our new customers. About 95 per cent of our service calls are by telephone. The effectiveness of our Yellow Pages program is great. It's good to know that the directory is doing such a fine selling job in thousands of homes!"

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Burroughs Corp 6072 2 Ave Detroit Mich
Burroughs Corp Burroughs Dr Radnor Pa
Burton Rogers Corp 42 Carlton St Cambridge Mass
Bussmann Mfg 2538 W University St St Louis Mo

C

C-B-C Electronics 2601 N Howard St Philadelphia Pa
CBS Labs Military & Industrial Systems Stamford Conn
C&H Sales 2176 E Colorado St Pasadena Calif
CJS Electronics 745 W Wilkes-Barre St Easton Pa
CP Electronics Columbus Ind
Cabinart Inc 35 Geyer St Haledon NJ
Cadre Industries Box 150 Endicott NY
Calbest Electronics 4801 Exposition Bldg Los Angeles Calif
Calcon Inc 100 Oakland Ave Washington Pa
Calibration Standards 1025 Westminster Ave Alhambra Calif
Calif Technical Industries 1421 Old County Rd Belmont Calif
Call Boy Systems 1605 Eastern SE Grand Rapids Mich
Calvideo Tube 18601 S Santa Fe Ave Compton Calif
Cambridge Electronics 294 Centre St Newton Mass
Cambridge Thermionic 445 Concord Ave Cambridge Mass
Campro Prods 3131 Alliance Rd NE Canton O
Cannon Electric 3208 Humbolt St Los Angeles Calif
Capcon Inc 61 Stanton St New York NY
Capehart Corp 87-46 123 St Richmond Hill NY
Capitol Records 1750 N Vine St Hollywood Calif
Capkit Int'l 816 W Olympic Blvd Los Angeles Calif
Capps & Co FL 20 Addison Pl Valley Stream NY
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Chester Cable Corp Chester NY
Chicago Condenser 3255 Armitage Ave Chicago
Chicago Miniature Lamp 1500 N Ogden Ave Chicago
Chicago Telephone Supply 1142 W Beardsley Ave Elkhart Ind
Chicopee Mills Lumite Div 47 Worth St New York NY
Christie Electric 3410 W 67 St Los Angeles Calif
Cinch Jones Div Cinch Mfg 1026 S Homan Ave Chicago Ill
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Clairton Mfg Box 171 Orange NJ
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Clearbeam Antenna 21341 Roscoe Blvd Canoga Park Calif
Clegg Inc Box 641 Morristown NJ
Cletron Inc 1974 E 61 St Cleveland O
Cleveland Electronics 1974 E 61 St Cleveland O
Cleveland Graphite Bronz 17000 St Clair Ave Cleveland O
Cleveland Institute of Electronics 1776 E 17 St Cleveland O
Cleveland Instrument 6220 E Schaaf Rd Cleveland O
Clevite Electronic Components 232 Forbes Rd Bedford O
Clevite Transistor Prods 241 Crescent St Waltham Mass
Clough-Brengle 6014 N Bdwy Chicago Ill
Cohu Electronics Massa Div 5725 Kearny Villa Rd San Diego Calif
Coleman Cable & Wire 1900 N River Rd River Grove Ill
Coleman Electronics 133 E 162 St Gardena Calif
Collins Radio Western Div 2700 W Olive Ave Burbank Calif
Collins Radio 855 35 St NE Cedar Rapids Iowa
Collins Radio PO Box 1891 Dallas Texas
Colman Tool & Electric Products PO Box 2965 Amarillo Texas
Colorgrams Inc 58 Old Stewart Ave New Hyde Park LI NY
Columbia Electric 4511 Hamilton Ave Cleveland O
Columbia Products 6625 Shakespeare Rd Columbia SC
Columbia Wire & Supply 2850 Irving Park Rd Chicago Ill
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Computer Systems Culver Rd Monmouth Junction NJ
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Conant Labs Box 3997 Bethany Station Lincoln Neb
Conar Instrument 3939 Wisconsin Ave Washington DC
Conn Hard Rubber 407 East St New Haven Conn
Connector Corp 6025 N Keystone Ave Chicago Ill
Conrac Inc 19217 E Foothill Blvd Glendora Calif
Consolidated Electro-Dynamics 300 N Sierra Madre Villa Pasadena Calif
Consolidated Wire & Assoc 1635 S Clinton St Chicago Ill
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Continental Connector 34-63 56 St Woodside NY
Continental Diamond Fibre Newark Del
Continental Electronics 2724 Leonis Los Angeles
Continental Electronics 19 W Allegheny St Philadelphia Pa
Continental Electronics & Sound 6151 Dayton Library Rd Dayton O
Continental Mfg 1612 California St Omaha Neb
Continental-Wirt Electronics 5221 Greene St Philadelphia Pa
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Control Electronics 10 Stepar Pl Huntington Sta NY
Controls Switch Div Controls Co of America 4218 W Lake St Chicago Ill
Cook Electric 2700 Southport Chicago Ill
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Corning Glass Electronic Components Bradford Pa
Cornish Wire 50 Church St New York NY
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Choose Tubes from Complete Stocks at Local RCA Distributor

Just call. And watch your RCA Industrial Tube Distributor perform on any of your OEM or replacement needs for RCA tubes. He carries large inventories. Latest tube types available immediately can help you meet emergency lab requirements, help keep your production schedules rolling.

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Electronic Prods 4642 Belair Rd Baltimore Md
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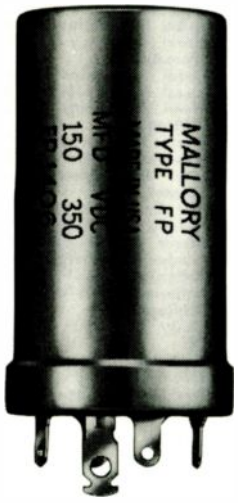
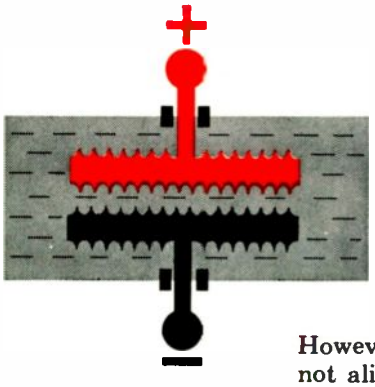
P.R. MALLORY & CO. Inc.
MALLORY

Tips for Technicians

Mallory Distributor Products Company
P. O. Box 1558, Indianapolis 6, Indiana
a division of P. R. Mallory & Co. Inc.

Why some filter capacitors develop hum... and some don't





Aluminum electrolytic capacitors are widely used as filters in DC Power Supplies. This is because of their large capacitance in relatively small size. All in all, they do an efficient job of reducing ripple (hum) to acceptable levels.

However, all electrolytic capacitors are not alike. This is often why some types seem to allow hum to rise to objectionable levels more quickly than do others. In order to understand why, we must investigate actual construction methods.

As you know, electrolytics are basically made by depositing a film of aluminum oxide on aluminum foil to form the positive anode. The oxide is the dielectric. A semi-liquid electrolyte surrounds the anode and is actually the negative cathode. In order to connect this semi-liquid cathode to a terminal, a second piece of aluminum foil is used. This is often *called* the cathode, but it is not. It is actually only the *cathodic connection*. (The preceding describes a "polarized" electrolytic capacitor.)

When high ripple currents are applied to polarized electrolytics, a thin oxide film forms on the so-called "cathode". It begins to assume the characteristics of a second anode. This in turn, has the same effect as placing two capacitors in series. Consequently, overall capacitance is reduced. Inevitably hum increases.

This action is especially noticeable in electrolytics which use plain foil as the "cathode". This is simply because the oxide builds up over a relatively small area.

Mallory avoids this problem by etching the "cathode" on electrolytics. As a result, oxide build-up is spread over a vastly increased area. Therefore, ripple currents are maintained at very low levels for very long time periods.

Of course etched "cathodes" cost a lot more to make. But you get them from Mallory at *no extra cost*. There's much more to the Mallory capacitor story, but we'll leave that to another TIP.

Meanwhile, see your local Franchised Mallory Distributor for capacitors, resistors, controls, switches, semiconductors, and batteries. In fact, he's the man to see for *all* of your electronic component requirements.

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Fidelity Chemical 470-474 Frelinghuysen Newark NJ
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GC Electronics 400 S Wyman St Rockford III
Gamewell Co 1488 Chestnut St Newton Upper Falls Mass
GV Controls Ockner Pkwy Livingston NJ
Garde Mfg 53 John St Cumberland RI
Gardiner Electronics 2545 E Indian School Rd Phoenix Ariz
Garlock Electronic Products 602 N 10 St Camden NJ
Garrard Sales 80 Shore Rd Port Washington NY
Gaylord Products 1918 Prairie Ave Chicago III
Gee-Lar Mfg 418 S Wyman St Rockford III
Gem Electric 239 37 St Brooklyn NY
General Cement Mfg 400 S Wyman St Rockford III
General Controls 2000 Wolf Rd Des Plaines III
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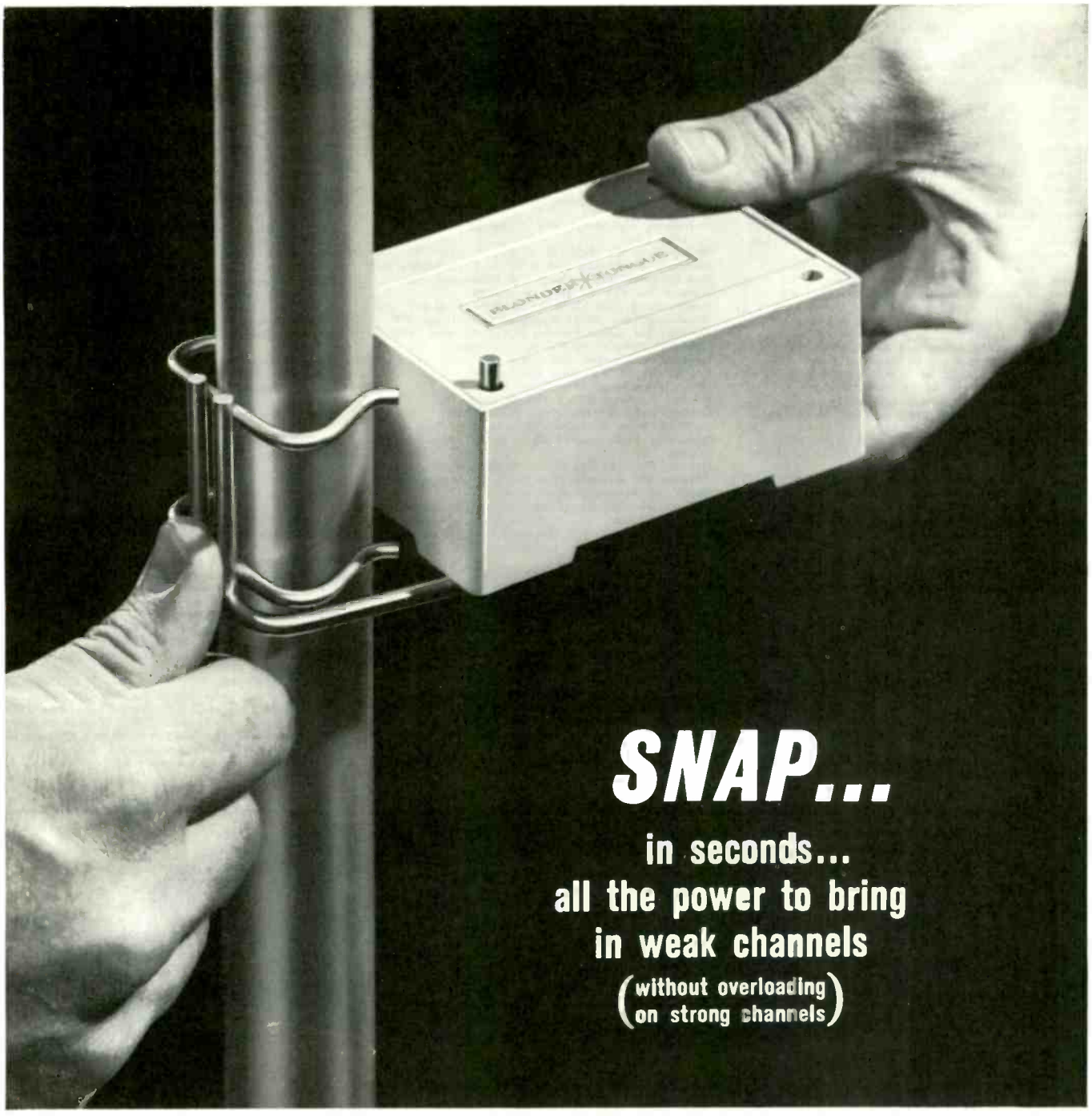

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The new two transistor ABLE-2 is no ordinary booster — it performs better, longer than other home boosters available today. It's well worth the slightly higher price. The toughest weak signal problems are no match for the ABLE-2. List $44.95

Also available—New ABLE-1—Top Quality mast mounted 3-set TV/FM booster similar to ABLE-2, but with only one transistor. Recommended for weak signal areas only. List $39.95

2 TRANSISTORS for more power on weak channels—handles up to 30X more signal voltage than one-transistor models without overloading

3-SET SPLITTER delivers sharp, clear pictures up to 3 sets with power to spare (TV, FM, COLOR)

'MIRACLE MOUNT' means fastest, easiest installation of any mast mounted booster

REMOTE AC POWER SUPPLY, stripless 300 ohm terminals and other features

Try these Blonder-Tongue Boosters today.

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Gotham Audio 2 W 46 St New York NY
Grado Labs 4614 7 Ave Brooklyn NY
Graham Research 666 22nd Ave NE Minneapolis Minn
Gramercy Sound 175 5 Ave New York NY
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Gray Mfg 16 Arbor St Hartford Conn
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Great Eastern Mfg 165 Remsen Brooklyn NY
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Greenfield Components 184 Shelburne Rd Greenfield Mass
Greenlee Tool Rockford III
Greentree Electronics 1122 S LaCienega Blvd Los Angeles Calif
Griebach Instruments 315 North Ave New Rochelle NY
Gremar Mfg Co 7 North Ave Wakefield Mass
Greyhound Package Express 140 S Dearborn St Chicago III
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Grove Electronic 4103 W Belmont Chicago III
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Harvey Wells 14 Huron Dr Natick Mass
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Hathaway Instrument 5800 E Jewell Ave Denver Colo
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Heath Co Benton Harbor Mich
Heiland Div Minneapolis-Honeywell 5200 E Evans Denver Colo
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Helipot Div Beckman Instruments 2500 Fullerton Rd Fullerton Calif
Hepco 74 Varick St New York NY
Heppner Mfg PO Box 612 Round Lake III
Hexacon Electric 180 W Clay Ave Roselle Park NJ
Hewlett-Packard 1501 Page Mill Rd Palo Alto Calif
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Hi-Par Products 347 Lunenburg St Fitchburg Mass
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Hitemp Wires 1200 Shames Dr Westbury NY
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Huggins Lab 999 E Arques Ave Sunnyvale Calif
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Hughes Aircraft Semiconductor Div Int'l Airport Station Los Angeles Calif
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Hughes Electronics 5343 Crenshaw Blvd Los Angeles
Hunter Sales RN 9851 Alburtus Ave Santa Fee Springs Calif
Hupp Electronics 6633 W 65th Bedford Park III
Hurst Mfg Princeton Ind
Hycon Electronics 1030 S Arroyo Pkwy Pasadena Calif
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20DP4	21BTP4	SG-24CP4A	20HP4C	21CBP4A
21AMP4A	SG-21FLP4	21XP4	SG-21ACP4A	24YP4
SG-17BJP4	21AVP4	21CMP4	20DP4C	SG-21AUP4B

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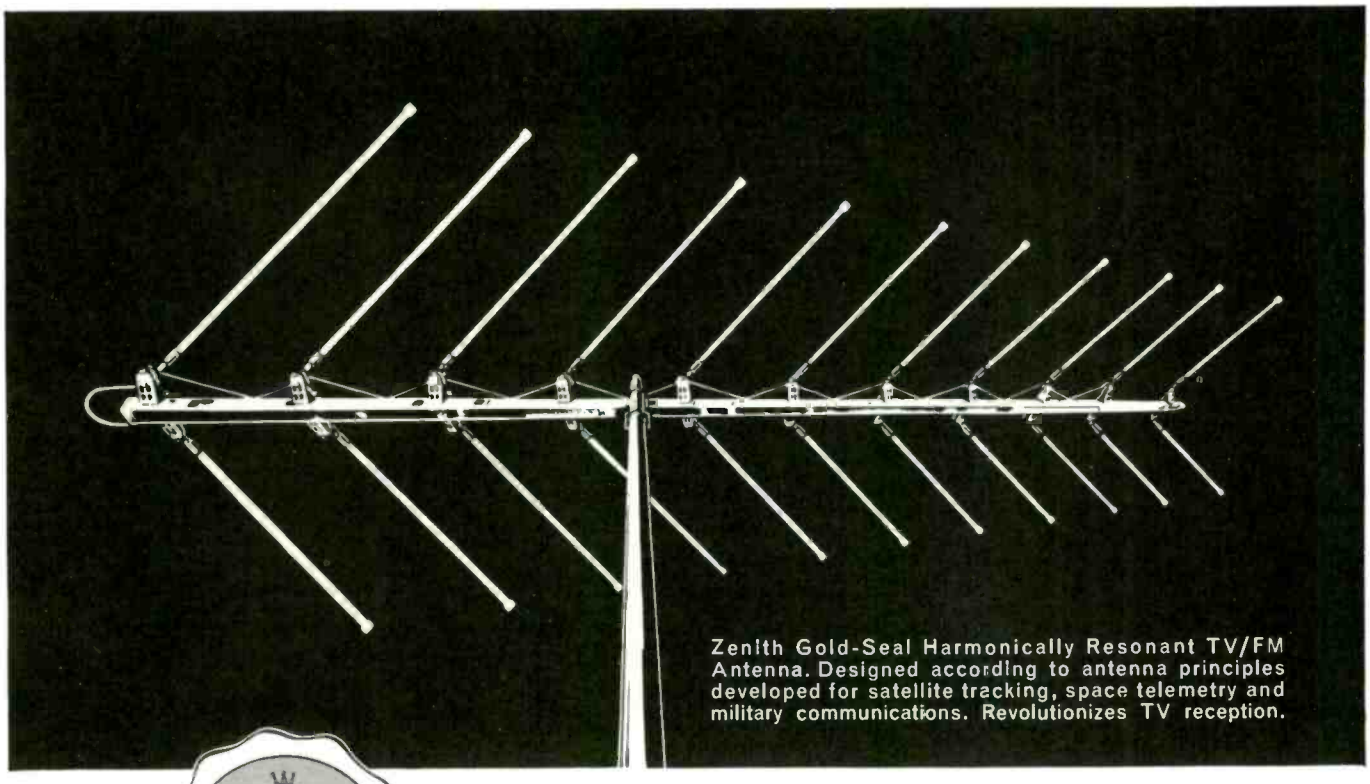

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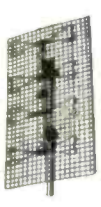

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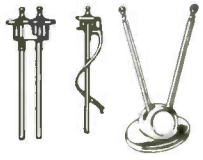

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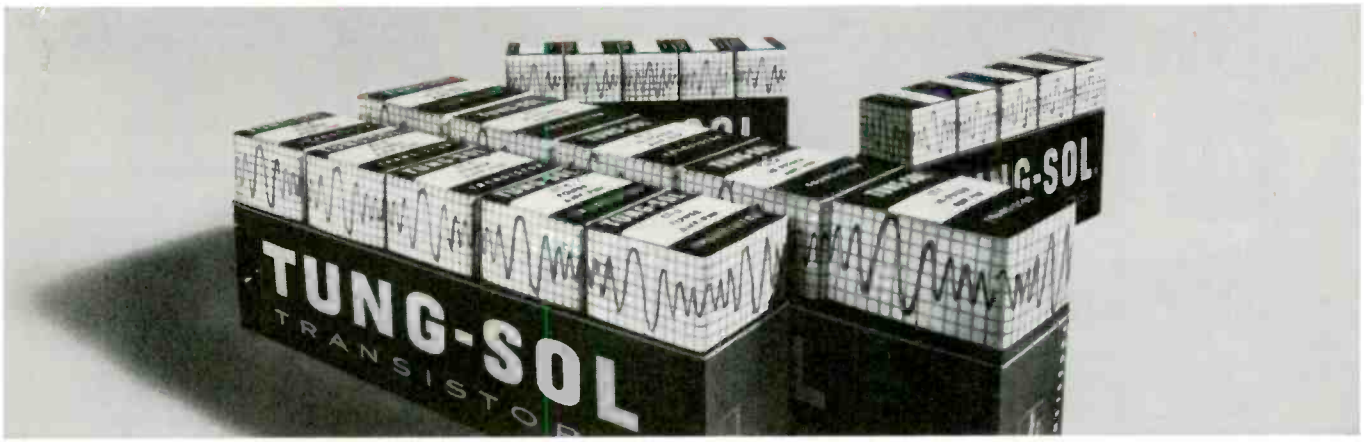

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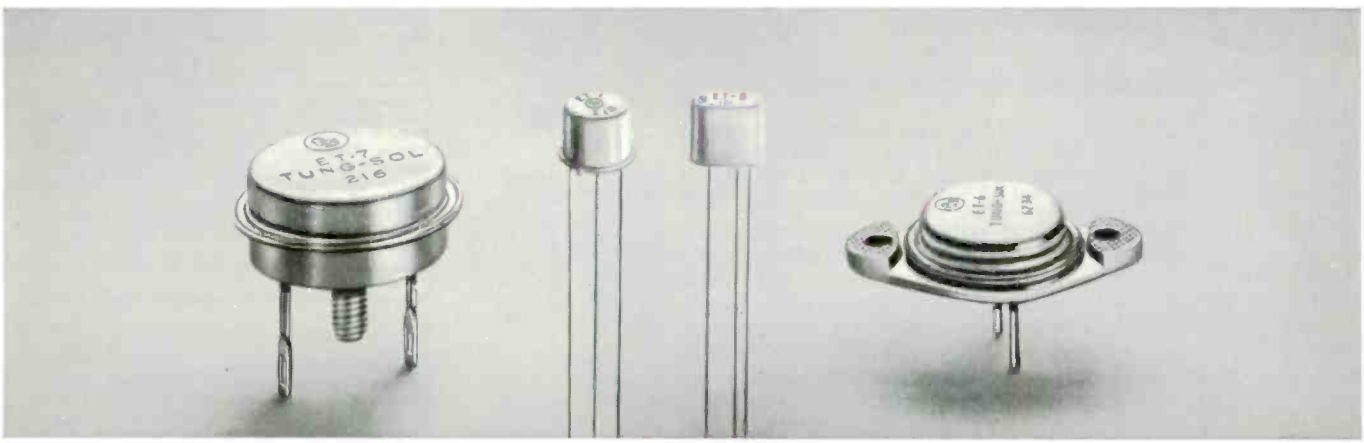

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Precision Thermometer & Instrument 1434 Brandywine Philadelphia Pa
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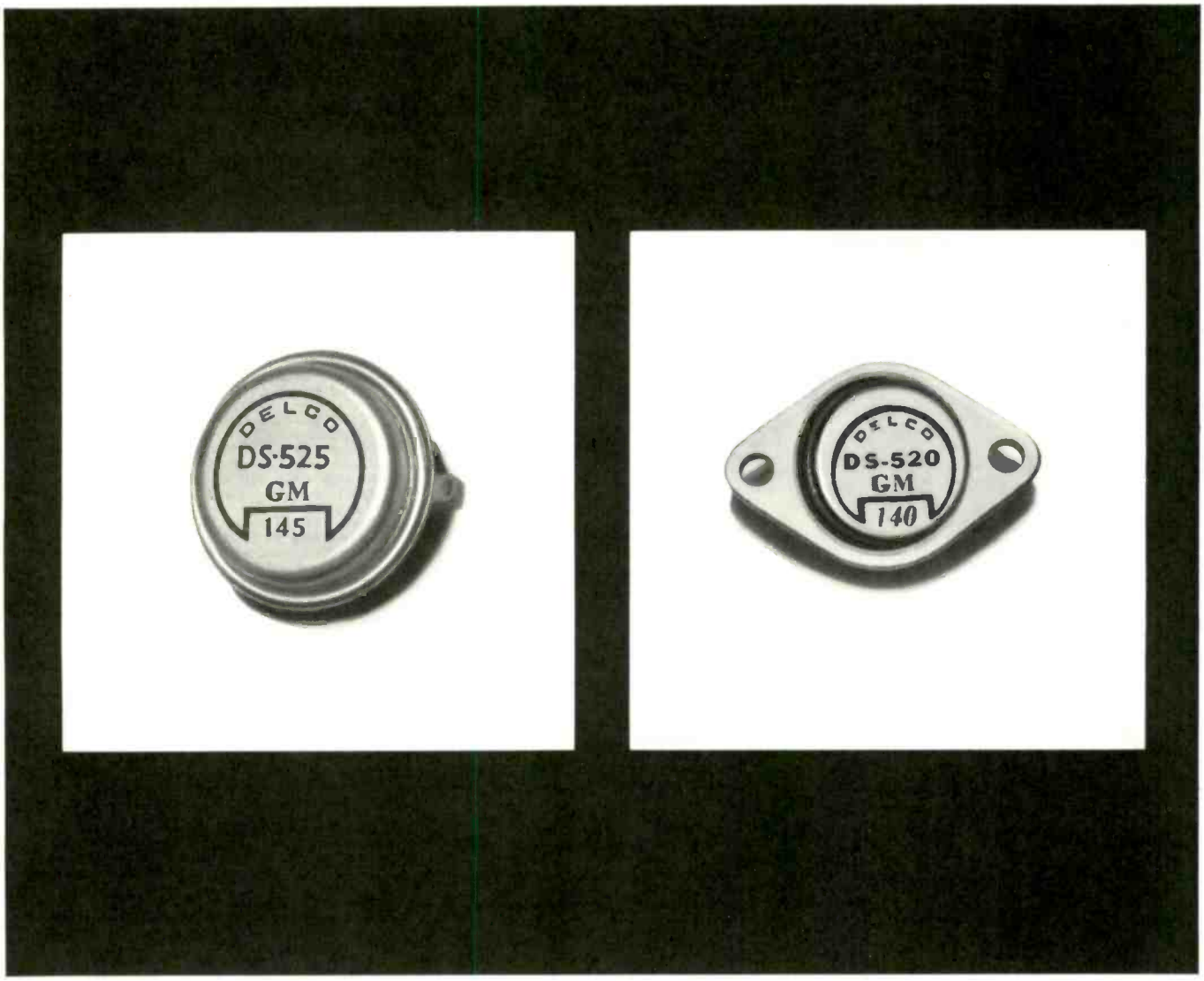

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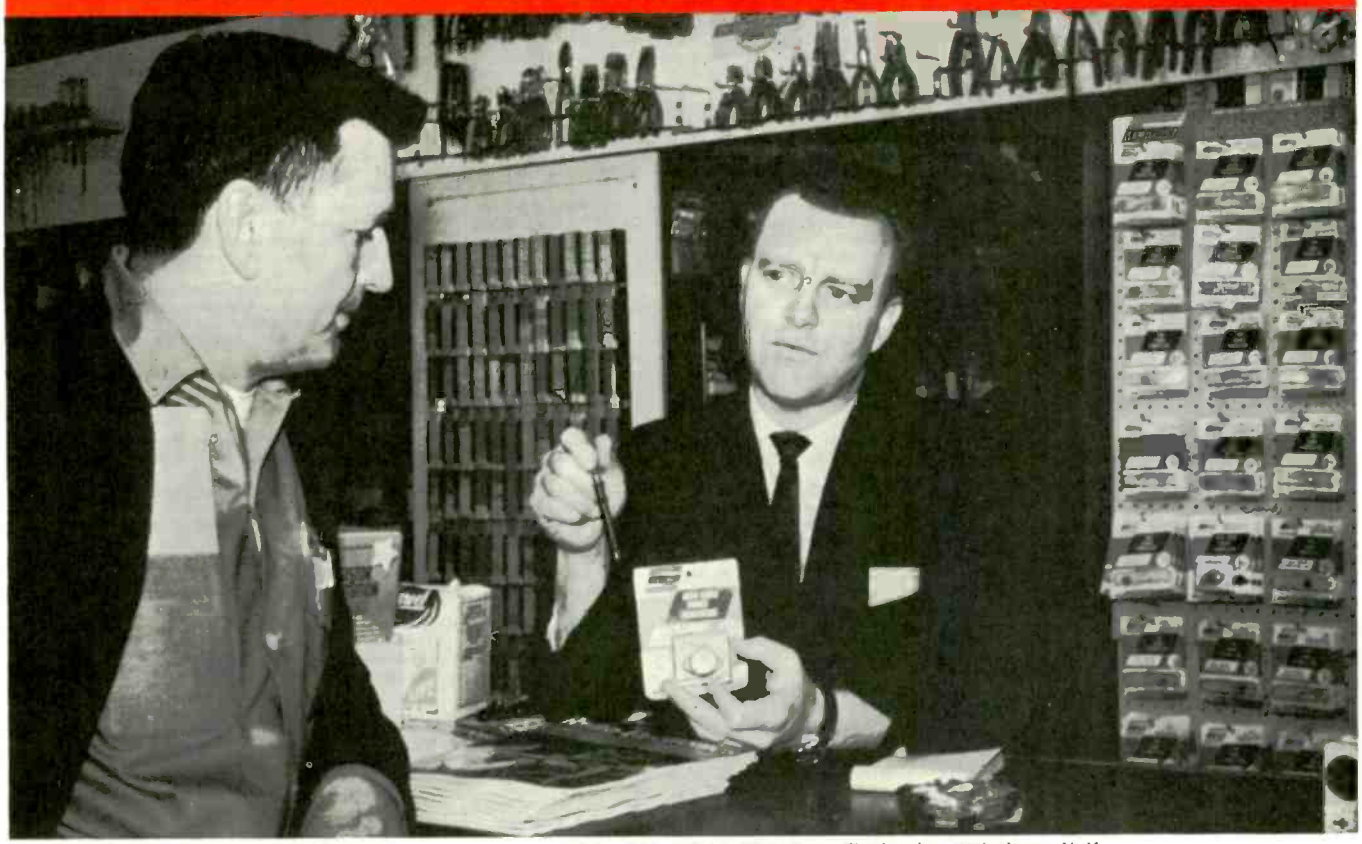

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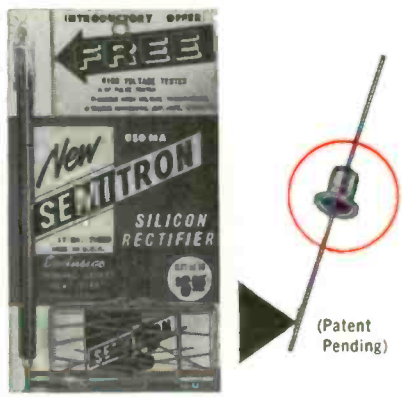

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National Community TV Assn 535 Transportation Bldg Washington 6 DC—Frank Thompson
National Electrical Mfrs Assn 155 E 44 St New York 17 NY—J F Miller Managing Dir
National Electronic Distributors Assn 343 S Dearborn St Chicago 4 Ill—G S Carter
National Electronics Conference 228 N LaSalle St Chicago 1 Ill—Dr E W Ernst

Phonograph Mfrs Assn 37 W 53 St New York 19 NY—A D Adams
Precision Potentiometer Mfrs Assn 27 E Monroe St Chicago 3 Ill—R E Pritchard
Producers of Associated Components for Electronics (PACE) 261 Broadway New York 7 NY—Walter Jablon
Purchasing Agents of the Radio-TV & Electronic Industry PO Box 62 Rosedale 22 NY—B Trimboli

Radio Club of America 11 W 42 St New York 36 NY—James Morelock
Radio Technical Commission for Aeronautics (RTCA) Room 1072 Bldg T-5 Washington 25 DC—L M Sherer
Radio Technical Commission for Marine Services c/o Federal Communications Commission Washington 25 DC—G R McLeod

Scientific Apparatus Makers Assn 20 N Wacker Dr Chicago 6 Ill—Kenneth Andersen
Society for Nondestructive Testing 914 Chicago Ave Evanston Ill—P D Johnson
Society of Motion Picture & TV Engineers 55 W 42 St New York 36 NY—H E Farmer
Society of Plastics Engineers 65 Prospect St Stamford Conn—Colin Campbell
Special Industrial Radio Service Assn 711 14 St N W Washington 5 D C—G K Adams
Standards Engineers Society 170 Livingston Ave New Providence N J—K W Truhn Pres

Ultrasonic Mfrs Assn 271 North Ave New Rochelle N Y—J R Fisher Pres

Western Electronic Mfrs Assn 1435 S La Cienega Blvd Los Angeles 35 Calif—W H Heflin

Electronic Schools

All have both Correspondence and Resident Courses, except those followed by R for Resident Courses or C for Correspondence Courses.

ARIZONA

PHOENIX—Middleton Institute of Electronics 2937 E McDowell Rd-1-2-3-4-5-10-R

CALIFORNIA

ANAHEIM—Coast Electronics Institute 501 S Brookhurst Ave—1-2-3-4-5-6-7-R
HOLLYWOOD—Hollywood Radio and TV Institute 7078 Hollywood Blvd—1-2-C
HOLLYWOOD—Pacific Int'l College of Arts & Sciences 5719 Santa Monica Blvd—6-9-10
INGLEWOOD—Electronic Technical Institute 970 W Manchester Ave—10
INGLEWOOD—Northrop Institute of Technology 1155 W Arbor Vitae St—10
LOS ANGELES—Grantham Schools 1505 N Western Ave—4

LOS ANGELES—National Technical Schools 4000 S Figueroa St—1-2-3-4-5-6-7-8-10
LOS ANGELES—Radio-TV Training School 815 E Rosecrans Ave—1-2-3-5-C
LOS ANGELES—RCA Institutes 610 S Main St—1-2-3-4-5-7-10
SAN DIEGO—Electronic Technical Institute 4863 El Cajon Blvd—10

CONNECTICUT

HARTFORD—New England Technical Institute of Conn Inc 56 Union Place—1-2-3-4-5-6-8-10
HARTFORD—Ward School of Electronics 44 Niles St—5-10

DISTRICT OF COLUMBIA

WASHINGTON—Capitol Radio Engineering Institute 3224 16 St NW—5-9-10
WASHINGTON—Grantham School of Electronics 821 19 St NW—4
WASHINGTON—National Radio Institute 3939 Wisconsin Ave NW—1-2-4-5-7-8-C

ILLINOIS

CHICAGO—Christy Trades School 3214 W Lawrence Ave—1-2-3-5-6-7-8-C
CHICAGO—Commercial Trades Institute 1400 W Greenleaf Ave—1-2-3-5-C
CHICAGO—Coyne Electrical School 1501 W Congress Pkwy—1-2-3-5-6-7-8
CHICAGO—DeVry Technical Institute 4141 Belmont Ave—1-2-3-4-5-6-7-8-10
CHICAGO—Industrial Training Institute 2150 W Lawrence Ave—1-2-5-8-C
CHICAGO—Motorola Training Institute 4501 W Augusta Blvd—4-C

INDIANA

ANGOLA—Tri-State College—1-2-3-4-5-6-9-10-R
INDIANAPOLIS—Indianapolis Electronic School 633 N Pennsylvania St—1-2-3-4-5-6-10-R
VALPARAISO—Valparaiso Technical Institute Box 490—1-2-3-4-5-10-R

KENTUCKY

LOUISVILLE—United Electronics Institute 3947 Park Drive—1-2-3-4-5-6-7-10

MARYLAND

BALTIMORE—Baltimore Technical Institute 1425 Eutaw Place—1-2-3-4-5-R

MICHIGAN

DETROIT—Radio Electronic & TV Schools 1625 E Grand Blvd—1-2-3-4-5-6-9-10-R

MINNESOTA

MINNEAPOLIS—Brown Institute of Electronics 3123 E Lake St—1-4-5-7-R
MINNEAPOLIS—Chicago Vocational Training 3330 University Ave SE—1-2-3-5-6
MINNEAPOLIS—Northwestern TV & Electronics Institute 3800 Minnehaha Ave—1-2-3-4-5-6-R

Our '63 story begins at the end.

Under the back cover.

That's our new air-cooled engine sitting in there, the largest any Volkswagen Truck ever had. The most powerful, too. It turns out 25% more horsepower than the engine it replaces.

You'll want the extra power if your business takes you out on the highway. (Top speed tops that of any other VW Truck going.) Or over a stop-and-go delivery route. (Pick-up is quicker.) Or up steep hills. (You can climb 28% grades with a full load: 1,830 pounds.)

Best of all, you get the extra power without burning extra gas. We still average about 24 mpg. On regular.

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Bigger brakes and a larger clutch to go with the more powerful engine.

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And that's the inside story on the '63 Volkswagen Truck.

From end to beginning.

- - - for more details circle 61 on post card

MISSOURI
KANSAS CITY—Central Technical Institute 1644 Wyandotte—1-2-3-4-5-6-7-8-10
KANSAS CITY—Grantham School of Electronics 3123 Gillham Rd—4

NEW JERSEY
PENNSAUKEN—Electronics Training Center 7300 Crescent Blvd—1-2-3-4-5-6-10-R

NEW YORK
BROOKLYN—New York City Community College 300 Pearl St—4-5-10-R
NEW YORK—Board of Education of the City of New York Manhattan Trades Center 45 Rivington St—1-2-3-4-8-R
NEW YORK—Delehanty Radio & TV School 117 E 11 St—1-2-3-4-R
NEW YORK—Electronic Development Institute 125 E 46 St—1-2-3-4-5-6-7-10
NEW YORK—Lincoln School of Radio & TV 127 Columbus Ave—1-2-3-4-5-R
NEW YORK—Radio TV Training of America 52 E 19 St—1-2-3-9-C
NEW YORK—RCA Institutes 350 W 4 St—1-2-3-4-10
NEW YORK—Voorhees Technical Institute 304 E 67 St—5-10

OHIO
CLEVELAND—Cleveland Institute of Electronics 1776 E 17 St—4-5-7-10-C

PENNSYLVANIA
ALLENTOWN—Electronics Training Center 29-31 N 7 St—1-2-3-6-R
PHILADELPHIA—Electronics Training Center 4013 Germantown Ave—1-2-3-5-6-10-R
PHILADELPHIA—Philadelphia Wireless Technical Institute 1533 Pine St—4-5-10-R
PHILADELPHIA—Philco Technological Center C and Ontario Sts Post Office Box 4730—5
PITTSBURGH—Penn Technical Institute 5440 Penn Ave—1-4-5-10-R
SCRANTON—International Correspondence Schools' School of Electronics Oak and Pawnee—1-3-4-5-6-8-9-10-C

RHODE ISLAND
PROVIDENCE—New England Technical Institute of R I Inc 184 Early St—1-2-3-4-5-6-8-10
PROVIDENCE—Rhode Island Radio & Electronics School 45 Mathewson St—1-2-3-4-10-R

TEXAS
PORT ARTHUR—Port Arthur College 1500 Procter—1-2-4-5-R

WASHINGTON
SEATTLE—Grantham School of Electronics 408 Marion St—4

WISCONSIN
MILWAUKEE—Milwaukee School of Engineering 1025 N Milwaukee St—5-10-R

CANADA
TORONTO ONTARIO—DeVry Technical Institute 970 Lawrence Ave W—1-2-3-4-5-6-8-10

FREE LITERATURE

SURGE PROCTECTION 300

A 20-page manual provides complete data on the protection of silicon rectifier diodes, transistors, silicon controlled rectifiers and other semiconductors through the use of selenium transient voltage suppressors. International Rectifier Corp.

COMPONENTS CATALOG 301

The 1963 Service Components Catalog lists, and fully describes, the complete line of wire-wound and carbon potentiometers, fixed and adjustable wire-wound resistors, switches, and other resistance devices for radios, television sets, Hi Fi systems, PA systems and com-

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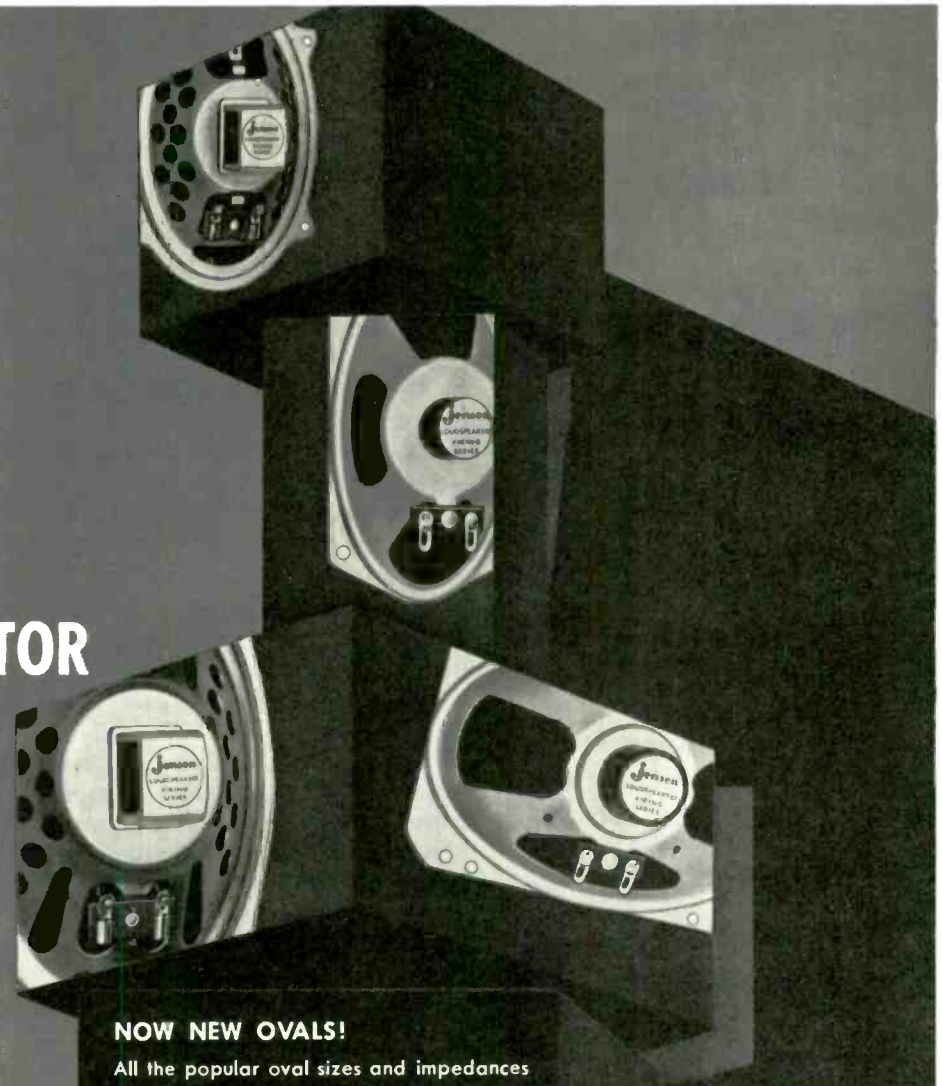

No businessman in electronic parts distribution can afford to overlook the remarkable pricing and profit features that have been built into the new, broader, updated Viking Series of general purpose and replacement speakers by JENSEN.

This collection of fast-moving items has what it takes to deserve first place in your speaker marketing plans with the undisputed plus of the JENSEN reputation for quality and advanced design.

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NOW NEW OVALS!

All the popular oval sizes and impedances are now available in the new JENSEN Viking series of replacement and general purpose loudspeakers. You get them at the right prices . . . and best profit margin!

Nom. Size	Model No.	Magnet Wt. Oz.	Imped. Ohms	List Price
3	3K7	.68	3.2	$ 3.80
3½	3SK7	.68	3.2	3.80
4	4K5	.53	3.2	2.90
4	4K7	.68	3.2	3.55
5	5K5	.53	3.2	3.25
5	5K7	.68	3.2	3.85
5¼	525K7	.68	3.2	4.35
6	6K7	.68	3.2	4.35
7	7W3	1.00	3.2	6.55
7	7J9	1.47	3.2	6.65
8	8W3	1.00	3.2	5.85
8	8J9	1.47	3.2	6.90
10	10J10	1.73	3.2	9.00
12	12J10	1.73	3.2	10.50
3x5	3X5K5	.53	3.2	4.10
4x6	4X6K7	.68	3.2	4.80
4x8	4X8W9	1.00	8-10	6.00
4x10	4X10W9	1.00	8-10	6.50
5x7	5X7W3	1.00	3.2	5.35
5x7	5X7W9	1.00	8-10	5.35
5x7	57J9	1.47	3.2	5.40
6x9	6X9W3	1.00	3.2	5.95
6x9	6X9W9	1.00	8-10	5.95
6x9	69J9	1.47	3.2	6.40

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Canada: Radio Speakers of Canada, Ltd., Toronto • Argentina: UCOA, S.A., Buenos Aires • Mexico: Fapartel, S.A., Naucalpan, Mex.

- - - for more details circle 35 on post card

FREE LITERATURE

mercial electronic equipment. Clarostat Mfg. Co., Inc.

FM STEREO BOOKLET **303**

"A GUIDE TO BETTER FM STEREO PERFORMANCE" is a booklet published for distribution by FM stereo service-dealers to customers and prospects. The booklet explains the reasons why an FM stereo engineered outdoor antenna is vital for properly balanced and separated stereo.

DISTRIBUTION SYSTEM **304**

This TV and FM antenna systems manufacturer has just introduced two instruction aids for service-dealers who are interested in installing home and master antenna systems. A 16-page manual, designated "fact-Finder #232" presents easy-to-understand information on laying out and installing both large and small antenna systems. It shows simplified step-by-step methods for figuring system losses, the proper equipment to use for various types of installations, several helpful guide charts, typical systems, a glossary of common terminology and many other aids for both new and experienced installers.

TROUBLE-SHOOTING GUIDE **305**

According to the firm, "there are over 30,000,000 'Telechron' clocks in homes today—a good market for the electronic service technician. The reasons that cause most clocks to fail can usually be located in the rotor and motor coil. All the serviceman needs is a screwdriver, 15 minutes and a motor coil and rotor replacement." The replacement motor coil and rotor can also be used for ovens and ranges, time switches, air conditioners, attic fan timers, photo timers, and advertising clocks. Semitronic Corp.

PA SPEAKERS **306**

A complete line of public address loudspeakers is included in this catalog. Along with the product listings, are several pages of general information on the selection of PA speakers. Trumpets, paging, column, special purpose and Hi Fi types are reviewed. University Loudspeakers Div., Ling-Tempco-Vought, Inc.

ELECTRONICS TRAINING **307**

A broad range of electronics training is outlined in this catalog. Included in addition to a list of courses is an introduction to the school and to its key personnel. Subjects offered include mathematics, general theory, operations of test equipment and specific types of electronic gear. Cleveland Institute of Electronics.

TOOLS CATALOG **308**

A new catalog No. 11 covers this line of tools. All items are illustrated, described and priced. These small tools and accessories include: sleeving cutters, connectors and plug holders heat sinks, soldering iron tip cleaner, soldering iron stand, and printed circuit board holder. McDonald & Co.

NEW PRODUCTS

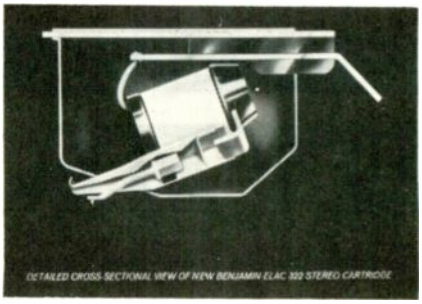
TUNER CLEANER **200**

The 16 oz aerosol can of a tuner cleaner, TUN-O- LUBE is combined as a special introductory offer, with a 3 oz caddy size. These "companion" products will be offered for a limited time for $2.98 the single price of the 16 oz can of TUN-O-LUBE only. This is the same tuner cleaner marketed since 1958. Chemtronics, Inc.

CARTRIDGES **201**

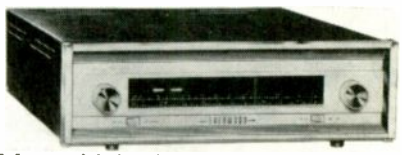
Two magnetic stereo cartridges,

NEW PRODUCTS



the 322 and 222, are said to be the subjects of a vigorous promotion program. Frequency response for the 322 is 20 to 20,000 cps, ±2 db. Channel separation is better than 25 db at 100 cps, 20 db at 10 kc, and 14 db at 20 kc. Compliance measures 14 x 10^{-6} cm/dyne, recommended tracking force is 1.5 to 3 g and price is $49.50. The Elac 222 is equipped with 0.7 mil diamond stylus for use with mono and stereo records. Price is $39.50 in case. Benjamin Electronic Sound Corp.

FM/AM TUNER



Many features of the S-2100 tuner are now available in the S-200 III FM AM mono tuners. FM sensitivity is rated at 1.8 μv for 30 db quieting and distortion (IHFM).

. . . COLUMNIST ASSAILS TECHNICIANS

Continued from page 35

of others: How about component failure? If a component changes value, often a set can still be aligned within tolerance of good performance. How about a bad solder joint? Or maybe in transporting the tuner, the RF coils and wiring were disrupted. That could happen easily. Of course, anytime a tube is replaced in a tuned circuit, a certain amount of detuning takes place.

The so-called evidence on which Canby bases his attack certainly does not justify giving all technicians a black eye.

Further, it is this very type of ignorance that has caused TV technicians to be the brunt of so many cruel jokes on TV, radio, in magazines by equally uninformed "Canby's."

One more point. The professional TV technician has for many years kept TVs older than a 10-year-old tuner in top flight condition. TVs that engineers predicted would require factory service when TV "caught fire" in the mid-forties.

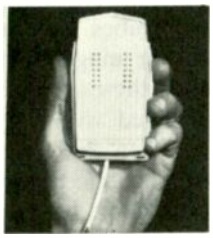
And do you know what background industrial and consumer electronic manufacturers like their potential technicians to have more than any other? That's right. TV repair experience!

V. L. B.

Capture ratio is 2.4 db. Price of the basic chassis with deluxe front panel is $155.50. The S-2000 III is 14 x 4 x 10½ in. Sherwood Electronics Lab Inc.

MICROPHONES **203**

A selection of seven ceramic microphones for tape recordings range from sensitive matched stereo



models to budget-priced models. The two newest units in the line are the Models "CM-40" and "CM-41." Designed especially for tape recording, they are made of high-impact plastic. Both have a frequency response of 40 to 8000 cps with a sensitivity of -50 db. The "CM-40" lists for $9.90 and the "CM-41" equipped with a push-to-talk" "long travel" switch, double pole, double throw type—lists for $11.90. Sonotone Corp.

SILICON RECTIFIERS **204**

This rectifier series TH800 reportedly provides improved thermal dissipation for increased life and

reliability. The built-in thermal jacket is electrically isolated from the rectifier element which allows physical and thermal contact to the chassis. The TH800 series has an epoxy encapsulated body and is rated at 850 ma. It is available with peak reverse voltage from 100 to 1000 v. Silver leads allow easy circuit soldering. For a limited time only, pocket size high voltage tester is packaged FREE with each kit purchase. The kit of 10 silicon rectifiers, plus free high voltage tester is $6.95 list. Semitronics Corp.

. . . REPLACEMENT CONTROLS

Continued from page 41

only a few volts to thousands of volts. The breakdown-voltage should always be higher than the highest voltage to be impressed across the pot.

Cleaning controls is one of the most controversial subjects among technicians. Most manufacturers agree, however, that it is not a good practice to use control cleaner without care. A control which is used infrequently may become dirty, however, and a good cleaner will correct this. If a control cannot be "cleaned up" with a light application of cleaner, the control should be replaced.

Carbon tetrachloride should not be used. Several good control cleaners are available. One of the cleaners with a good lubricant should always be used. Other cleaners simply wash out the lubricant installed during manufacture. The shaft too, is lubricated, so special attention should be given to the shaft and its bushing when cleaning controls. ■

. . . PICTURE TUBE IDENTIFICATION AND INTERCHANGEABILITY

Continued from page 53

Aluminized tubes may be spotted by looking around the anode-well, or the picture tube rim for the bright silvery coating on the inside of the bulb. This is also sometimes visible around the front edge of the CRT screen.

One other pair of tubes some technicians have trouble separating are the 21YP4 and the 21AUP4, as they are almost identical except for the slightly larger face on the 21AUP4. The only other physical difference is that the 21AU/AVP4 has a large numeral "3" stamped on or molded into the bell. This actually makes it easier to distinguish these types from each other than other similar tubes. The same is true for the magnetic focus counterparts of these two tubes, which are the 21ZP4 and the 21AWP4. The numeral is molded on the bell of the 21AUP4.

Interchanging CRTs

The most usual interchange is between tubes of the same physical and basic electrical characteristics different types of focus. Most older type tubes have an electrostatic focus or magnetic focus counterpart, and these can be directly interchanged with very small effort.

When changing from electrostatic to magnetic types (see Chart I) supports must be used to hold the magnet snugly. Triad's YC1 tapered rubber yoke clamp, which wedges around the picture tube neck is an example of such a support. To replace the magnetic type with the electrostatic type, remove the magnetic focus assembly and connect a jumper wire from pin 6 to pin 10 on the CRT base. Pin 6 may also be connected to a ground point on the chassis or a lower B + point than pin 10 for better focus if desirable. In most instances, a jump-

er from pin 6 to pin 10 is fast and satisfactory.

When the focus coil is removed, the resistance of the coil should be measured and equivalent 10 w resistor mounted neatly on the chassis.

To change from metal to glass tubes, no changes are usually necessary except a new anode connector for the lead require anode glass type; a slight compensation in mounting strap size may also be required.

One exception is the RCA 21 in. line. In these sets the mask must be taken out, part of the plastic rear supports cut away, and the rim slotted with a hack-saw, so that it will spread enough to accept the 21YP4 or 21ZP4.

In early 12 in. Zeniths, the 12LP4 will replace the 12UP4 with ease.

One further extension of practical picture tube interchangeability is the obvious use of a similar type with larger physical screen size. The use of the 17BP4 or 17HP4 (with focus coil removed) as a replacement for the 16KP4 for example. In general, the only noticeable effect will be a "fuller" screen, with less or no border showing.

Similarly, the square cornered 21WP4 and 21XP4 can in most cases replace or be perfectly replaced by the 20CP4 and 20HP4. The 21AUP4 is an excellent replacement for the 21YP4 or 21ZP4 (with focus coil removed) and so on to almost unlimited substitution by changing masks, sliding yoke mounting assemblies back and forth and other obvious physical changes.

The short-necked 21FP4 electrostatic focus tube requires no ion traps and replace older types such as the 21CBP4. It also replaces the 21ALP4, and eliminates the ion trap; and will replace the 21AMP4 by removing the focus coil.

The 24AEP4, may be changed for the 24DP4 or the 24CP4 with the focus change. The 17BJP4 is a trap-less replacement for the 17AVP4 and so on. These replacements are listed in most interchangeability guides.

Later type tubes are all electrostatic focus types, and are pretty well catalogued as to interchangeability. These types are not commonplace enough to warrant working out complete practical interchangeability at this time. ■

ADVERTISERS INDEX

It's an open-and-shut case for better closed circuit TV

Consider the Norelco Television Camera. Open, it exposes its secrets of ruggedness and long life: no tubes to burn out—just tough little transistors . . . pivoted side panels for easy inspection and repair in the remote event of a malfunction . . . room to accommodate the larger Plumicon tube, when available.

Closed, the Norelco epitomizes ease of operation by its stark simplicity. Missing are the standard adjustment knobs, because all 'trimming' is done internally when the vidicon tube is installed. And since the camera adjusts automatically to light intensities as great as 1:15, it needs focusing only once, when the camera is positioned. From then on, just flip the on-off switch.

What else? The Norelco CCTV camera is compact (13" x 7" x 4") and weighs only 11 lbs. It will feed a signal to as many as 30 TV receivers without amplification. A complete line of accessories is available for both manual and remote control operation.

Where is it used? Everywhere. For instance, factories, banks, hospitals, stores, airports—to name just a few current uses.

Want to know more? See it perform at the May Parts Show, Room 519A. Or write to Dept. ET, North American Philips Company, Inc., 100 East 42nd St., New York 17, N. Y.

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Sound Systems

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KEEPING SILVERAMA'S MATCHLESS COMPLEXION

Critical inspections assure highest quality screen for RCA picture tubes

Because your customers judge a picture tube by its face, RCA makes certain that every Silverama® picture tube has a matchless complexion. Super-critical inspections at various stages of manufacture assure the virtually blemish-free television viewing surface your customers expect in an RCA Silverama.

At the screen inspection station in our Marion, Indiana picture tube plant (above), for example, an inspector uses transmitted light to check for pin-holes and other flaws in newly applied phosphor screens. The most minute imperfection—even the slightest variation in screen texture, color or smoothness—is cause for rejection of the bulb.

Screen inspections using both ultra-violet and transmitted light are but one phase of the exhaustive battery of visual, mechanical, and electrical quality control tests each Silverama must pass. The object: to maintain a product you can recommend and install with confidence in your customers' TV sets.

Envelope inspection. Picture tube envelopes are polished, and given a series of acid baths prior to re-use that delicately etch the interior of the glass to restore it to the peak of its optical capability. Then they are thoroughly inspected to meet the standards of the original new envelope.

Screen inspection. Every completed Silverama is re-inspected for screen quality and sharpness of focus at this special automatic testing station near the end of the production cycle. Each Silverama undergoes as many as 26 inspections before it is released for sale to your customers.

RCA ELECTRON TUBE DIVISION, HARRISON, N. J.

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