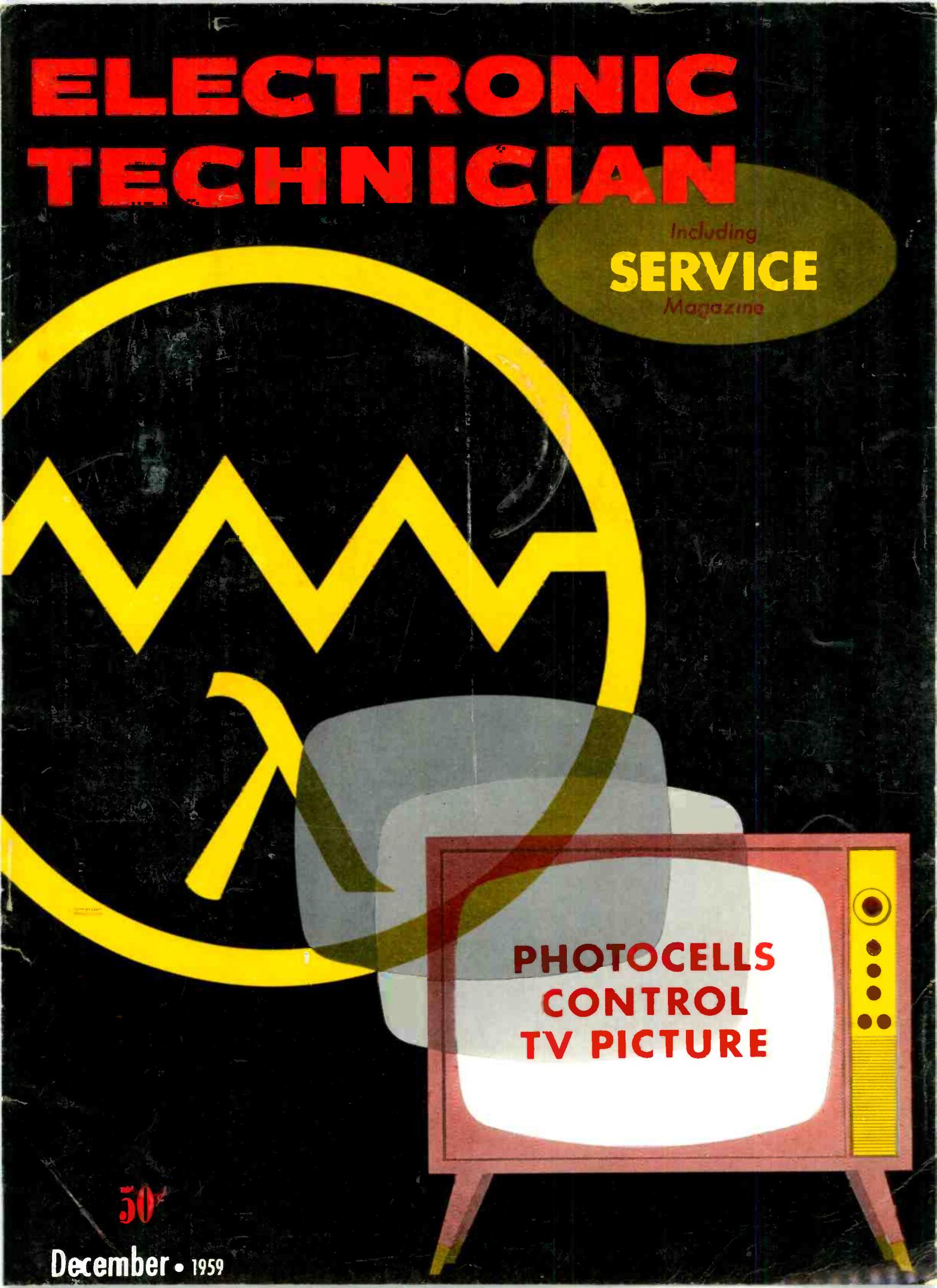


# ELECTRONIC TECHNICIAN

Including  
**SERVICE**  
Magazine

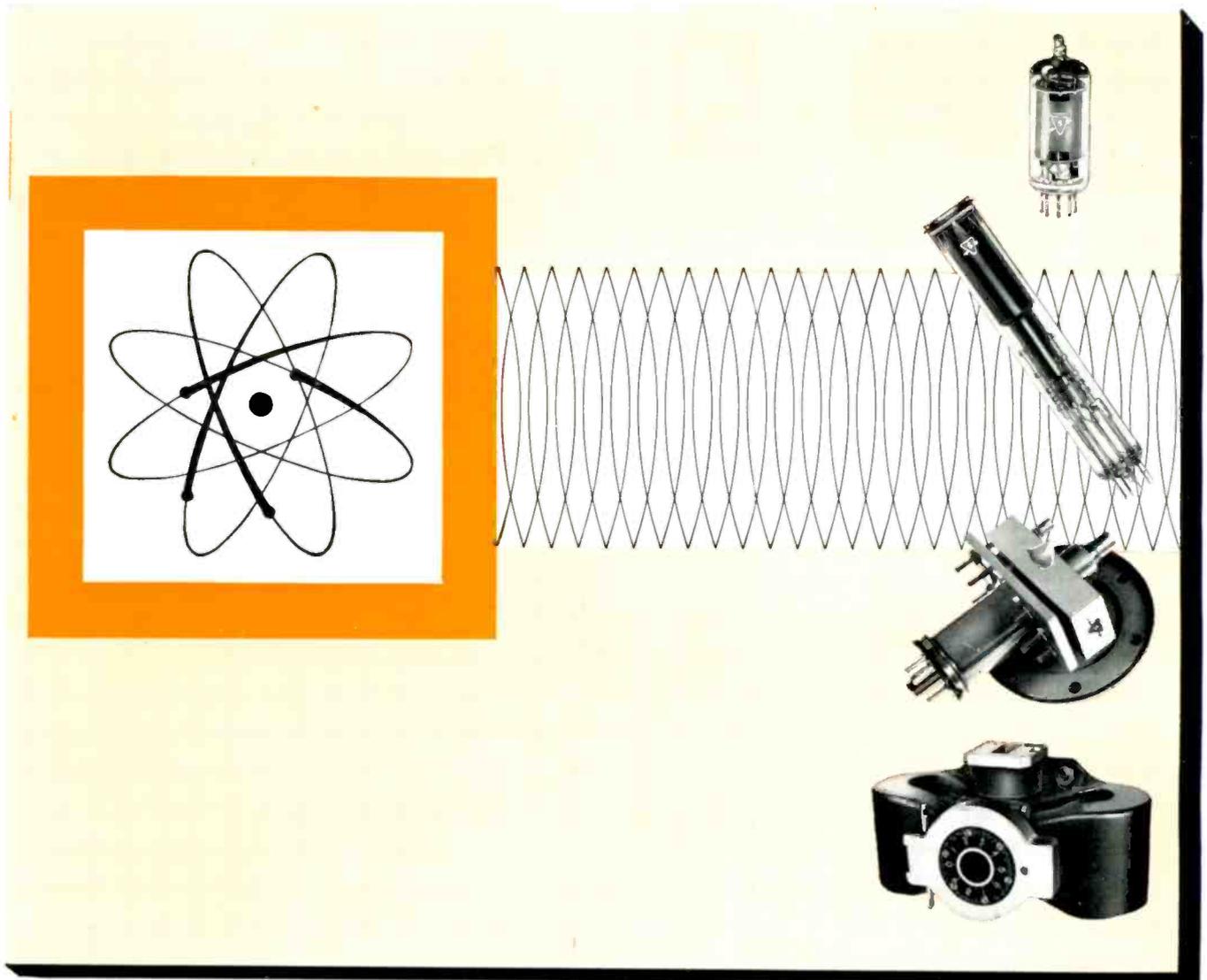


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50<sup>th</sup>

December • 1959

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# ELECTRONIC TECHNICIAN

Now Including  
**SERVICE**  
Magazine

World's Largest Electronic Trade Circulation

December, 1959

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**FRONT COVER** TV's design metamorphosis has resulted in many automatic features adding to the set-owner's leisure-living pleasure. What feature, possibly another potential defect for the technician to troubleshoot, will be next? It may well be automatic brightness and contrast adjustments, actuated by room lighting. For working examples of this circuitry, see article starting on page 34.

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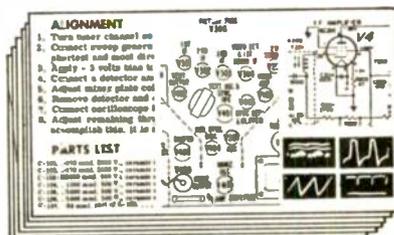
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- PACO: Stereo Preamp-amplifier, Model SA-40W



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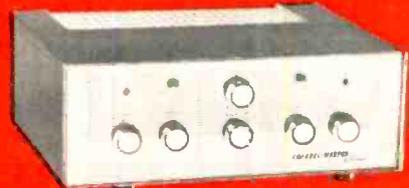
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## Editor's Memo



You've probably heard of "jumpology," one of the newest and most entertaining semi-sciences. Essentially it says that much can be told about a person's character by the way he jumps. There is much truth in this, based on the psychological concept of expressive movements. In other words, the way we go about doing something or expressing ourselves reflects what we are . . . which is just plain common sense.

Some photos published recently in *Life* showed that when politicians jump, they still look like they're addressing an audience (Nixon) or leading a rousing cheer (Stevenson). Some women (S. Loren, A. Hepburn) show their vivacity and abandon by jumping with arms and legs spread-eagled. Others (M. Miller, B. Bardot) keep their knees together while drawing their feet up behind them in little-girl fashion.

People who deal with the public don't get much of a chance to judge others by the way they jump. However, service technicians encounter a number of pet expressions by customers who say one thing, but mean something else. For example:

"It must be one of the little tubes."  
(*I hope the picture tube is OK.*)

"Mrs. Gallstone next door said you were capable and reasonable."  
(*You don't know what fantastic prices other TV men charge.*)

"Does it have to go to the shop?"  
(*Will you hold it for ransom?*)

"You guarantee your work, of course."  
(*I expect a one year warranty.*)

If you have some favorite interpretations of pet customer expressions, tell me about them. Readers of our letters column may be interested to see them.

Coming back to jumpology, I was reminded of the story of an ambitious young technical school graduate who approached the owner of the town's most successful electronic service business.

"What's the secret of your success?" he inquired.

"No secret," replied the shop owner. "You simply have to be alert for opportunities, and then jump at them."

"But how am I going to know when my opportunity comes along?" asked the young graduate.

"You won't," answered the owner. "You just have to keep jumping!"

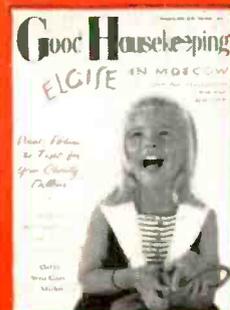
*Al Foman*

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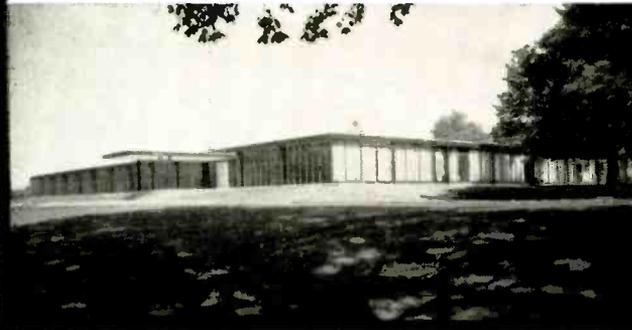
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**SAVE MONEY, TOO!**



advanced engineering assures

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...improves efficiency...reduces listener fatigue

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List Price, \$46.33

**Model 847-45** CDP with 45-ohm voice coil for Intercom applications.

List Price, \$47.83

**Model 844** 30-watt Reentrant. Diecast aluminum horn, with removable driver, and universal mounting bracket. Designed for easy servicing with field-replaceable voice coil. Wide-range response: 250-10,000 cps. Dispersion: 90°. Sound pressure level: 120 db. Imp.: 8 ohms. Size: 9 1/4" diam. x 8 3/4" deep. Net wt. 5 lbs. 10 oz.

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\*Design Patent 169,904

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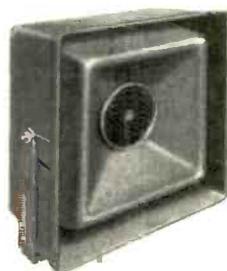


Model 844



848 CDP

848LT CDP



Musicaster



# LETTERS

## To the Editor

### Licensing—Pro & Con

(Editor's Note: The following letters are representative of reader comments on the forum in the October issue of ET—"Should TV Servicing be Licensed?" Mr. Moch presented the pro view, Mr. Wolfson the con position. Reader responses favoring licensing far outnumbered those opposing it.)

Editor, ELECTRONIC TECHNICIAN:

A *Serviceman* is one who repairs power mowers, furnaces. He has a plumber's type tool chest, filled with grimy pipe wrenches, hammers, worn and bent screwdrivers. His dress is untidy, dirty shirt, crumpled work trousers. He frequently has offensive B.O. Mr. Wolfson is absolutely right, he needs no license; as a matter of fact, a license could mean disaster to his trade. A *Service Technician* is a trained specialist, and he looks like one. He is a businessman, puts on a clean shirt every morning and wears pressed dress pants. He knows his stuff, and with many expensive specialized instruments, is able to promptly restore to proper operating condition any home electronics device. He is proud of his profession. To protect it, and his customers, he is even willing to give up some of his freedoms to a regulatory set-up such as licensing. More often than not, he is an active member of a service association, promoting efforts to obtain licensing for his profession. After all, he feels, just where would the public and the respective professions be if doctors, lawyers, C.P.A.'s, etc. all could operate without a license, leaving the door wide open for every quack and crook? I am a *Technician*, proud to be one, and I want to be licensed.

Paul Boller

Springfield, Ohio

... We have had licensing in Detroit for the past three years and its aims of enhancing the prestige of the technicians have not materialized. Neither has the public benefited much because there can't be price regulations. I have yet to be asked to show my license, and I feel that the fee for it has been wasted money. This licensing act was pushed by a local television service association who, while publicizing concern for the public, was trying to freeze out the little independent men. The act they pushed through contained one large loophole which gave the public little protection. This was the permit system which allowed any number of men to work for a licensed technician without being examined and paying fees to the city. For instance, RCA Service Company, with about 75 men, has only three licenses. Of course, the

(Continued on page 12)

12% TO 15% LESS ATTENUATION!

## polyfoam

### RG-8/U TYPE CABLE

#### DESCRIPTION

AMPHENOL introduces a new polyfoam dielectric coaxial cable equivalent of RG-8/U but with a significant reduction in attenuation. Part number is 621-111.

#### ELECTRICAL AND MECHANICAL CHARACTERISTICS

Impedance—50 ohms  $\pm$  2 ohms  
Attenuation—4.0 db/100 feet nominal at 400 mc.  
Dielectric Strength—5000 V. RMS  
Corona—3000 V. RMS  
Capacity—26.0 mmf/ft. nominal  
Overall Diameter—.405"  $\pm$ .010"

#### FEATURES

From 12% to 15% less attenuation than standard RG-8/U.  
Lower capacity than solid dielectric 50 ohm cables.  
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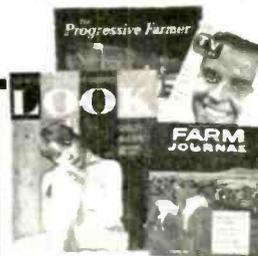
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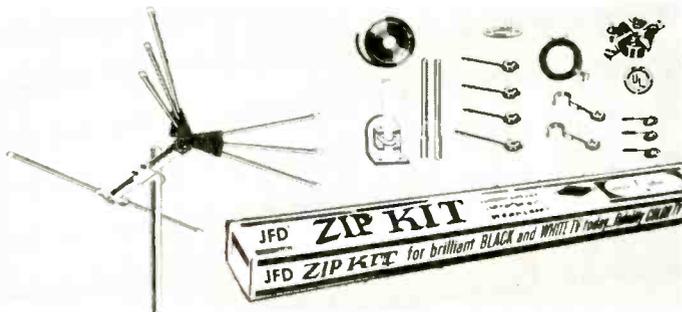
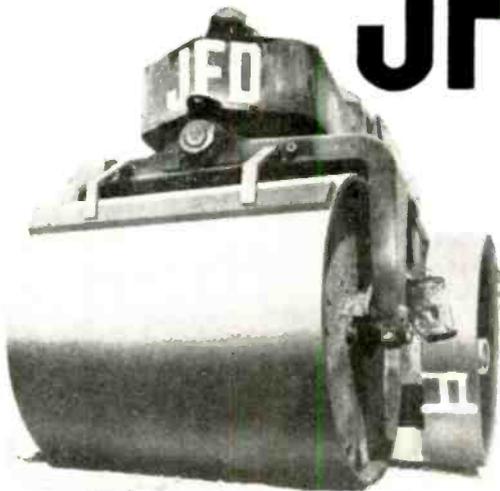
**LOOK**

**TV GUIDE**

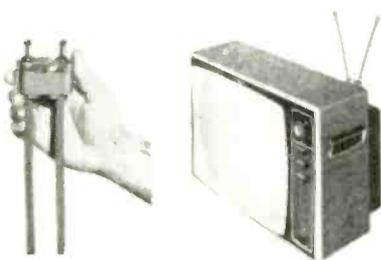
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**LOCAL TIE-IN CO-OP ADVERTISING TO HELP YOU CONVERT ANTENNA REPLACEMENT LEADS INTO SALES.**

**NEWSPAPER MATS, RADIO-TV SPOTS, POP DISPLAYS THAT PUT MUSCLE INTO YOUR LOCAL SALES DRIVES.**



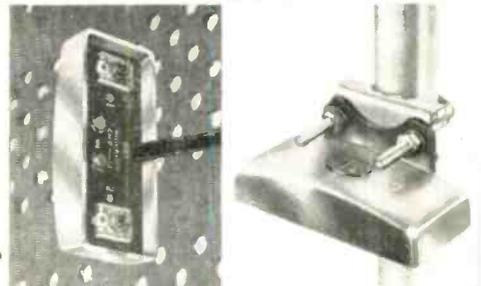
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THE BIG NEWS FOR 1960

# SYLVANIA 23-INCH TV



• Viewing area 275 square inches. 23-inch picture tube measured diagonally.

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- Square corners of the 23-inch\* bonded shield picture tube pioneered by Sylvania presents more of the TV picture as the camera sees it. New squared shape is closer to the 3 x 4 ratio of the true TV camera raster.
- The 23-inch\* tube flattens the TV screen. "Bonded shield" face-panel eliminates the dust trap, cuts reflections in half, and improves brightness and contrast.
- ◆ New Super HaloLight® is bigger and better than ever. It's a Sylvania exclusive that adds eye comfort to eye appeal.

**SYLVANIA 23"\* TV OFFERS THE NEWEST AND  
FINEST FEATURES YOU CAN RECOMMEND**

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GENERAL TELEPHONE & ELECTRONICS



(Continued from page 9)

licensee is responsible for all the permit men under him, but it has led to a condition where only a small minority of licensed men are entering people's homes. The do-it-yourself tube checkers are riding high. My opinion of licensing is that it is no panacea for ills that plague the servicing industry, as claimed by Mr. Frank Moch. There should be less battling among the associations so as to have a united front to handle our major problems, such as captive servicing.

Harry Goldman  
Harry's Television Service  
Detroit, Michigan

. . . It seems to me that Mr. Wolfson's objections to licensing follow the same old pattern. (1) It will fall into the hands of unscrupulous bureaucrats and we will therefore all become enslaved by it. (2) Those who are now cheating and hoodwinking the public will find ways and means of circumventing the law: "The fix and political clout comes into play for those who know their way around." His objections in the main do not deny the need for licensing, but for the most part dwell on his fears that it will not work. This is not a valid argument against licensing. So long as humanity exists, laws governing acceptable standards must be established and enforced. Licensing is needed to promote the ever growing need for greater and greater servicing knowledge. It is needed to encourage and protect the men who have a natural bent for this type of work. When high standards of performance are established and maintained, both the public and the worker reap benefits in equal proportion. Licensing is as natural for us as it is for any professional group. The most Mr. Wolfson and others of like mind can do is to delay the inevitable. They cannot stop it.

O. N. Timmons  
Timmons Television  
Campbell, California

. . . All should be glad now that this matter of TV Technician licensing has been brought out in the open by ELECTRONIC TECHNICIAN. Let's go. Let's get the job done! My background? Denver, without doubt the most disorganized, the most part-timer, the most cut-throat city in the United States, TV servicewise, is a shining example of conditions outlined by Frank Moch. Here we have Martin government radar schools, Ramo-Woolldridge, Bureau of Standards, Hamilton Watch, Sunstrand, etc., etc. with many of their employees going after this glamorous TV service business part-time. Parts jobbers come and go like the seasons. Many, many good men try the business a few years, throw up their hands and go to work for these technical man-hungry firms all around and in Denver where they find the income and griefless life they had thought of as TV technicians. The local BBB has called upon the FCC to

(Continued on page 14)

# DIFILM<sup>®</sup>



## BLACK BEAUTY<sup>®</sup> CAPACITORS BEAT HEAT AND HUMIDITY

New DIFILM Black Beauty Capacitors lead the way in tubulars! The operating temperature range of these new capacitors goes up to 105 C (221 F) *without voltage derating*. **Capacitance tolerance is held to  $\pm 10\%$ .**\*

- The new dual dielectric used in DIFILM Capacitors combines the proven long life of paper capacitors with the effective moisture resistance of polyester plastic film capacitors . . . to give you performance that can't be beat.
- Here's the kind of performance you can expect from DIFILM: very high insulation resistance, low power factor, moderate capacitance change with temperature,

excellent retrace under temperature cycling, and superior long-term stability . . . *all at regular prices!*

- This high performance is fully protected by HCX<sup>®</sup>, an exclusive Sprague hydrocarbon material which impregnates the windings, filling all voids and pinholes before it polymerizes. The result is a solid rock-hard capacitor section. These capacitors are further protected by an outer molding of humidity-resistant, non-flammable phenolic.

*For complete technical information on DIFILM Black Beauty Capacitors, write for Bulletin M-759 to Sprague Products Company, 65 Marshall St., North Adams, Mass.*

\*From .001  $\mu$ F up

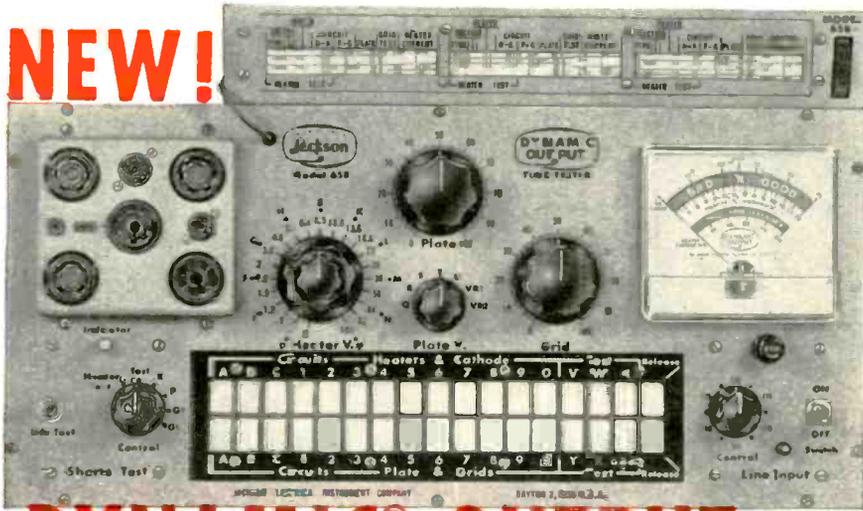
The major capacitor improvements come from

# SPRAGUE<sup>®</sup>

*world's largest capacitor manufacturer*

SPRAGUE RESEARCH IS CONSTANTLY PRODUCING NEW AND BETTER CAPACITORS FOR YOU

# NEW!



## DYNAMIC® OUTPUT 658 TUBE TESTER BY JACKSON

Makes More . . . and more accurate tests  
Than Any Service Tube Tester Ever Made!

At last, here is a tube tester that will test practically every tube the average serviceman will ever encounter. Faster, more versatile, more accurate for more types, the new 658 is the ideal choice for service, laboratory, and engineering applications.

**DYNAMIC OUTPUT PRINCIPLE**—8 voltage positions for plate, screen and voltage regulators. Variable DC voltage, plus variable AC signal voltage is applied to control grid. The meter then reads only the AC component in the plate circuit. A much more valid test than mutual conductance, because it considers the entire output curve of the tube, not just a small portion.

**TESTS NEW 12-VOLT PLATE HYBRID TUBES**—Ampere current capacity for even high current space charge grid tubes. The 658 is the only tester made with this capability.

**TRUE RECTIFIER TESTS**—AC voltages are applied to diodes and rectifiers. Meter then reads plate current—the only valid test for rectifiers. Easily handles even high current rectifiers up to 250 ma.

**GRID LEAKAGE TESTS**—Highly sensitive grid leakage test indicated directly on special meter scale. Sensitivity of 15 megohms.

**TESTS "EYE" TUBES UNDER DYNAMIC CONDITIONS**—Eye can be opened and closed to determine accurately its operating limits.

**HEATER-CURRENT TESTS ON SERIES STRING TUBES**—Actual current is read directly on meter scale.

**HEATER CONTINUITY CHECK WITHOUT WARM-UP**—No wasted time if the heater is burned out.

**TESTS ALL VOLTAGE REGULATOR AND REFERENCE TUBES**—Actually indicates striking voltage and control voltage range.

### PLUS THESE AND MANY MORE FEATURES

Famous Jackson Push-Button Sequence Switching  
New Silicon-Rectifier Balanced double-bridge circuit  
Triple Shorts Sensitivity Tests to suit each tube  
231 Heater voltage combinations from 0.6 to 120 volts  
Fused line for overload protection. Panel mounted fuse

Famous Jackson Life-Line Test  
Grouped tube sockets for easy accessibility  
Complete data for testing more than 1,200 types  
Compact portable case—21" l. x 13 3/4" w. x 7" d.  
Sockets for 4, 5, 6, 10ktal, octal, miniature 7 and 9 pin tubes plus two for sub-miniatures

SEE IT AT YOUR DISTRIBUTORS OR WRITE TODAY FOR LITERATURE

**\$189.95**



THE JACKSON ELECTRICAL INSTRUMENT CO.  
16-18 S. Patterson Blvd., Dayton 2, Ohio  
In Canada: The Canadian Marconi Company

(Continued from page 12)

see if that agency won't do something about the ridiculous advertising permitted by radio and TV broadcast stations which stations, by the way, do not seem to give a hang how much their listeners are gypped. Wolfson's arguments against licensing are wholly specious and without substance. Time was when everyone abhorred licensing of any activity connected with serving the public, except for plumbers, barbers, etc., where the items of health and sanitation are involved. However, the technique of fleecing the public has been so highly developed in modern life that "public welfare" has demanded and got licensing of real estate men, accountants, teachers, lawyers, etc. Not only do TV technicians come under the matter of "public welfare" but also public health. Wolfson's own Chicago witnessed the death of a small boy not too long ago by a defective portable TV set. Wolfson also makes much of possible abuses under licensing. Would he advocate the delicensing of plumbers, electricians, etc.? Certainly not. It is necessary, not particularly as protection of the servicers as both Moch and Wolfson appear to deem the most important consideration, but to protect the public! Let's get off the theme of self protection so evident in Moch's and Wolfson's pieces and approach licensing from the public's standpoint.

John C. Pyle, Editor

TESA of Denver Magazine  
Denver, Colorado

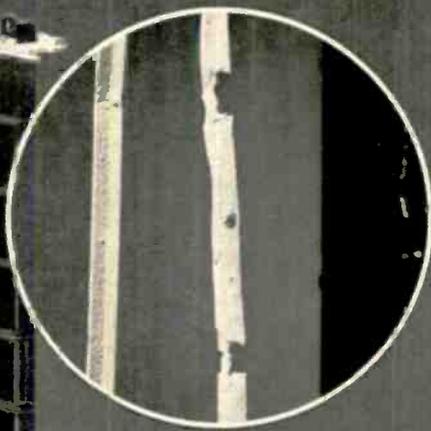
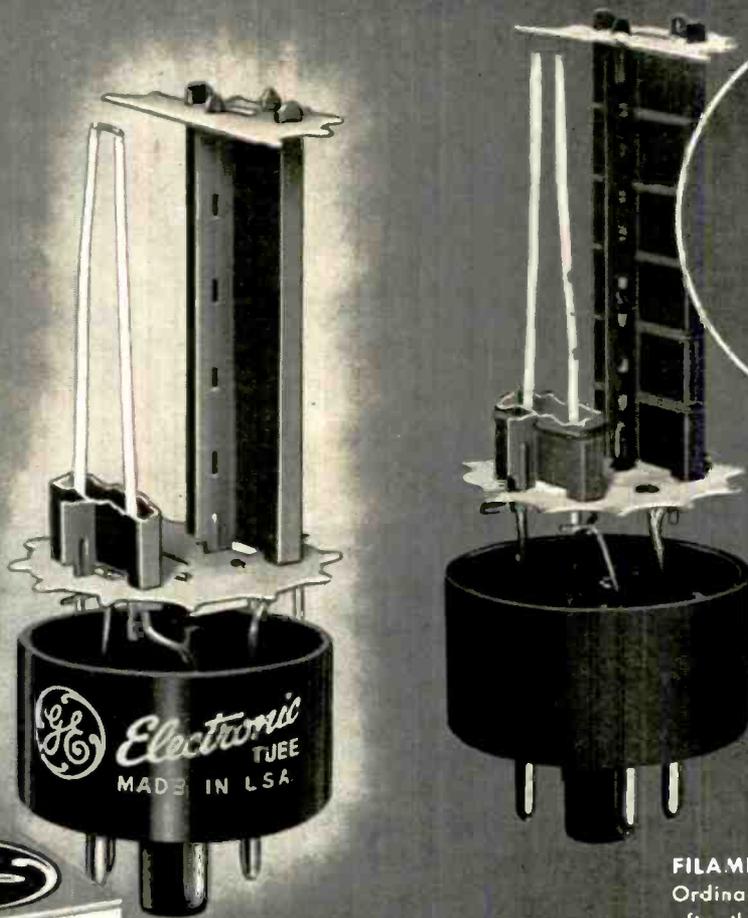
... Licensing frightens people, because they think it means an FCC examination. Many good service men couldn't pass it. Any part-timer can pass an FCC examination, if he took a correspondence course. What we need is a good "Fair Trade" law to regulate rates and charges. Such laws exist for freight rates, some retail items are "Fair Traded" in California. When an American can't start from scratch with his hands, brains and time and build himself up as far as he can go, we might as well let Russia take over.

James R. Ball

Ball's TV Service  
Port Arthur, Texas

... I thought I would add my two cents to the licensing debate now going on. I have been doing part time service work on radios and TVs for about 10 years, servicing radios before TV came in. TV was very limited here until about 5 years ago when Channel 22 in Ft. Smith came on the air. Since I was the only person here in town who had much radio experience, except for another part time radio man, I started repairing sets for the two dealers who were trying to sell them. This worked fine for about 6 months when they started to service their own sets. They had the audacity to tell their customers if they bought a set from them, they would not charge them any service fee

(Continued on page 18)



**CLOSE-UP** of pitted area. The filament is so badly damaged that it soon will break, or bend to meet the plate, shorting out the tube.

**FILAMENT INTACT.** General Electric 5U4-GB filament, after life test inside its unribbed plate at 35% above rated tube voltage, shows no destructive effects from "hot spots"

**FILAMENT BADLY PITTED.** Ordinary 5U4-GB filament, after the same life test inside its ribbed plate, shows minor or heavy damage that has occurred opposite each rib.

## Smooth Plates of G-E 5U4-GB Protect Filaments!

**Service-Designed Tube is free from "hot spots" that damage filaments of less dependable 5U4-GB's with ribbed plates!**

Install the rectifier tube with the smooth, unribbed plates—General Electric's Service-Designed 5U4-GB! No raised metal lips to collect contaminants! These build up into ridges which serve as sources of back emission, causing "hot spots" that melt and eventually destroy the filaments of ordinary tubes (see photographs above, right).

Dependable from the moment you install them, Service-Designed 5U4-GB's mean fewer callbacks and less chance of a rectifier-tube short-circuit, with risk of transformer burnout—a costly possibility in many modern TV sets. See your G-E tube distributor! *Distributor Sales, Electronic Components Division, General Electric Company, Owensboro, Ky.*

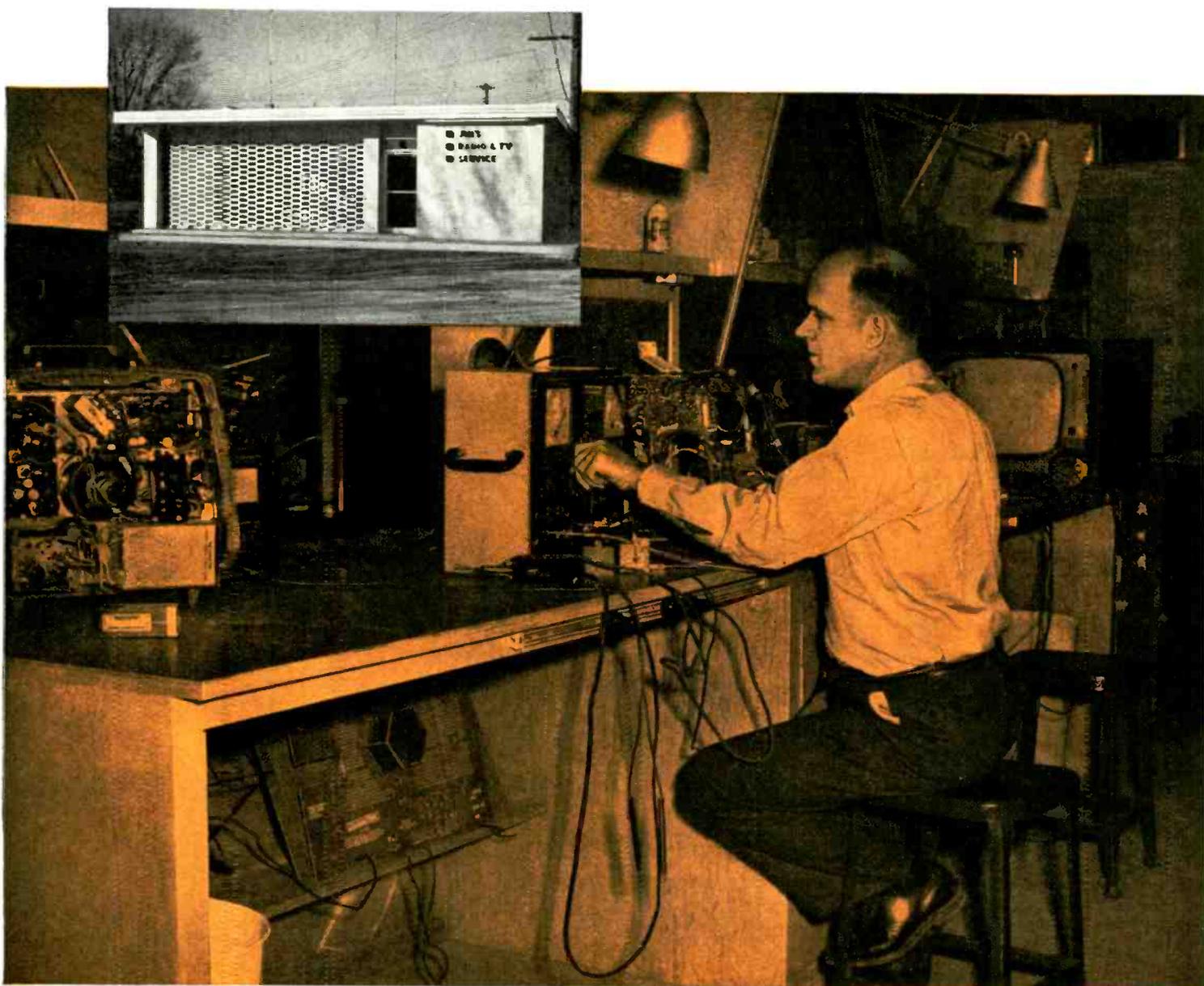
*Progress Is Our Most Important Product*

**GENERAL  ELECTRIC**

2-111-239

*TV Technician JIM CARPENTER says...*

# “Service Is Our Only Business... That’s Why We Use Mallory



Jim Carpenter started his own business—Jim’s Radio & TV Service—in Springdale, Arkansas. Over a period of ten years it has grown from a one-man operation to a firm that employs six full-time men. Recently Jim moved to the new building shown above.

Concentrating on dependable service gave

Jim a reputation which allowed business to grow quickly. Jim and his men handle radio and television service throughout their trade area.

Jim is a Major in the active Army Reserve. He carries a commercial card and is branching out into commercial mobile work.

# Quality Parts"

"When a shop concentrates on service, it can't afford to take chances with customer satisfaction. So we depend on Mallory components. They're always consistent in quality. And I always feel 'safe' about a job when I've used Mallory components . . . there's no worry about costly, time-consuming callbacks. Mallory has been giving me the same quality



and dependability since I started in business . . . quality and dependability that I've come to take for granted."

When it comes to controls, for instance, hundreds of technicians like Jim choose low-noise, long-lasting Mallory Sta-Loc\* controls. In just 30 seconds their distributor can give them the exact replacement they need . . . of any

of over 30,000 combinations. No need to wait days for out-of-stock controls. What's more, Sta-Loc design lets you replace the line switch by itself, without unsoldering control connections.

Whatever your service needs, Mallory provides the widest selection of quality components at sensible prices. And every Mallory component is service-engineered to assure long, trouble-free life.

\*Trademark



*Put an end to callbacks  
with these quality  
Mallory products...*



**Gems**—5 rugged, moistureproof, Mallory "Gem" tubular capacitors in an easy-to-use dispenser that keeps your stock fresh and clean—easy to find—no more kinks in lead wires. They're your best bet for outstanding service in buffer, by-pass or coupling applications.



**RMC Discaps**®—are a product of the world's largest producer of ceramic disc capacitors. Long the original equipment standard, Mallory RMC Discaps are now available for replacement. They come in a handy 3" x 5" file card package . . . easy to stock, simple to use.

© Registered Trademark of Radio Materials Company, a P. R. Mallory & Co. Inc. Division.



**FP Electrolytics**—The Mallory FP—the original 85°C capacitor—now has improved shock-resistant construction and leakproof seal. Its etched cathode construction—standard in all FP's—assures hum-free performance. High ripple current ratings fit the toughest filter circuits.



**Silicon Rectifiers**—New Mallory design gives far longer life, lower forward voltage drop and reverse leakage current than conventional types . . . exceeds the requirements of military humidity tests. In convenient kits for replacement of selenium rectifiers in radio and TV.



**TC Tubular Electrolytics**—provide the same high quality and performance characteristics that are found in all Mallory components. They are now available in the handy twin pack.

Now...from Sonotone—

# 4 Big Improvements

in the quality stereo cartridge



**Sonotone 8TA cartridge replaces 8T as industry standard**

The new Sonotone 8TA cartridge gives greater than ever stereo performance... has 4 big extras:

- fuller, smoother frequency response
- higher compliance than ever before
- lighter tracking pressure
- practically eliminates dust pile-up

**ONLY \$1450\***

**Sonotone 10T unitized stereo at lowest price ever**

New 10T cartridge sells at record low price of \$6.45.\* And it covers the complete high fidelity range. 10T's unitized construction makes it easiest to install, easiest to replace. Low price means more sales—more profits.



## SPECIFICATIONS

	8TA	10T
Frequency Response	Smooth 20 to 20,000 cycles. Flat to 15,000 with gradual rolloff beyond.	Flat from 20 to 15,000 cycles $\pm$ 2.5 db.
Channel Isolation	25 decibels	18 decibels
Compliance	$3.0 \times 10^{-6}$ cm/dyne	$1.5 \times 10^{-6}$ cm/dyne
Tracking Pressure	3-5 grams in professional arms 4-6 grams in changers	5-7 grams
Output Voltage	0.3 volt	0.5 volt
Cartridge Weight	7.5 grams	2.8 grams
Recommended Load	1-5 megohms	1-5 megohms
Stylus	Dual jewel tips, sapphire or diamond.	Dual jewel tips, sapphire or diamond.

\*including mounting brackets

Sonotone makes only 6 basic ceramic cartridge models... yet has sold over 9 million units... used in over 662 different phonograph models. For finest performance, replace worn needles with genuine Sonotone needles.

# Sonotone

CORP.

Electronic Applications Division, Dept. CT-129  
ELMSFORD, NEW YORK



Leading makers of fine ceramic cartridges, speakers, tape heads, microphones, electronic tubes.  
In Canada, contact Atlas Radio Corp., Ltd., Toronto

(Continued from page 14)

for repairing the sets when it was only a tube that was out. Of course, they couldn't repair anything else, and half the time even replace a defective tube, and called me to do it. When I would charge a service charge, the owners would get very angry and say that the people who sold the sets said there would be no service charge for service calls. At the present time, we have the one dealer here, one other man doing almost full time work, myself, a part time repairman and one dealer who is still replacing tubes, all working on TV's. I have all the work I can do in part time and would still like to get into it full time, but with the situation of small service charges still prevailing here, I hate to give up my full time job which pays \$2.32½ per hour 40 hours a week, to go into full time operation. I am in favor of licensing so that anyone who services televisions has to have a well equipped shop and know what he is doing before he can start repairing electronic equipment. This would raise the prices paid for service to a point where small town men who are qualified could go into full time work. I don't think that licensing will protect the customer too much. There are rotten apples in every box, but it would help. It isn't a cure-all, but I am one part time man who wishes that Arkansas had a licensing law 6 or 7 years ago, I would now be in full time.

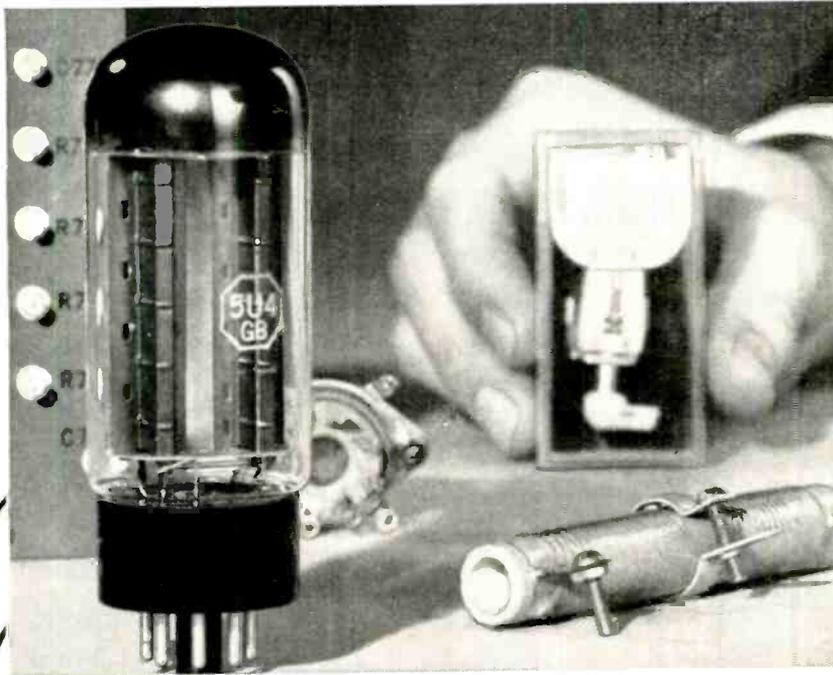
Don Lansche

Don Lansche Radio-TV  
Charleston, Arkansas

... Approximately 78 years ago, business began forming trade associations, the purpose being essentially the same as the TV service industry is doing. Businesses were on a comparatively small scale but when big business dawned, the inadequacy of these associations had to be realized. Free men can't be driven, regulations became urgently necessary. Licensing became necessary because of confusion, wasted energy, futile efforts and the restraint of trade laws. Efforts to maintain equity in competing businesses or to organize and operate on equal terms is unlawful, that it is illegal to do more than teach. These are some of the reasons why we have not had or cannot have universally accepted associations, regulations, etc., without licensing to provide teeth and a statute. Undeniable are the facts, associations have been necessary in our business economics and will continue. The consensus among associations from the beginning of radio servicing, in the middle '20's has been that some rules, regulations or code ethics, etc., were needed and could be set up by the service industry, that would enable them to legally handle the service business. This individual initiative, without licensing, has left the way open for failure and disaster.

Sam L. Winton, Jr.

Houston, Texas



*Now you can  
be sure he'll  
get his tuner  
sooner...*



## **IT'S THERE IN HOURS... AND COSTS YOU LESS!**

**24 HOUR SERVICE...7 DAYS A WEEK...  
HOLIDAYS TOO!**

Your packages go anywhere Greyhound goes... and Greyhound goes over a million miles a day! That means faster, more direct service to more areas, including many places not reached by other public transportation.

Packages get the same care as Greyhound passengers... riding on dependable Greyhound buses on their regular runs. And you can send C.O.D., Collect, Prepaid—or open a Charge Account.



Call your nearest Greyhound bus station or write to Greyhound, Dept. H12, 140 South Dearborn Street, Chicago 3, Illinois





*Helping you avoid  
complaints and call-backs —  
That's the job of BUSS Fuse Engineers. . .*

Essential to your building a profitable business is creating satisfied customers and avoiding service complaints.

Handling known, 'trouble-free' items helps you do this. In fuses, the brand you can handle with confidence is BUSS. To assure you of this, our engineers are:

(1) Testing in a sensitive electronic device every BUSS and FUSETRON Fuse made. Any fuse not properly calibrated and constructed and right

in all physical dimensions is automatically rejected.

(2) Maintaining a 44 year reputation for fuses that give maximum protection against damage due to electrical faults — and maximum protection against wasteful shutdowns caused by fuses blowing needlessly.

(3) Providing a complete line of BUSS and FUSETRON Fuses of all sizes and types . . . plus a companion line of fuse clips, blocks and holders to

meet all electrical protection problems.

It's easy to see that when you standardize on BUSS fuses — you are protected against faulty fuses causing you trouble, you are handling the brand of fuses your customers know and trust, — and you are simplifying your stock handling and record keeping problems by using one source for all your fuse needs.

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

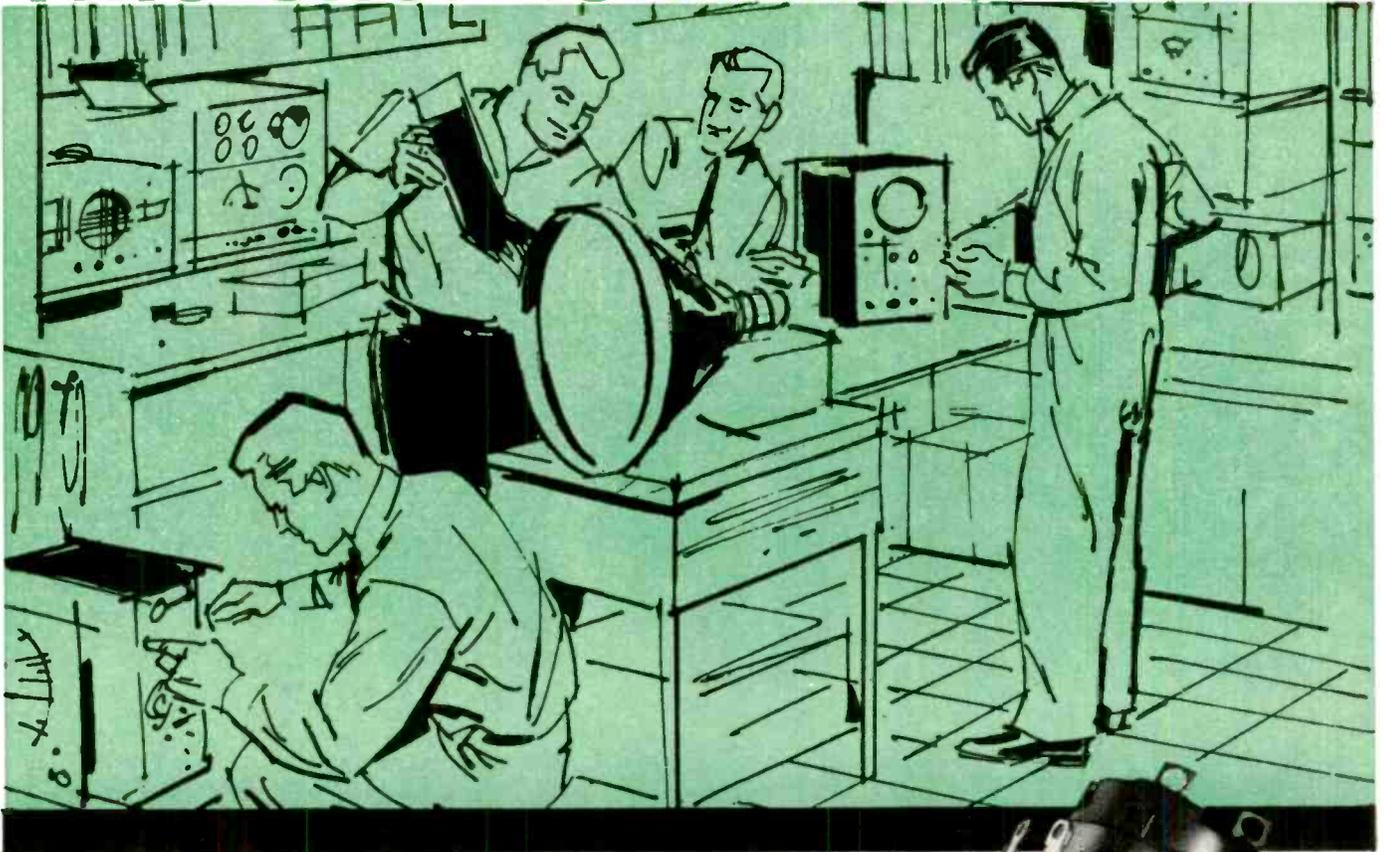
1259

*BUSS fuses are made to protect - not to blow, needlessly.*

*BUSS makes a complete line of fuses for home, farm, commercial, electronic, electrical, automotive and industrial use.*



# THIS SHOP IS MAKING MONEY



## with **CLAROSTAT** RTV controls

Radio and television repair shops in all parts of the country are increasing their profits with Clarostat RTV controls—the controls that are *right* for the job, *right* from the carton.

RTV controls are manufactured as matched replacements under rigid quality control standards at the factory. Clarostat offers the direct replacement for practically every radio and TV set control ever produced. RTV controls can save you many hours per man per week, raising your output and multiplying your profits.

**Always ask for CLAROSTAT!**



GET THE COMPLETE DETAILS ON RTV CONTROLS FROM YOUR DISTRIBUTOR

**CLAROSTAT MFG. CO., INC.**  
DOVER, NEW HAMPSHIRE

In Canada: CANADIAN MARCONI CO., LTD., Toronto 17, Ont.



# News of the Industry

**ADMIRAL CORP.** conducted color TV service schools in 72 cities during the past two months; in addition, the company's field engineers held dealer service clinics in 26 locations throughout the country.

**BECKMAN INSTRUMENTS** appoints **GEORGE S. GRAMLICH** to the Corporate Advertising Dept. to be responsible for coordinating operations of the company's corporate and division advertising operations.

**CENTRALAB** Distributor Sales Div. has been joined by **RONALD AMANN** as an account supervisor to provide increased technical service to distributor customers.

**RAYTHEON** Storage Tube Dept. has been transferred to the company's Industrial Tube Div. The new 60,000 sq. ft. building located in Westwood, Mass. is now in use by employees of the Distributor Products Div.

**SUPREME ELECTRONICS**, subsidiary of **HICKOK ELECTRICAL INSTRUMENT**, has broken ground for a 25,000 sq.ft. addition to their plant in Greenwood, Miss. Production space will be increased to 47,000 sq.ft.

**WELLER ELECTRIC** is currently promoting their tools for Christmas giving and will supply sales aids to help dealers tie-in with their advertising campaign.

**CHANNEL MASTER** will use network television, featuring four TV and motion picture stars, to spearhead their new national advertising campaign for T-W antennas. In addition, two national magazine campaigns will be launched.

**HUGHES AIRCRAFT** Semiconductor Div. has opened four new regional sales offices with the following regional mgrs.: **DANIEL J. LINHART**, Orlando, Fla.; **WILLIAM BALFOUR**, San Diego, Cal.; **JACK W. WOODRUFF**, Englewood, Col.; and **EDWARD A. HUNTER**, Silver Spring, Md.

**HOFFMAN ELECTRONICS** Semiconductor Div. announced plans to develop and market a line of silicon transistors. **WOLFGANG G. PRENOSIL** was appointed to the new post of Director, Transistor Marketing. The Consumer Products Div. has appointed **CARROLL R. MINER** Chief Engineer.

**MOTOROLA** Semiconductor Products Div. has named **DONALD G. PATERSON**, **G. EDWARD PAVLIK** and **H. BRUCE WEST** to positions as Product Marketers. Price reductions ranging from more than one-third up to 50% on the company's complete line of 25-amp high current switching power transistors have been announced.

**DORCA (DOOR OPERATOR & REMOTE CONTROL ASSOC.)** has been formed to aim for better industry standards, according to **GEORGE GEMBERLING**, spokesman for the group. Membership is restricted to prime manufacturers of garage door operators and/or operator remote controls. Headquarters of the new trade group are at 110 N. Wacker Dr., Chicago, Ill. Elected officers are: Pres., **HOWARD A. NUSBAUM**; Vice Pres., **CHARLES G. ENGELHARDT**; Exec. Secy. & Treas., **GEORGE M. SCHLOSSER**; Asst. Secy. & Treas., **ROBERT D. BARNES**.

**GENERAL ELECTRIC** Receiving Tube Dept. opened nominations for the 1959 Edison Radio Amateur Award, given to the amateur radio operator who performs the most outstanding public service during the year. Deadline for nominations is Jan. 4, 1960 and they may include persons in Alaska and Hawaii. Nominations may be submitted by anyone familiar with a public service performed by a licensed U.S. radio amateur and should be addressed to the secretary of the Edison Radio Amateur Award committee, General Electric Co., Owensboro, Ky. A "Guide to Preparing Nominations" is available from that committee.

(Continued on page 24)

## Transistor Radio Servicing CAN be Highly Profitable



The ONLY Complete Transistor Radio Service Lab  
Everything you need for less than \$50

### Check Transistors, Diodes, Rectifiers . . .

#### SENCORE TRC4 TRANSISTOR CHECKER

Accurately checks all transistors in hearing aids, radios and power transistors in auto radios. Tests for opens, shorts, leakage, current gain. Measures forward-reverse current ratio on all crystal diodes. Measures forward and reverse currents on selenium rectifiers. With set-up chart for accurate checking of each transistor. Size, 5x4 1/2 x 2 1/2". With batteries. DEALER NET..... 17<sup>95</sup>



### Replace Batteries During Repair . . .

#### SENCORE PS103 BATTERY ELIMINATOR

All-new "Transi-Pak," twin to TRC4 Checker above. Provides variable DC voltage to 24 volts; 1.5-volt biasing tap (a "must" for servicing Philco and Sylvania radios). Metered current output, to 100 ma. Handles 200-ma peaks. Two 200-mfd electrolytics provide proper filtering and low output impedance. No hum or feedback problems. Ideal for alignment using station signal; adjust IF slugs for max. current, also ideal for charging nickel-cadmium batteries. Size, 5x4 1/2 x 2 1/2". DEALER NET..... 17<sup>95</sup>



### Find Defective Stage in a Minute . . .

#### SENCORE HG104 HARMONIC GENERATOR

New signal generator designed primarily for fast signal-tracing of transistor radio circuits. No need to unsolder all transistors. Provides RF, IF and audio signals *simultaneously*, drastically cutting service time. Traces from speaker to antenna. Clear 1000 cycle note signal is heard in speaker from all good stages. Signal weakens or stops at defective stage. Equally as effective for testing TV, hi-fi and other audio circuits also. Size, 3 1/2 x 4 1/2 x 1 3/4". With batteries. DEALER NET..... 9<sup>95</sup>



Turn page for other



See your Parts Distributor NOW!

# SENCORE

ADDISON 2, ILLINOIS

**Hold that line  
against callbacks**



Just one callback throws your profits for a loss on the next three service calls. But you can tackle any service job and make big gains in profit territory, when you back your line with Tung-Sol Blue Chip quality. Made to industry's top standards, Tung-Sol tubes are best for every replacement — radio, tv or hi-fi. Tung-Sol Electric Inc., Newark 4, N. J.

*Tell your jobber you'd rather have*

**ts TUNG-SOL<sup>®</sup>**

*Blue Chip Quality*

**TUBES • TRANSISTORS • DIODES**

(Continued from page 22)

**HEWLETT-PACKARD's** board of directors has elected **ERNEST C. ARBUCKLE** to the board.

**ROHN MFG.** general offices, Peoria, Ill., remain at the main manufacturing plant but have moved to a new and modernized location therein to provide greater office space.

**INTERNATIONAL RECTIFIER** appointed **RONALD HENDERSON** as Mgr. of the Market Research Dept., and **JAMES HUTCHISON** was named as Asst. Sales Mgr., Distributor Div.

**THE INDUSTRIAL TEST EQUIPMENT CO.** appointed **THE JAY COMPANY** to represent its Phazor and Iteco product lines of electronic test equipment.

**STROMBERG-CARLSON** has begun full-scale production of custom auto radios for 1960 cars, featuring 35 different models in both manual and push-button.

**TEXAS INSTRUMENTS** will deny any charges that it has infringed Woodyard Patent No. 2,530,110 in an answer to be filed in the U.S. District Court for the Northern Dist. of Tex. to a suit brought by the **SPERRY RAND CORP.**

**SPECTROL ELECTRONIC CORP.** reports that **STACK INDUSTRIAL ELECTRONICS, INC.** has been appointed distributor for the E. N.Y. state area.

**ALLEN B. DU MONT LABS.** has purchased the two-way mobile radio business of **AVIA PRODUCTS CO.**, Los Angeles, Calif.

**DELCO RADIO DIV.** announced plans for the construction of a 125,000 sq.ft. engineering building in Kokomo, Ind.

**THOMAS ELECTRONICS** appointed **JESS E. DINES** to the new position of Sales Mgr., Industrial & Military Tube Div.

**BENDIX AVIATION CORP.** Industrial Controls Section has named **GLEN O. CORBETT** as Southwestern Field Service Mgr.

**GLOBE-UNION** reports the appointment of **WILLIAM T. WARRENDER** to Vice Pres. in charge of administration for the Battery Div.

**INSTRUMENT DEVELOPMENT LABS.** announces the appointment of **EDWARD T. CONNOR** as Mgr. of New Product Planning.

**LORAL ELECTRONICS** has opened West Coast sales and engineering headquarters at 12791 Newport Ave., Tustin, Calif.

**CONLEY ELECTRONICS CORP.** is a new corporation organized for the development and merchandising of electronic products for the consumer, industrial and military markets with the following three divisions: **WATERS CONLEY CO., INC.**, Rochester, Minn.; **FIDELIVOX DIV.**, Skokie, Ill.; and **FIDELIPAC DIV.**, Toledo, O.

**RADIO CORP.** has appointed **MORT GAFFIN** as Mgr., Special Advertising & Sales Promotion Programs. **RCA SERVICE CO.** has realigned their operations into two major depts., Commercial Services and Government Services, with the following appointments: **G. W. PFISTER**, Vice Pres., Commercial Services; **A. L. CONRAD**, reappointed Vice Pres., Government Services; **JESSE LIPPINCOTT, JR.**, Mgr., Personnel for the company. Operating under Commercial Services will be a new department, the Electronic Data Processing Services, established to handle installation and servicing of RCA's new "501" electronic data processing equipment. Administrative posts in the new department are as follows: **JOSEPH E. STEOGER**, Mgr., Field Operations; **BRADFORD K. GESNER**, Mgr., Administrations; **JOHN J. LAWLER**, Mgr., Engineering; **BRUCE AARONT**, Mgr., Field Support Engineering; **A. LEE CHRISTEN**, Field Mgr., EDP Services.

(Continued on page 26)

**Servicemen! SAVE TIME...SUBSTITUTE THE SENCORE WAY**  
**The Fastest, Surest Method Known!**

**Substitute for Capacitors, Resistors**  
**SENCORE H-36—THE "HANDY 36"**  
 36 most-often-needed resistors and capacitors, for fast, easy, direct substitution in all circuits. • Eliminates searching for replacement components for test purposes. • Avoids unnecessary unsoldering and soldering—no more solder mess. • Pays for itself the first month in time saved. • Flick of a switch instantly selects any one of...  
 24 RESISTORS from 10 ohms to 5.6 megohms  
 10 CAPACITORS from 100 mmfd to .5 mfd  
 2 ELECTROLYTICS, 10 mfd and 40 mfd  
 DEALER NET..... **1275**

**Substitute for Electrolytic Capacitors**  
**SENCORE ES102 ELECTRO-SUB**  
 Usable from 2 to 450 volts, D.C.  
 Contains 10 electrolytics from 4 to 350 mfd. Select the correct value with the flick of a switch. Features automatic discharge, surge protector circuit. Prevents accidental "healing" of capacitor being bridged. Completely safe—no arc or spark when connecting or disconnecting. DEALER NET..... **1595**

**Substitute for Fuse Resistors During Repair**  
**SENCORE FS3 "FUSE-SAFE" CIRCUIT TESTER**  
 Instantly tells you whether or not it is safe to replace fuse resistors, fuses, or circuit breakers. Separate red and green scale for each commercially available fuse resistor used in radio and TV. Eliminates guesswork and wasted time. Also handy for wattage checks up to 1100 watts. DEALER NET..... **895**

**Substitute for Bias Batteries During Repair**  
**SENCORE BE3 "ALIGN-O-PAK"**  
 Completely isolated DC supply, with less than 0.1% ripple. Eliminates messy batteries in TV service work. Handy for alignment, AGC trouble-shooting, or checking gated sync circuits. Just dial the voltage you need, 0-18 volts, positive or negative. Covers all voltages recommended by TV set manufacturers. Size, 3½x4½x1¼". For 110-120 volts, 60 cycle AC. DEALER NET..... **785**

**UNIVERSAL TV JUMPER CORD**  
 Fits any set from back to chassis. Box has male and female plugs for additional power source, soldering, etc. DEALER NET **195**

Turn page for other  
**SENCORE**  
 Time Savers

See your Parts Distributor Now!  
**SENCORE**  
 ADDISON 2, ILLINOIS

## Reps & Distributors

**EICO** has named **J. K. ROSE & CO.** as sales rep in Ill. and Wis.

**WARD PRODUCTS CO.** has appointed **MARTY BETTAN SALES** as sales rep.

**PYRAMID ELECTRIC** announced the appointment of **KEN STEINKE SALES** as rep for their line of capacitors and silicon rectifiers in Wis.

**ADMIRAL** has appointed **DEALER APPLIANCES, INC.** as distributor to handle sales and servicing of all the company's products in the Va. territory.

**ENTRON** reports the appointment of **NELSON E. THOMAS & ASSOC.** as Southern rep for the company, to handle the new Master Television Antenna System equipment.

**CHEMTRONICS** has added the Southeast rep firm of **STANLEY K. WALLACE**, covering the territory of Ala., Fla., Ga., Miss., N. & S. Carolina and Tenn.

**TRIAD TRANSFORMER** reports the appointment of **BOB NELSON**, Mt. Vernon, N.Y. as rep for the upper N.Y. State area, to handle sales of OEM or manufacturers type items.

**CLEAR BEAM** announces the appointment of the following two rep firms: **ROBERT W. PETERS CO.**, O., W.Va., and Eastern Pa.; and **FELLEISEN ASSOC.**, Ill., Wis., Minn., N. Dak. and S. Dak.

**SOLA ELECTRIC** has appointed **MC DOWELL-REDLINGSHAFFER SALES CO.** to handle their complete line of constant voltage transformers and regulated dc power supplies in Mo., Kan., Ia., Neb., and Quincy, Ill.

**ELECTRONIC REPS. ASSOC.** First National Convention will be held Feb. 11-13 in the Drake Hotel, Chicago, Ill. It will also mark the 25th anniversary of the founding of ERA. A 16-pg. brochure entitled "The Electronics Market and the Manufacturers Representative" has been printed and is available without charge to interested manufacturers. The consulting firm of **JOHNSON & HIGGINS** was awarded the responsibility for design of a Retirement Income Plan for ERA member firms. The Executive Committee proposed the establishment of a joint Manufacturer-Representative Council to study problem areas in manufacturer-rep relationships and make recommendations toward solutions. This proposal was an outcome of the workshop on Communications held during the NEC Show.

**HOFFMAN** appointed **PAT FLANIGAN SERVICE & SUPPLY CO.** as Indiana distributor of consumer products.

**SPERRY PRODUCTS** named the rep firm of **INDUSTRIAL X-RAY ENGINEERS** to handle the fully ultrasonic line in the Pacific Northwest, including Ore., Wash., Ida., and W. Mont.

**SIMPSON ELECTRIC** held a four-day conference for their sales rep principals in Sept. at Lac du Flambeau, Wis. Honored at the meeting were **RAY SIMPSON**, founder of the company, and **JOHN FORSHAY**, a Simpson factory rep for over 20 years.

**U. S. TRANSISTOR** has announced appointment of sales reps in a number of U.S. cities as follows: **WILLIAM B. SEATON ASSOC.**, N.Y.C.; **FRED WAMBLE SALES CO.**, Montgomery, Ala.; **BURT ANDERSON & ASSOC.**, Chicago, Ill.; **J. W. MARSH CO.**, Los Angeles, Calif.; **FREDERICK L. OHMER**, Dayton, O.; **C. E. SNOW CO.**, Philadelphia, Pa.; **CIROLIA LEBLANC SALES CORP.**, Waltham, Mass.; **WALTER J. BRAUER & ASSOC.**, Cleveland, O.; **JOHN W. RICHARDT CO.**, Pine Brook, N.J.; **F. C. SOMERS & CO.**, Kansas City, Mo.; **HARRY ESTERSON**, Philadelphia, Pa.; and **OLIVER C. WOLF**, Onendaga, N.Y.



**IT WIFES IN!** To directly replace axial lead types.

**IT CLIPS IN!** Ten-second conversion permits plug-in to existing clip-type sockets. Kit contains all parts.

**IT STAYS IN!** Because it's hermetically sealed, operates to 100°C, and supplies full-rated power under normal convection cooling with no heat sink.

**IT CASHES IN!** Because it's fast to install, reduces rectifier stock, cuts call-backs, costs no more.

# INTERNATIONAL RECTIFIER

**SD-500 KIT** — The silicon radio-TV rectifier kit that replaces a drawerful!

**INTERNATIONAL RECTIFIER CORPORATION**

Distributor Sales Division: El Segundo, Calif.



(Continued from page 24)

# Check TUBES, VIBRATORS THE SENCORE WAY



**America's Most Popular Tube Tester**  
more than 25,000 now in use

## SENCORE LC3 LEAKAGE CHECKER

Whips those "tough dog" tube troubles . . .

Ask any serviceman who owns one . . . or try one for just one day of servicing in your shop. You'll see for yourself how much time the LC3 can save you. Checks for leakage between all elements, whether caused by gas, grid emission or foreign particles. Also checks leakage on all capacitors with voltage applied—including electrolytics. Provides instant filament checks in "Fil-Check" position—no need for a second filament checker. One spare pre-heating socket and new roll chart prevent obsolescence. New charts provided—no charge. Leakage sensitivity; 100 megohms, control grid to all other elements; 50,000 ohms, heater to cathode. Size, 7x6x3½". Wt., 3 lbs. For 110-120 volts, 60 cycle AC. DEALER NET **28<sup>95</sup>**



**NOW . . . checks 172 tube types—more than any other checker of this type.**

**NEW . . . replaceable Roll Chart prevents obsolescence.**

**Check Filaments of All Receiving Tubes and Picture Tubes**



## FC4 FILAMENT CHECKER

For fast, easy checking of all tube filaments, without pulling chassis. Neon light goes out if tube filament is good. Also acts as continuity and voltage tester. Neon lamp glows when 115 v. AC is applied by cheater cord, providing a check on power to TV set. Size, 3½x4x1". **295** With leads. DEALER NET.....

**Check 3- and 4-Prong Vibrators . . . Faster, Easier**



## VB2 "VIBRA-DAPTOR"

Plugs into any tube checker; ideal for use with LC3 above. To check 6-v. vibrators, set for 6AX4 or 6SN7; for 12-v. vibrators, set for 12AX4 or 12SN7. Two No. 51 lamps indicate whether vibrator needs replacing. Instructions on front panel. Steel case. Size, 1½x1½x3". **275** DEALER NET.....

See your Parts Distributor NOW!

Turn page for other



# SENCORE

ADDISON 2, ILLINOIS

It's Easy to Install This

## CITIZENS BAND 27 MC ANTENNA

DESIGN permits rapid mounting similar to that used for TV antennas—on 1½" mastings, tubing, chimney mounts, sidewall brackets, etc.

PROVEN PERFORMANCE: Full half-wave coaxial type widely used in communications. Maximum performance by resonating to operating frequency. Eliminates uncertainty of flexible wire ground plane systems. And requires no loading coils!

FINEST CONSTRUCTION: All aluminum seamless tubing, with weather-proof UHF coaxial connector. Aluminum casting main support. Weighs only 2 lbs., 14 oz. Overall height a full 17' 6".

**MODEL CO-27 ★ PRICE ONLY \$14.95**

Free literature from  
**HI-PAR PRODUCTS CO.**  
FITCHBURG, MASS.



VOCALINE reports the appointment of DONALD G. FERTMAN as Sales Coordinator.

PACKARD BELL COMPUTER CORP. has appointed THEODORE J. SMITH as Sales Mgr.

TELEMETER MAGNETICS has named R. DAVID MINER as Sales Mgr. of the Components Div.

TRU-OHM announces that the firm has employed the services of TOM WRIGHT as Chief Engineer.

P. R. MALLORY Distributor Div. broke ground for a 12,000 sq.ft. addition to the warehouse in Indianapolis, Ind.

PYRAMID ELECTRIC reports the appointment of RAY LANE to the position of Dir. of Research & Engineering.

TACO is now equipped with an antenna test range extending more than 3000' between receiver and transmitter location.

INTERNATIONAL RESISTANCE Distributor Div. reports the appointment of REED WALDRON to Sales Promotion Mgr.

TECHNOLOGY INSTRUMENT announces the following two appointments: IVAN DORNBUSH, Gen. Mgr. and A. C. TRIBE, Gen. Sales Mgr.

PHILCO announced the appointment of WILLIAM BALDERSTON, JR. to the newly created post of asst. to ROBERT J. THEIS, merchandise mgr.-TV.

RAYTHEON's Industrial Market Master Program consolidates into one continuing program all the elements required by a distributor's salesman to sell electronic components to industrial markets. JOHN A. HICKEY, industrial products manager, states this is the first such educational undertaking by an electronic components manufacturer to aid distributor salesmen in correlating all available technical and sales information into a non-technical format.

TRIAD TRANSFORMER CORP. is breaking ground in Venice, Calif. for a 4,000 sq. ft. building to house its growing jobber sales offices.

SENCORE awarded serviceman HARRY TOROSSIAN, Dearborn, Mich., a complete Sencore Transistor Radio Service Lab as purchaser of the one millionth unit produced by the company.

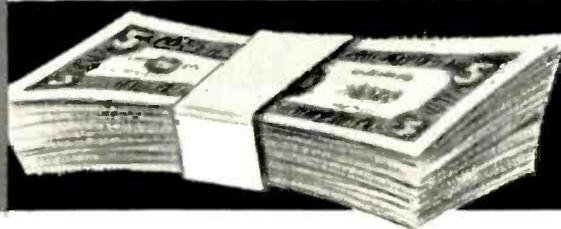
JERROLD ELECTRONICS has entered into an agreement with INTERNATIONAL TELEMETER CO., a div. of PARAMOUNT PICTURES CORP., relating to the manufacture of distribution equipment and installation of distribution systems for Telemeter closed-circuit pay-as-you-see TV. Arrangements have also been made for continued joint engineering development in the field.

**now...**

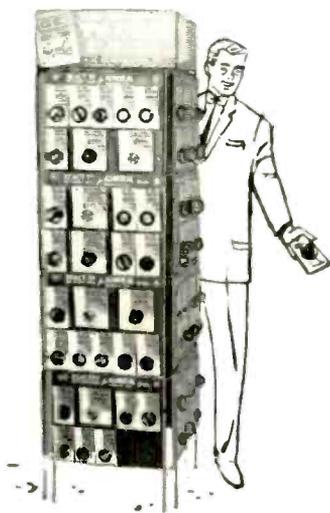
**make your customers happy**



**...make more money!**



# with NEW G-C EXACT TV REPLACEMENT KNOBS



- 97 KNOBS TO CHOOSE FROM
- COVERS ALL 8 POPULAR TV MAKES
- REPLACEMENTS FOR ON-OFF, VOLUME, FINE TUNING, CHANNEL SELECTOR
- MODERN SKIN-PACK—PRICE-MARKED FOR YOUR TRADE

Whenever you run across a broken or missing knob on your TV service calls, you can supply an exact replacement that makes your customer happy, gives you extra money on that call. Your nearby G-C jobber is now showing the complete G-C TV Knob line . . . with each knob skin-packed, clearly identified, and marked with list price for the set owner's information. It's another great service for you from G-C and your G-C jobber.

WRITE today for your free G-C Catalog . . . other literature too.



## G-C ELECTRONICS CO.

Division of Textron Inc.

West Plant: Los Angeles 18, California

Main Plant: ROCKFORD, ILLINOIS, U. S. A.

# Audio NEWS LETTER

HARTLEY announces the Holton Junior speaker system @ \$205 in lacquer. It contains the 220 speaker and a 30" x 15" x 12" enclosure. Also, the opening of an L.A. branch office with Piers H. Powell as Western Sales Vice-Pres.

ELECTRO-VOICE appoints Don Kirkendall asst. manager of advertising.

HEATH announces the US-3 utility speaker rated at 15 watts. It is a coaxial type with 12" woofer and 3" tweeter.

SARKES TARZIAN names Tom Brown, ex-Oxford Electric VP, as Sales Manager for its newly formed Magnetic Tape Div. Production should start shortly.

HARMAN-KARDON appoints Leon Kuby sales manager of the new Citation Kit div.

SONOTONE appoints Ray Ripley, Minneapolis, as OEM and distributor rep.

JENSEN INDUSTRIES publishes 16-page cartridge catalog and stock record.

OXFORD COMPONENTS names Carl L. Sundberg as distributor sales manager.

ROBINS INDUSTRIES publishes a 4-page consumer catalog listing over 150 accessories.

DYNACO introduces the Stereodyne II cartridge made by Bang and Olufsen of Denmark. It features 4-coil structure with moving iron member.

AUDIO DEVICES new "High Spirits" promotional tape is available in three recordings: 2-track stereo, 4-track stereo and dual-track mono. All are at 7-1/2 ips.

CHEMTRONICS new tape recorder cleaner is said to effectively clean tape heads, pressure rollers and capstans without staining or marring plastic parts. Two oz. bottle is \$1.49.

CBS announces a "breathing" Rochelle salt crystal cartridge for its CBS-Ronette line. Moisture cannot be trapped, so no impregnation is said to be needed.

NEW YORK HIGH FIDELITY MUSIC SHOW attendance this year was 46,000, a drop of some 6000 from the 1958 high, despite a strong promotion program boosting the show. Maybe the rain and humidity was the trouble. Or the World Series. Or perhaps the Trade Show Building is no longer suitable. Or any of a dozen second-guessed reasons. Though satisfaction with the serious interest of attendees is reported, some exhibitors are displeased with the turnout.



The missing link in TV service ...

## SENCORE SS105 SWEEP CIRCUIT TROUBLE SHOOTER

**IT'S A ... UNIVERSAL HORIZONTAL OSCILLATOR.** For direct substitution. No wires to disconnect in most cases. Traces trouble right down to the defective component. Variable output from 0-200 volts, peak-to-peak.

**HORIZONTAL OUTPUT CATHODE CURRENT CHECKER.** A proven method that quickly checks the condition of the horizontal output tube and associated components. Adaptor socket prevents breaking wires. Easily replaceable Roll Chart gives all necessary pin, current and voltage data.

**UNIVERSAL DEFLECTION YOKE.** A new, simple way to determine yoke failure accurately—without removing yoke from picture tube. Merely disconnect one yoke lead and substitute. If high voltage (also bright vertical line) is restored, TV yoke is defective.

**DYNAMIC FLYBACK TRANSFORMER CHECKER.** Merely flip switch to "Flyback Check" and meter will indicate condition of flyback transformer, in degrees of horizontal deflection. Extremely sensitive and accurate; even shows up one shorted turn on flyback.

**VOLTMETER.** For testing bootstrap, screen and other voltages. Direct-reading voltmeter, 0-1000 volts.

**UNIVERSAL VERTICAL OSCILLATOR.** Checks oscillator, output transformer and yoke. Merely touch lead to component and check picture on screen.

Size, 7x6x3 1/2". Wt. 4 lbs.  
For 110-120 volts, 60 cycle AC.

DEALER NET 39<sup>50</sup>



HORIZ. OSC.	VERT. OSC.
HORIZ. OP. STAGE	VERT. OP. STAGE
HORIZ. FLYBACK XFORMER	VERT. OP. XFORMER
HORIZ. DEFLEC. YOKE	VERT. DEFLEC. YOKE

See Your Parts Distributor NOW!

# SENCORE

ADDISON 2, ILLINOIS

PRECISION ELECTRONICS appoints Herb Solmsen as Grommes sales rep for Northern California and Reno, Nevada.

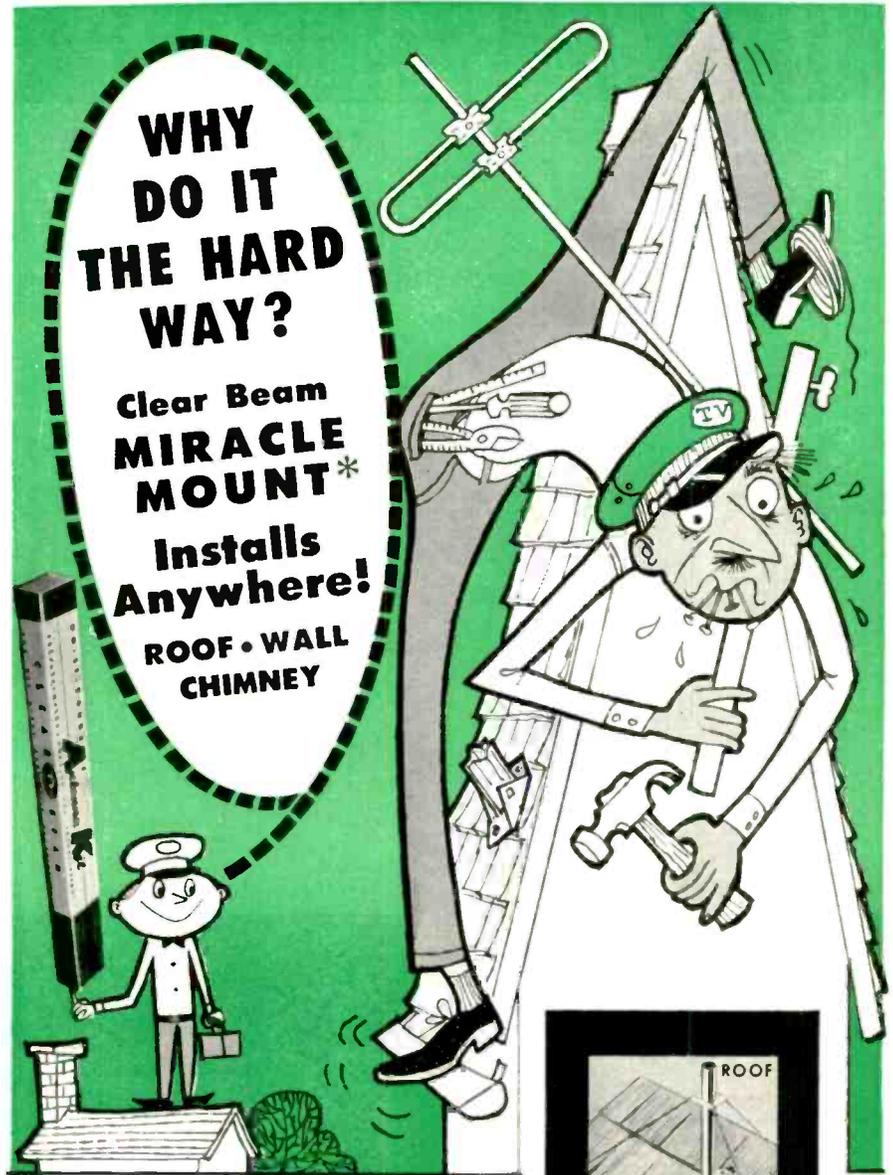
LAFAYETTE introduces the KT-236 stereo amplifier kit @ \$52.50. Ratings are 18 watts/channel, 15-30,000 cps  $\pm$  1 db, 0.3% IM at normal listening level.

AMPEX introduces the Model 403 stereo audio control unit @ \$159.50. Features pushbutton function and selector controls, frequency response 20-20,000 cps  $\pm$  2 db, cathode followers.

ALLIED RADIO releases the Knight 520 stereo amplifier, 10 watts/channel, 40-15,000 cps, distortion 1.5%, hum & noise -52 db. Price is \$62.50. Also the Knight 500 stereo magnetic cartridge @ \$16.85. The 4-coil moving magnet design has compliance rating of 4.

H. H. SCOTT publishes "How To Use Stereo Components In Your Decorating Plans" booklet. Includes room plans, decorating ideas and suggested furniture conversions to accommodate components. Also announced is the improved FM tuner 310C, with IHFM sensitivity of 2  $\mu$ v. Unit incorporates new knob and dial assembly.

TELEVISION DIGEST reports discordant sounds from the package stereo market. Of 8 manufacturers interviewed, sales for 4 were lagging far behind pre-season estimates, 2 were hewing to schedule, 2 were ahead. Of 4.1 million phonos sold last year at \$402 million retail, 3.4 million were priced \$75 and up for a total of \$334 million. Expected sales for 1959 are 4.8 million units at \$500 million retail, including 3.1 million \$75-up units at \$350 million. Trends indicate near-extinction of 2-piece stereo units. Confusion in dealer and consumer minds is attributed to the introduction of 3-channel sets. Buyers appear to be waiting for a 4th channel, or even a 5th.



**\* MIRACLE MOUNT COMPLETE ANTENNA KITS**

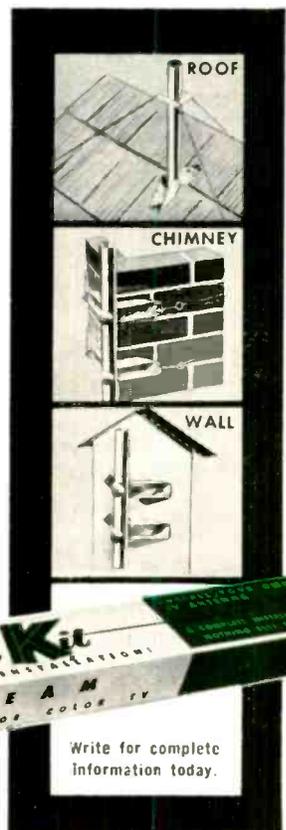
Clear Beam new Miracle Mount Antenna Kits install anywhere, allow you to pick the best, fastest and easiest to reach installation site on any home.

**MOUNTS ON ROOF, WALL OR CHIMNEY**

Everything you need for all types of installations in one complete low cost antenna kit which mounts anywhere . . . roof, wall or chimney.

**LESS STOCK, MORE PROFIT**

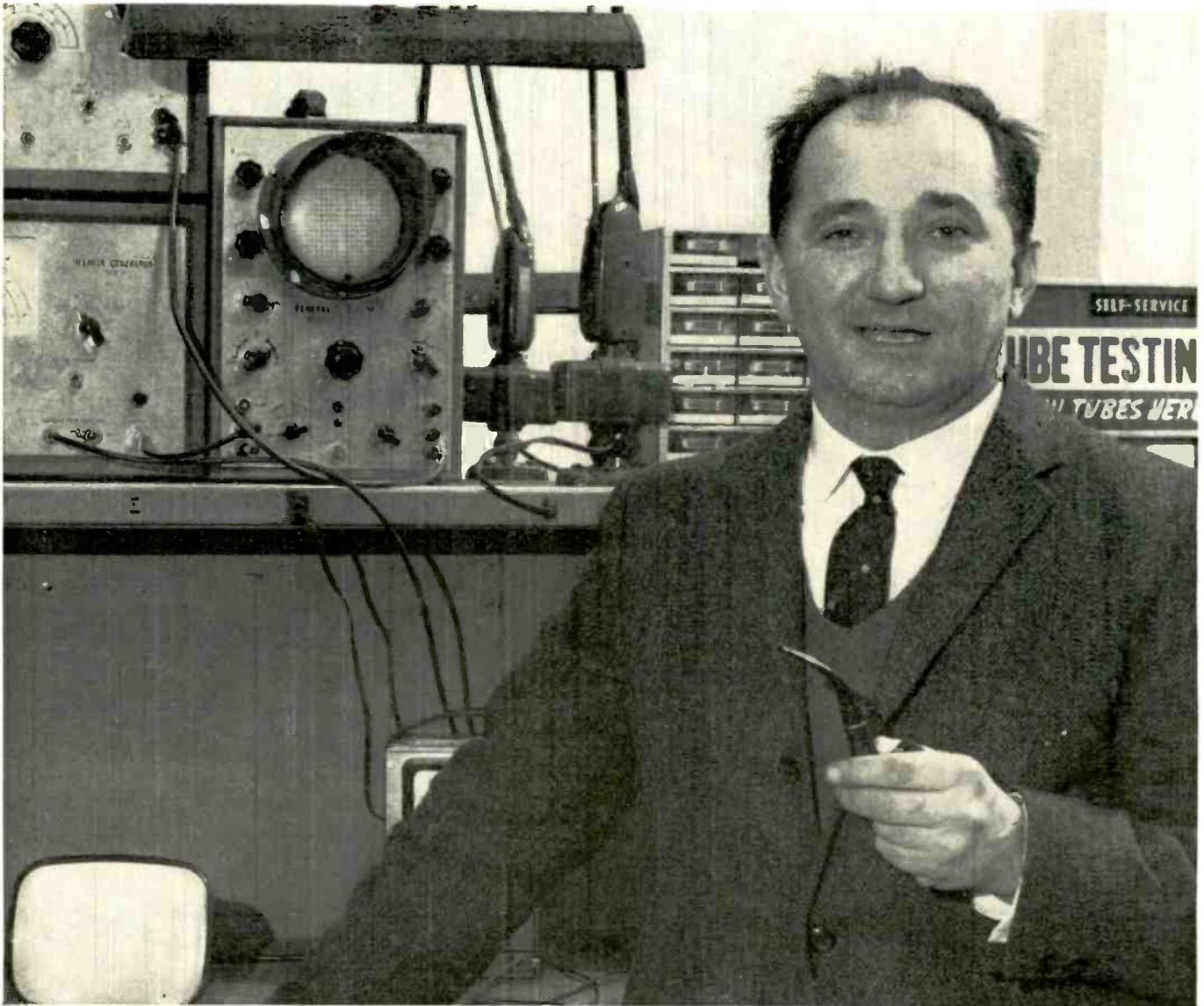
Carry Clear Beam Miracle Mount Antenna Kits with you on all service calls and be ready for any type of installation job. Install as service or sell outright to Do-It-Yourselfers. You stock less, sell more with customer approved Clear Beam Kits.



Write for complete information today.



**CLEAR BEAM ANTENNA CORPORATION**  
21341 Roscoe Boulevard • Canoga Park, California



# “YOU’LL RARELY SEE a General Electric ‘Designer’ in the shop,”

says Richard Vician, West Branch Manager of Television Engineers Inc. and Certified Television Service Inc., Chicago, Ill.

“Our men seldom have to pull the chassis of a General Electric ‘Designer’. They can do 9 out of 10 repairs in the home, because most key check points are easy to get at when you take the back off.”

Mr. Vician and Glenn W. Geist, President of the firm—Television Engineers Inc. and Certified Television Service Inc.—agree this makes money.

As Dick Vician puts it: “The easy availability lets us get more service calls done in a working day . . . more calls per man and more profitable operation. It means happy customers, too, because their bills are easier to take and sets stay in service.”

You can leave the “Designer” chassis in the set and still get at *both sides* of the printed boards. All tubes are easily replaceable. Fuses are accessible and you can get at key check points.

**Precision Etched Circuitry** is the name General Electric gives to its reliable, uniform circuitry. Each board has a *painted* schematic so that you can find your way through it easily. Service one and you’ll be thoroughly familiar with it.

“Designer” TV—the easiest-to-service sets in television! General Electric Company, Television Receiver Department, Syracuse, N. Y.



**GENERAL  ELECTRIC**

# ELECTRONIC TECHNICIAN

Now Including  
**SERVICE**  
Magazine

## *Difference of Opinion*

*"It is difference of opinion that makes horse races."*—Samuel Langhorne Clemens (Mark Twain)

In a democratic society, differing viewpoints are to be expected. They are in fact a healthy sign, an indication of vitality and freedom.

Difference of opinion, however, can become untenable when both sides are adamant, absolutely refusing to reconcile one's attitude with an opposing one.

A good example of the damage which can result was illustrated by the recent steel strike. Regardless of whether you put the blame on labor or management—or perhaps more deservedly, on both—workers and companies alike have suffered. Even more important, the public and economy generally have been injured. Factories not involved in the dispute have been forced to lay off many thousands of employees.

The electronic maintenance industry has its plentiful share of differing opinions, both within and without. Internally, the conflict over legislation to license TV service technicians continues. In time this will no doubt be resolved. Since it is a local matter, many communities and states will probably end up with licensing; others will not.

The ever-present bickering between associations is one of the more regrettable aspects of differing opinions. Our entire industry has suffered from its inability to speak with a unified voice.

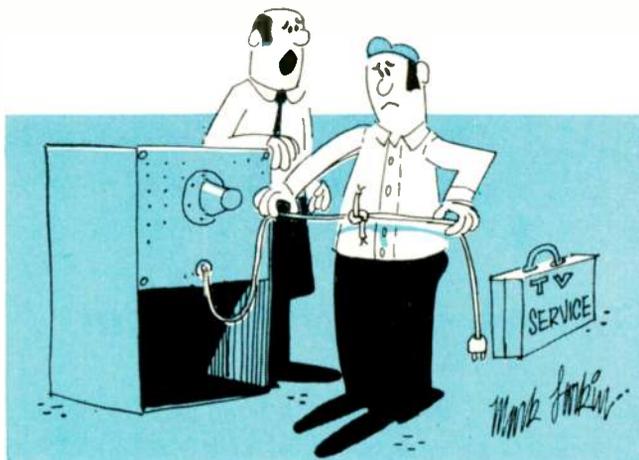
Externally, technicians will always view many things different than manufacturers. We are pleased to see increasingly better understanding and improved set serviceability. There is much still to be accomplished, however.

Let us hope that some of the warm feelings and good fellowship of the Christmas holiday will carry over to the coming year to help differences to be resolved amicably.

Season's greetings to all readers from the entire ELECTRONIC TECHNICIAN staff.

# Tuning In the

**NEW THIN PICTURE TUBE** type, resembling a standard automobile wheel in diameter and thickness, is being developed by RCA to improve brightness, detail and compactness of large screen military and commercial radar display systems. Of a type known as "reflected-beam kinescope," the tube displays its images on a viewing screen 21 in. or more in diameter employing a tube structure that is only 10 in. long and has a recessed rear area large enough to hold most of the receiving circuit equipment. The phosphor screen is mounted over the curved rear inner surface instead of at the tube face. Rather than striking the back of the phosphor screen, the beam approaches the transparent face of the tube, which acts as an "electron mirror" to reflect the beam back to the phosphor. In the experimental tube the full 180-degree deflection is obtained with the equipment of a 90-degree deflection system since the angle is doubled by the reflection from the tube face.

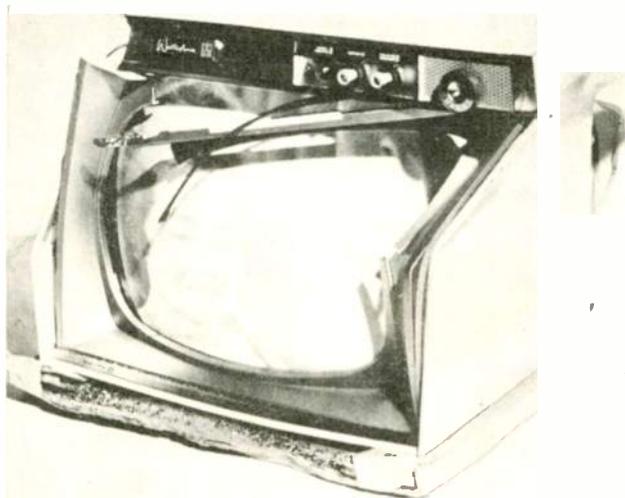


"I even tried splicing the cord."

**RADAR BOON TO ANGLERS?** Capt. Walter Drobecker of the sportfisherman "Knickerbocker's Pacemaker" is using radar to help him locate surface fish of appreciable size and turbulent white-water tide rips which contain game fish. The skipper is experimenting with range, size limits and the interpretation of blips to distinguish between fish and debris; radar would be particularly helpful if it could spot gamefish that escape detection by unaided eyes. How about radar for duck hunters?

**U.S. WEATHER BUREAU** is installing a 10 mile microwave system to transmit official reports between computer stations at the National Bureau of Standards in Washington, D.C. and the National Meteorological Center in Suitland, Md. Being provided by Motorola, the system will take information from a magnetic tape at one station and record it on a similar tape at the receiving station. The tape to tape transmission speed of 75 inches per second will be possible whereas formerly, the tapes were hand carried by couriers.

## IT STILL WORKS!



Following a plunge down an 85 ft. embankment in a highway semi-trailer (which was reduced to scrap), this Westinghouse TV table model set was turned on. The steel cabinet had been crushed but the set produced a clear picture and normal sound without repairs.

**COLOR TV DEFECTS** may not be in the set. Service men employed by a Pa. retailer at first could not determine why a customer's color TV kept "cutting off." Finally, they tracked it down to a pet canary, whose shrill chirp would hit the high frequency band utilized by the remote control unit, and inadvertently cut off the color set. Repair teams have found that a hard-to-hear dog whistle used by a youngster, or a certain ring of the telephone, could cut off the remote control devices.

**JAPANESE EXPORTS** of electronic products to the U.S. during the first 6 months of 1959 were valued at \$22.1 million, exceeding the total for the entire calendar year 1958, and nearly tripling the total for the calendar year 1957. The U.S. is by far the most important single foreign market for Japanese electronic products, accounting for more than 50% during the first half of 1959. Although consumer type radio receivers represent the largest part of this trade, other items such as recorders, electron tubes, transistors and phonograph parts and accessories are showing significant gains.

# Picture .....



**DRIVING SCHOOLS** in Baltimore and Chicago are saving time and mileage with RCA mobile communications hookups that enable home offices to maintain constant two-way contact with their drivers. The instructor reports the conclusion of an assignment, arranges via radio for the student's next lesson and is informed of any last-minute cancellations on his schedule.

**CLOSED CIRCUIT TV** provides conveniences for stock brokers. One New York firm, Brand, Grumet and Seigel, Inc., uses closed circuit television to transmit the latest quotations from the big board to every other room in their offices. Before, customers had to call the board room or leave the customer to find out the latest quotations. Now it is possible to see the latest price of a particular stock without leaving customers. A TV receiver is constantly in operation, showing an up-to-the minute report of the latest prices as received direct from the floor of the Exchange.

**RUMORED** to be reentering the television business is Stromberg-Carlson Co. According to reports, the company, which abandoned TV in the spring of 1956, held a meeting of its consumer products district managers during which plans were advanced to expand activities in the home entertainment field. No denial or confirmation of this report has come from Stromberg.

## CALENDAR OF COMING EVENTS

- Jan. 13-17: Los Angeles High Fidelity Music Show, Pan Pacific Auditorium, Los Angeles, Calif.
- Jan. 25-28: Plant Maintenance & Engineering Show, Convention Hall, Philadelphia, Pa.
- Feb. 3-5: Professional Group on Military Electronics, 1960 Winter Convention, Biltmore Hotel, Los Angeles, Calif.
- Feb. 11-13: Electronic Representatives Association, First Annual Convention, Drake Hotel, Chicago, Ill.
- Mar. 21-24: IRE National Convention, Coliseum and Waldorf Astoria Hotel, New York, N.Y.
- Apr. 4-7: 1960 Nuclear Congress & Atomic Exposition, New York Coliseum, New York, N.Y.
- Apr. 18-19: Conference on Automatic Techniques, Sheraton Cleveland Hotel, Cleveland, Ohio.
- Apr. 20-22: S.W. IRE Regional Conference & Electronics Show, Shamrock-Hilton Hotel, Houston, Tex.
- Apr. 29-May 1: Producers of Associated Components For Electronics, Annual Meeting, Nevele Hotel & Country Club, Ellenville, N.Y.

**"TALLEST MAN-MADE STRUCTURE** in the world" is claimed for the 1,619-ft. television antenna tower of WGAN-TV under construction at Raymond, Me. The structure is 154 feet higher than the Empire State Building's antenna. A regular office-building type of elevator operates to within 40 feet of the top of the tower.

## RANDOM NOISE

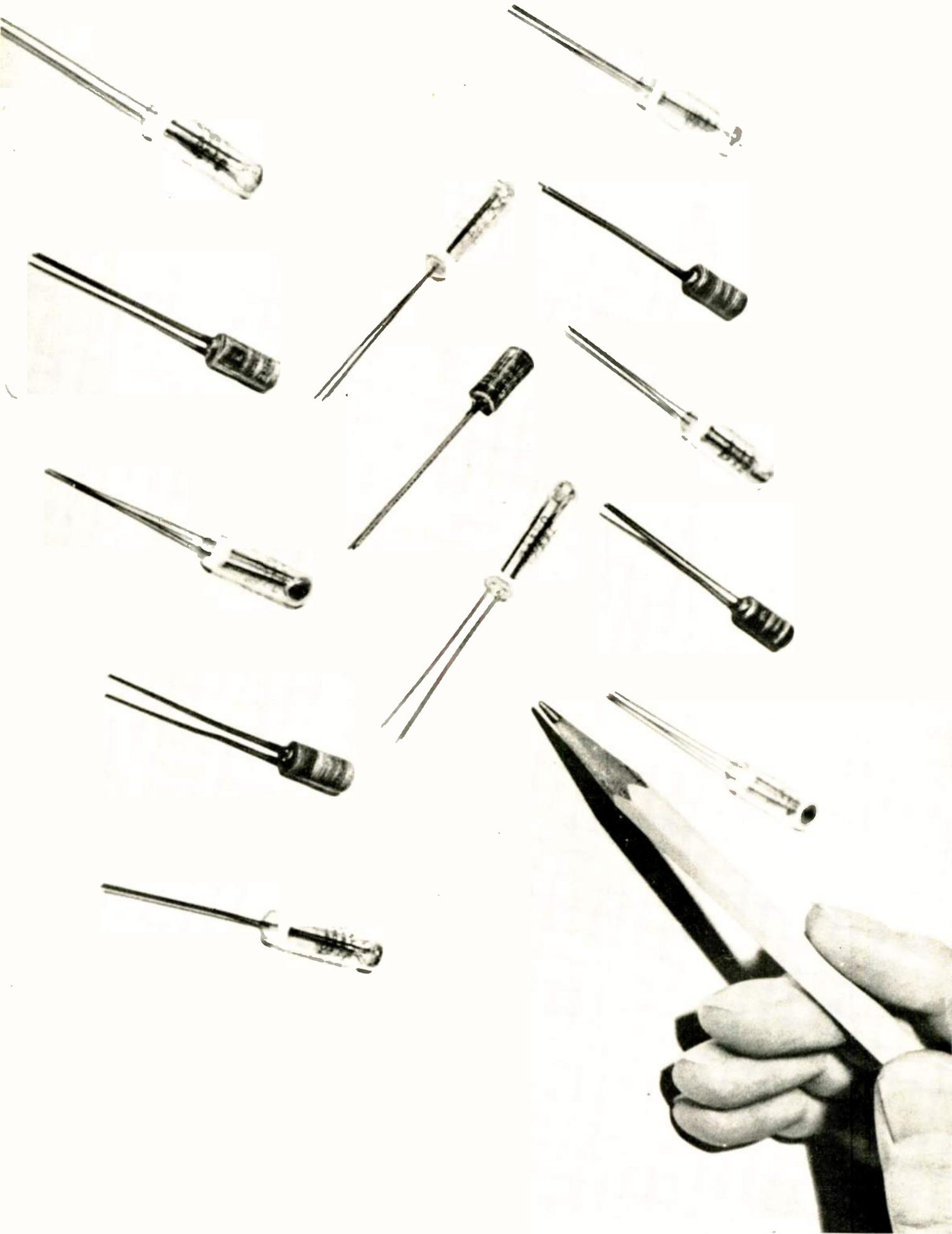


A TV CAMERA SMALL ENOUGH TO SWALLOW HAS BEEN DEVELOPED BY THE SURGERY DEPARTMENT OF AN AUSTRALIAN MEDICAL SCHOOL-IT'S USED FOR DIAGNOSTIC PURPOSES

TV CAMERA ON N.Y. SUBWAY TRAIN SPOTS TROUBLE. IT'S USEFUL IN SOLVING MOTOR BURNOUT PROBLEMS

FOREIGN TV. THERE ARE 985 STATIONS AND 28,047,700 TV SETS IN USE OUTSIDE THE US AND CANADA, REPORTS USIA

TOM HIGGINS JR.



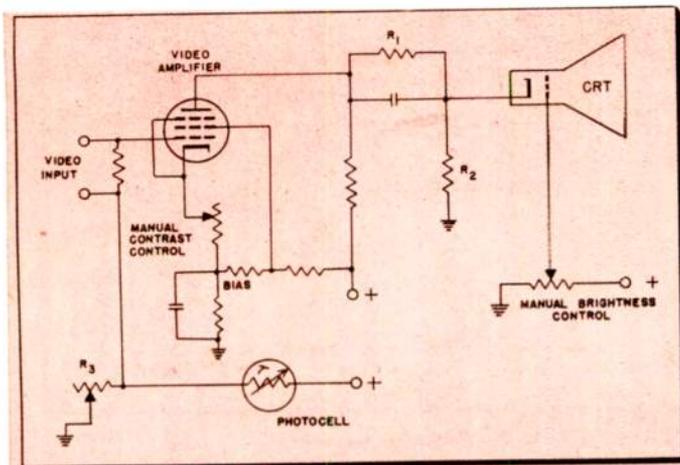


Fig. 1—Automatic TV picture compensation for different lighting conditions is achieved through use of a photocell whose output varies the video amp's bias. Increased light increases the tube's gain.

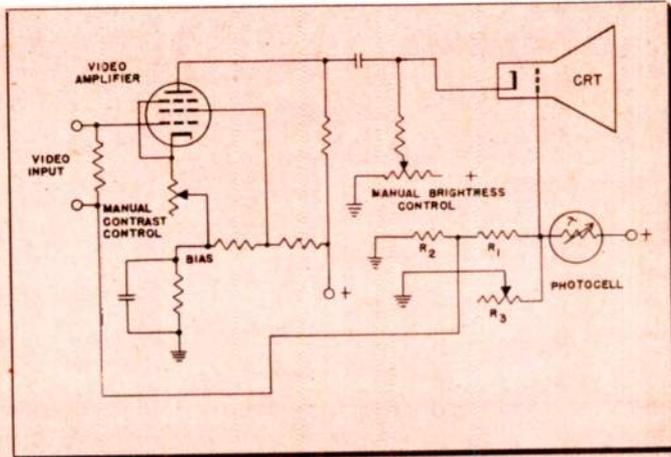


Fig. 2—The output of the photocell is applied directly to the grid of the CRT. A portion of the output is also developed across  $R_2$  and is applied to the grid of the video amplifier to reduce its bias.

# Photocells For TV

## Harnessing Light Sensitive Devices To Control Home Products

### MANY APPLICATIONS

Industry use of photocells has been apparent for some time. Recent years, however, witnessed the integration of this component into the home through burglar alarms, door announcers, automatic camera exposure, etc. The photocell's versatility, which includes its "automatic" facility, will no doubt be extended to additional home products. TV may be next, since a photocell can control brightness and contrast to match room lighting conditions.

• Photocells are, without fanfare, entering our electronic lives in increasing number. Though used in a wide number of applications, they are still generally viewed as simply

"electric eye" gadgets. They are much more, of course, as indicated by some typical applications listed in Chart I.

The photocell's ability to generate a voltage when light strikes its surface is receiving the attention of many manufacturers. Three basic types are available: Photoconductive, photovoltaic and photoemissive.

### Types

A photoconductive cell is basically a light-sensitive semiconductor when it is provided with an external source of power.

Photovoltaic cells are semiconductor devices that also convert light energy into electrical energy when light strikes the surface. However, an outside voltage source is unnecessary since it is a self-generating device.

The photoemissive type or phototube has a cathode and anode in an evacuated glass envelope. The cathode is coated with a substance that emits electrons when exposed to light. A supplementary voltage supply is needed.

(Continued on page 60)

### CHART I

#### Photocell Applications

1. Industrial Control
  - Daylight switches for:
    - Stores
    - Chicken houses
  - Door control for:
    - Elevators
    - Stores
  - Machine operator protection devices
  - Flame detectors
  - Toll booths
2. Automobiles
  - Headlight dimmer
  - Rear view mirror
3. Computers & Data Processing
  - Magnetic tape control
  - Punched tape readers
4. Missiles
  - Liquid level indicators
5. Medical Instruments
  - Flame photometer
  - Ultra violet & X-ray
6. In the Home
  - Night lighters
  - Announcers
7. Photography
  - Exposure meters
  - Automatic exposure control
8. Electronic Instruments
  - Furnace controllers
  - Linear accelerator beam focusing
9. Television
  - Remote control
  - Automatic brightness control

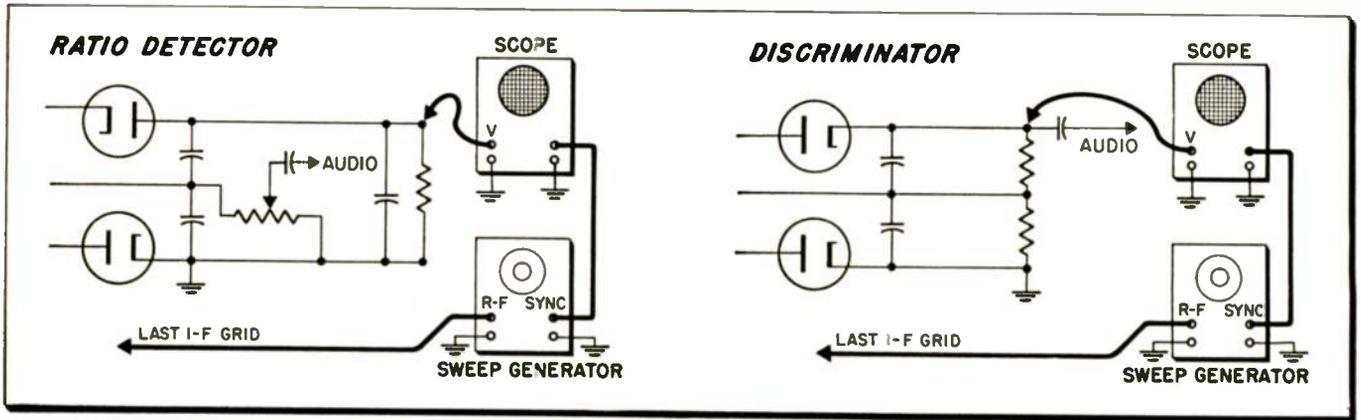


Fig. 1—A sweep generator and scope set-up for proper alignment of an FM ratio detector and a sound discriminator type circuit. The sweep generator output is applied to the last i-f tube grid and the detector's output is applied to the scope's vertical plates.

# Aligning FM Tuners

## Visual Alignment Precautions Are Needed For Best Reception

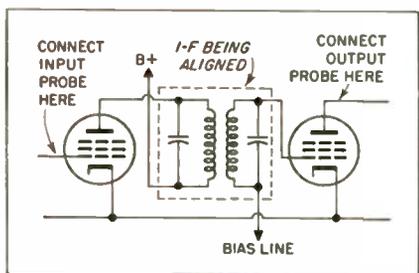
NORMAN H. CROWHURST

● Whither FM? It's difficult to speculate on FM's final place in the radio industry, but one thing is certain, it's on the upsurge. Newly authorized FM stations and the expanding service of existing stations have coupled with tremendous public interest to make FM a growing, vibrant medium.

Manufacturers, alert to these factors, have upped production of FM tuners and receivers. They are being marketed as FM tuners, integrated tuner/amplifiers, FM receivers, and in packaged hi-fi console units.

Owners of such equipment are demanding the top performance that their units are capable of producing.

Fig. 2—Align each i-f stage separately, connecting a sweep generator probe to the grid of the preceding tube and a scope probe to the plate of the following tube.



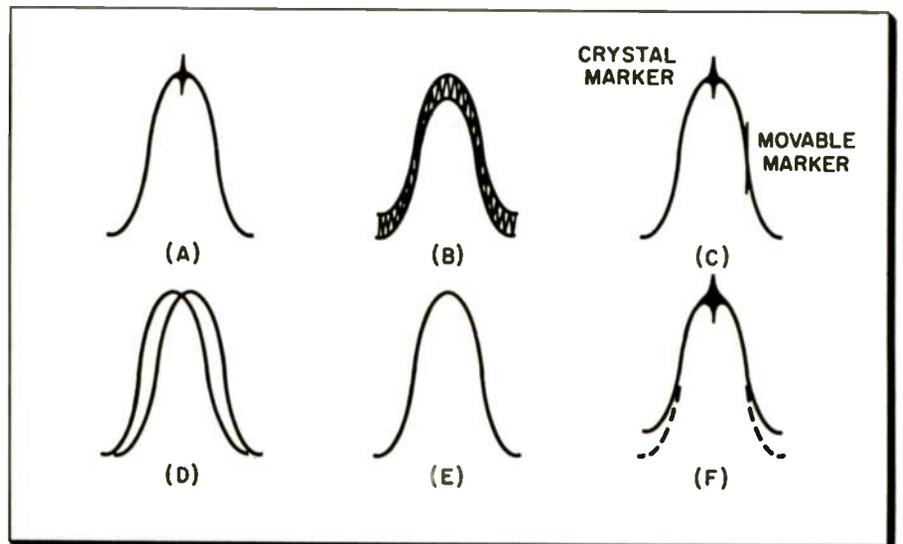
Top performance may, at times, not be obtained if a defective tube is replaced without also aligning the set. Often, alignment is imperative to secure optimum results. And an alignment doesn't mean just a rough "touch-up" of the i-f cans.

The alignment method you adopt will depend largely on your potential business in this field. If you are unlikely to ever have more than an odd tuner come into your shop, you

may not feel it will justify a large investment in equipment.

If you can foresee a larger amount of business in FM tuner servicing, it will prove profitable to invest a more substantial sum in equipment. The volume of business needed to make this feasible will probably be restricted to larger metropolitan areas. However, don't overlook the possibility of pulling in customers from surrounding areas where this

Fig. 3 (A)—An i-f response curve with a single marker pip. (B)—The same curve when two marker signals are zero beating at the center frequency. (C)—Two markers at different frequencies on a response curve. (D)—A double traced curve caused by the scope phase control being slightly misadjusted. (E)—A single response curve without a marker signal. (F)—Adding a marker signal to the input signal can affect the curve, especially if the marker signal is too strong. The dotted line indicates the proper curve shape and response.



quality service is not available, even though you are not in a large city.

### Equipment

A sweep generator and scope are essential for servicing and aligning hi-fi FM tuners. You may kid yourself about the "dog ears" you've developed over the years, but nothing will replace good equipment and the knowledge to use it in the quest for quality reception.

All of the precautions needed when aligning with a sweep generator could still result in invalid interpretations, so be sure the display you are looking at is what you think it is. It's surprising how many things can "throw" you.

Following the manufacturer's instructions is always best, although an i-f section is basically standard. The detector section, though, is different, depending upon the individual manufacturer. Alignment methods are, however, still basically the same, whether a discriminator or ratio-detector type is used. See Fig. 1.

### I-F Alignment

Set the sweep generator to scan the required i-f frequency, and align each i-f transformer separately. Inject the signal on the grid of the preceding stage, and measure at the plate of the following stage (see Fig. 2).

Here is the first "make sure"

Fig. 4—Complete set-up alignment of FM receivers. The band-width of an individual i-f, or overall response, can be more accurately and conveniently determined by the use of a marker-adder. It is also useful when adjusting the sound discriminator.

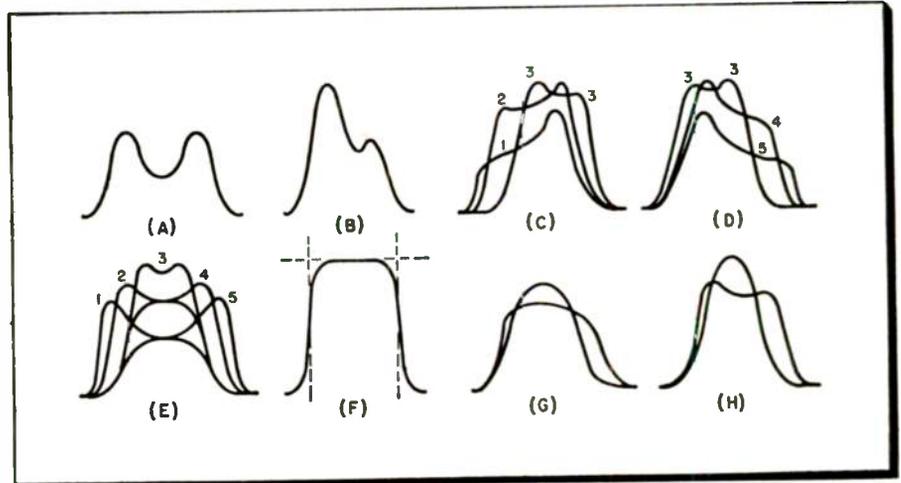
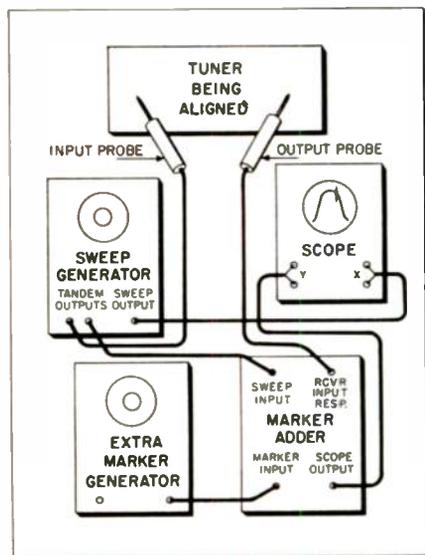


Fig. 5 (A)—Over-coupled i-f, with band-pass too wide. (B)—Improper adjustment. (C)—Points 1 and 2 indicate steps and effects of tuning only one side of an i-f winding through the same frequency as that of the other side, identified as 3. (D)—Same as (C) but with reverse tuning procedure. (E)—Indicates the results obtained by proper alternate tuning of primary and secondary of an i-f transformer in order to arrive at the nearest coincident point, at 3. (F)—An "ideal" response curve to aim for. (G)—A low Q i-f will not produce double hump. (H)—A high Q i-f produces a double hump when properly tuned.

check. Be sure what frequency range you are scanning: not only where it is, but how wide it is. Usual sweep is at least 200 kc. A crystal output, usually provided with the sweep generator, will check *where* you are. Any convenient separate generator can be used to explore the range. You are not even dependent on its calibration accuracy to any critical extent.

First, with the crystal already providing a marker pip about the middle of a peaked response (see Fig. 3A), search with the extra generator until you find the same frequency with it. At this frequency, the two markers will beat, as shown in Fig. 3B, producing a thickening of the whole trace and probably some visible beat waves as well.

Assume the correct i-f frequency is the usual 10.7 megacycles and you are using a crystal of this frequency. But the separate generator reads 10.2 megacycles when you get the beat indications: this means the calibration is "off" by 0.5 megacycle. You can still use its dial to estimate 0.1 megacycle on either side of the setting you have found to be 10.7 megacycles. For 10.6 megacycles you will set the dial to 10.1 and for 10.8 the setting will be 10.3. You just "shift" the setting by the error you have found.

In identifying horizontal frequency locations on the trace, you will also need to make sure the time base (usually 60 cycles) is correctly phased. A blanking switch is helpful for this. With the blanking off

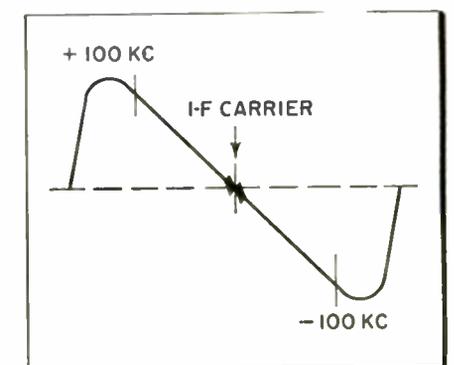
you will get a double trace, caused by the sweep going both ways (Fig. 3D). This is difficult to read. But the phasing control can be used to make the two traces coincide as nearly as possible, while the blanking switch can be used to remove the "return" trace.

Next, there are things that can falsify the vertical reading across the scope. If your input signal is too large, you will get a square topped response, regardless of the i-f's tuning, because the following stage is saturating for most of the trace. Turn the input level down until you see the real shape across the top.

At the bottom (along the skirts), the shape can be falsified by something other than signal getting in. Noise is one possibility, which will usually show up by being a little unsteady. Your marker may also

(Continued on page 66)

Fig. 6—For high fidelity reproduction a discriminator curve as seen on a scope should appear symmetrical and the linear portion must extend for at least 100 kc each side of the i-f center frequency.



# Japanese Transistor Radio Guide

## Brand Name And Distributor List Ease Technician's Service Pains

• The phenomenal Japanese transistor radio market in the United States has created problems for electronic technicians servicing these units. Dissemination of parts and service information for most brands just hasn't kept pace with its awesome sales figures.

As any technician will confirm, troubleshooting one of these midgets is difficult enough without the added handicap of a missing or illegible

schematic. Locating a non-standard replacement part, a time-consuming and often futile task, is another major complaint frequently expressed by the technician.

"Whom can I contact to get this service information?" In an effort to supply the answer to this question, ELECTRONIC TECHNICIAN Magazine has compiled a list of Japanese transistor radio brand names and their American distributors. •

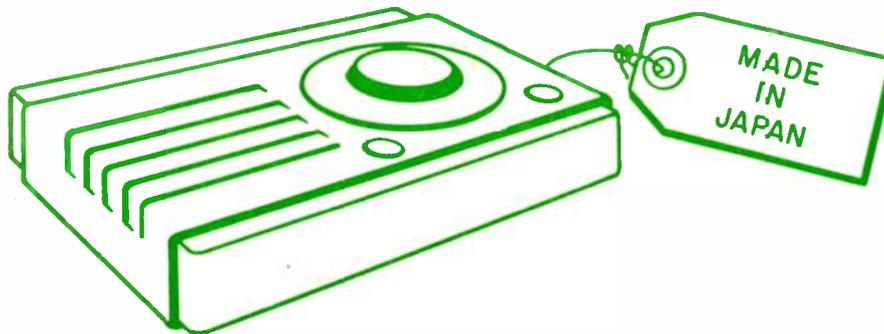
### Product Finding Index

This is a listing of Japanese transistor radio brand names—with the names of American companies that distribute and/or import them. Products are listed alphabetically with the distributor's code number following the name. Distributors and importers are listed by the code number next to the brand name.

### Japanese Transistor Radio Brand Names

NAME	CODE	NAME	CODE	NAME	CODE
Alpha	19	Jet	10	Realistic	34
Brighton	1	Jeweltone	19	Realtone	35
Channel Master	6	Jupiter	14	Romance	31
Continental	8, 28	Kawa	22	Sharp	28, 42
Crestline	5	Linmark	38	Sony	9
Crown	38	Little Pal	23	Spica	19
Elite	3	Longwood	22, 41	Standard	26
Empire	43	Maco	24, 30	Star-lite	39
Esquire	11	Manton	11	Startone	11
Eterna	11	Mantone	23	Sunton	11
Excel	12	Marvel	38	Suntone	40
Fenton	4	Mascot	15, 30	Switch-It	4
Gemtone	19	Micronta	34	Ten	37
Global	25	Minute Man	17	Taptone	28, 30
Gloratone	19	Mitsubishi	21	Toshiba	29, 34, 44
Harlie	11	Nanaola	26	Transcel	44
Harpers	16	NEC	20, 30	Viscount	7, 26
Hi-Delity	32	Oceana	30	Wealth	28
Hitachi	36	Olympic	19	Wilco	37
Holiday	19	Polyrad	33	Yashica	2, 13, 18, 27

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### Distributors of Japanese Transistor Radios

1. A & A Trading Co.  
1140 Broadway  
New York, N.Y.
2. Arel, Inc.  
4916 Shaw Blvd.  
St. Louis, Mo.
3. Berger Electronics, Inc.  
109-01 72nd Rd.  
Forest Hills, N.Y.
4. Berlin-Fenton, Inc.  
132 Nassau St.  
New York 38, N.Y.
5. Canton-Sun Inc.  
12 W. 27th St.  
New York, N.Y.
6. Channel Master Corp.  
Ellenville, N.Y.
7. Consolidated Sewing Machine  
1115 Broadway  
New York, N.Y.
8. Continental Merchandise Co., Inc.  
236 Fifth Ave.  
New York, N.Y.
9. Delmonico International  
42-24 Orchard St.  
Long Island City, N.Y.
10. Electronic Development Assac.  
125 E. 46th St.  
New York, N.Y.
11. Elize Mercantile of N.Y., Inc.  
1140 Broadway  
New York 1, N.Y.
12. Excel Corp. of America  
9 Rockefeller Plaza  
New York 20, N.Y.
13. Farnan & Seeman  
752 N. Highland Ave.  
Los Angeles, Calif.
14. General Export Co.  
74 Sacramento St.  
San Francisco, Calif.
15. Gosho Trading, Inc.  
50 Broad St.  
New York 4, N.Y.
16. Harpers International, Inc.  
315 Fifth Ave.  
New York, N.Y.
17. Intercontinental Industries, Inc.  
555 W. Adams St.,  
Chicago, Ill.
18. Intercontinental Marketing Corp.  
45-17 Pearson  
Long Island City, N.Y.
19. Intercean Commerce Corp.  
170 Broadway  
New York 38, N.Y.
20. Kanematsu, Inc.  
150 Broadway  
New York, N.Y.
21. Lissner Trading Co.  
134 LaSalle St.  
Chicago, Ill.
22. Longwood Radio Distr., Inc.  
1261 Broadway  
New York, N.Y.
23. Montone Radio Co.  
263 Conal St.  
New York, N.Y.
24. Matsushita Electric Corp. of  
America  
1776 Broadway  
New York, N.Y.
25. Masuyomo International Corp.  
79 Madison Ave.  
New York 16, N.Y.
26. Mitsui & Co.  
530 Fifth Ave.  
New York 36, N.Y.
27. Movie Supply of Hawaii, Ltd.  
1354-A Kapioloni Blvd.  
Honolulu 14, Hawaii
28. Nichimen Co., Inc.  
39 Broadway  
New York 6, N.Y.
29. Nomura Trading Co.  
52 Broadway  
New York, N.Y.
30. Oceano Importing  
150 W. 4th St.  
South Boston, Mass.
31. Peerless Radio Distr.  
92-32 Merrick Rd.  
Long Island, N.Y.
32. Petely Enterprises, Inc.  
300 Park Ave., So.  
New York, N.Y.
33. Polyrad Corp.  
521 Broadway  
Cincinnati, Ohio
34. Radio Shack Corp.  
730 Commonwealth Ave.  
Boston 17, Mass.
35. Realtone Electronics  
184 Fifth Ave.  
New York, N.Y.
36. The Somson Co.  
2244 South Western Ave.  
Chicago, Ill.
37. Sanyo Trading Co., Ltd.  
149 Broadway  
New York, N.Y.
38. Shiro, Inc.  
276 Park Ave. So.  
New York, N.Y.
39. Starlite Merchandise Corp.  
37 W. 23rd St.  
New York, N.Y.
40. Sun Coast Merchandise Co.  
410 S. Spring St.  
Los Angeles, Calif.
41. Tazuke & Co.  
1133 Broadway  
New York, N.Y.
42. Toyomenko, Inc.  
2 Broadway  
New York 4, N.Y.
43. Trade Distributors, Inc.  
461 4th Ave.  
New York, N.Y.
44. Transistor World Corp.  
52 Broadway  
New York, N.Y.

# Analyzing TV Damper Faults

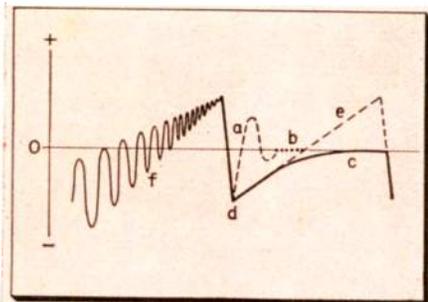


Fig. 1 (a) Residual oscillations are suppressed by damper. (b)—Horizontal output tube conducts. (c)—Damper current. (d)—Damper starts conduction. (e)—Output tube and damper current combined. (f)—How yoke current would appear without damper tube.

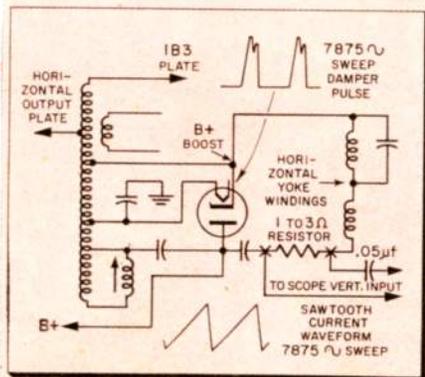


Fig. 2—When an auto-type horizontal output transformer is in use, a voltage waveform is obtained from the damper cathode by clipping a low-capacity scope probe over its insulated lead. A sawtooth current waveform is obtained across a resistor inserted in series with the lead at the low end of the horizontal deflection winding.

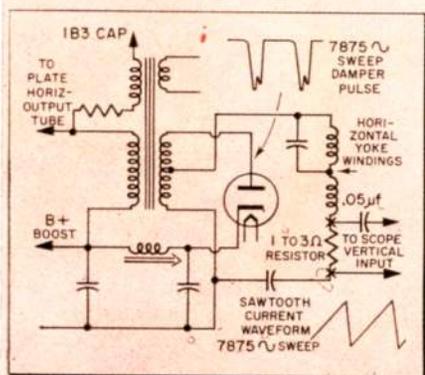
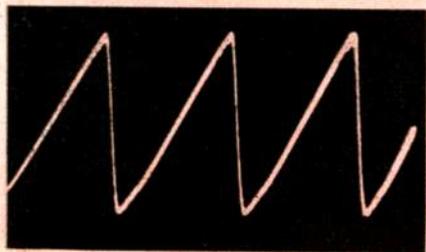


Fig. 3—In a primary-secondary type horizontal output circuit, a voltage waveform is obtained from the damper plate by clipping a low capacity scope probe over the insulated lead going to it. A current waveform is obtained across an inserted resistor.

Fig. 4—A scope trace of an ideal sawtooth current waveform obtained from the low end of a horizontal deflection yoke winding.



## Overloaded Boost Supply Line

### Can Upset Technician's Composure

EDWARD C. KILEY

• Only a small number of components are used in the damper circuit of TV receivers. Despite this fact, some technicians approach damper fault symptoms with no little confusion. One possible explanation for this uncertain attitude is the knowledge that many similar appearing symptoms can originate in circuits ahead of the damper.

A brief refresher on the role played by the damper may prove helpful at this point. For purposes of this description, it is unimportant if attention is not directed to variations in flyback-yoke configurations.

#### Damper Functions

In magnetic deflection receivers, when a linear sawtooth voltage of proper amplitude is applied to the grid of the horizontal output tube, a constant current rise begins in the horizontal windings of the deflection yoke. This linear sawtooth current sweeps the electron beam from left to right across the TV screen. The horizontal output and damper tubes conduct during sawtooth current rise, taking turns at maintaining stable current. (See Fig. 1.)

When the sawtooth current wave reaches its peak at the end of trace, the horizontal output tube ceases to conduct. The magnetic field around the yoke collapses, creating a fast

high amplitude flyback voltage pulse.

The entire circuit (yoke-flyback inductance and distributed capacity), is shock-excited into self oscillation at its natural resonant frequency: about 71 kc. Conduction in the damper tube has also stopped. Retrace takes place on the first negative half cycle of this transient oscillation. Near the end of this half cycle the damper conducts heavily, presenting a low resistive load across the flyback-yoke circuit; suppressing what would otherwise be a series of undesirable damped oscillations. The horizontal output tube starts conduction again, with the damper carrying most of the load for approximately one third of the scan time.

Out of all this is derived sufficient high voltage, additional B+ (boost), automatic return trace and blanking space, plus suppression of unwanted damped oscillations—primary function of the damper tube.

In sets having a linearity coil, a capacitor and the coil act as a phase shift circuit to add the ripple boost to the regular B+ in a manner insuring better horizontal linearity. It is sometimes called a boost filter.

#### Waveforms

When the sawtooth voltage waveform at the grid of the output tube is normal, then scope voltage waveforms from the damper tube high side and the sawtooth current wave-

## PROFILE

*If a damper tube could speak it would probably deny family affiliation with its low-voltage rectifier cousin. The suggested fantasy would probably stem from its many-faceted activities; it rectifies, restricts oscillations and feeds voltage to many circuit sections. In addition, a multitude of symptoms can be evidenced if it's not operating properly. Nevertheless, it is still a rectifier, though a high-current one with a complicated job.*

form in the yoke become invaluable aids in quickly isolating damper circuit faults.

A sawtooth current waveform may be taken from the deflection yoke by disconnecting the low end of the horizontal coil lead, inserting a 1 to 3 ohm, 1 watt carbon resistor in series completing the circuit, as shown in Fig 2 and Fig 3. The scope should not be grounded at any point and care should be taken with connections to prevent shorting, grounding or accidental shock. The ideal sawtooth current waveform scope trace is displayed in Fig 4.

High side damper scope traces can be safely made by clipping the regular low capacity scope probe over the insulated wire connected to the plate or cathode of the damper tube. This will normally furnish sufficient voltage to the scope.

In regular primary-secondary fly-back transformers the voltage pulse waveform is taken from the plate of the damper, and appears normally as a negative pulse. It can be reversed if desired with the phase reverse switch on the scope. In auto transformer types the pulse is taken from the cathode in the same manner and will normally appear in the positive position. These pulses are essentially rectangular waveforms, although the average scope trace appears as in Fig. 5.

Scope traces from the horizontal output tube plate are often helpful in isolating damper problems. A capacitance type voltage divider probe with a ratio of about 100 to 1 should be used. The high voltage type probe employed with VTVM's and VOM's for 2nd anode measurement is inadequate. If the proper capacitance type probe is not available, the technician can construct a reasonably satisfactory substitute from two lengths of RG-59U coax cable, as shown in Fig. 6.

### Nonlinear Problems

Almost any change affecting the LC relationship of the oscillatory yoke-flyback circuit, including the width coil, LC boost network and blocking capacitors from the yoke, will create nonlinear conditions almost duplicating those created by faults in the horizontal oscillator or grid input circuits of the horizontal output tube.

With the aforementioned facts in mind, it is generally best to begin observations at the grid of the horizontal output tube when isolating damper faults. Since the sawtooth waveform shapes generated by the blocking oscillator vary somewhat from those produced by the multi-vibrator, the technician should be guided by those waveforms indicated on manufacturers' specifications.

To illustrate the possibilities inherent in waveform analysis, two practical examples are given here.

If a correct sawtooth voltage appears at the grid of the horizontal output tube, as shown in Fig. 7A, and the picture pattern on the TV is stretched on the left and compressed on the right, as illustrated in Fig. 7B, trouble is indicated from the output tube toward the yoke. A waveform at the high side of the damper appears normal, as was shown in Fig. 5. The sawtooth current waveform in Fig. 7C, however, is badly distorted. Note the too-fast rise, indicating a speeding up of the beam trace, corresponding to the stretched area on the left side of the picture pattern. Also notice the rounding near the end of trace, indicating a slowing down of the beam, with corresponding compressed effect at the right of the picture. The trouble is clearly indicated between the damper and the yoke. In this

*(Continued on page 74)*

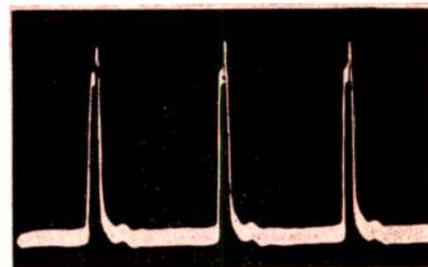


Fig. 5—Scope trace of an ideal voltage pulse from a damper tube high side is essentially rectangular in shape with a relatively straight base line between pulses.

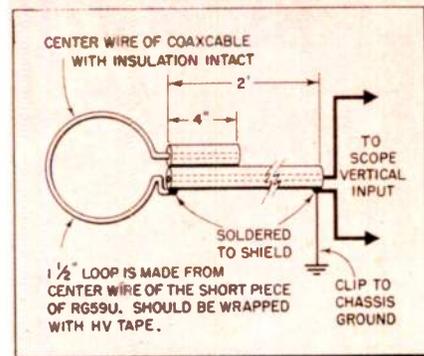
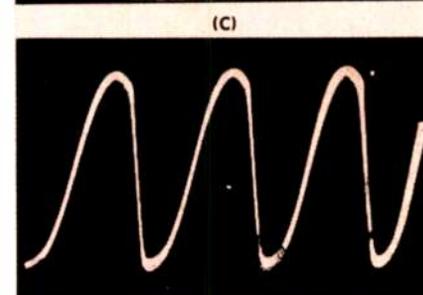
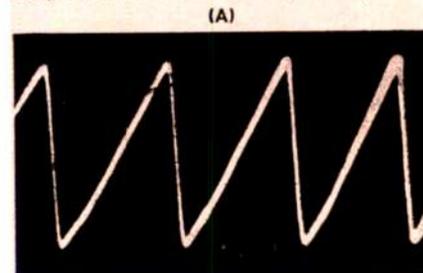


Fig. 6—A home-made probe for observing uncalibrated scope waveforms at the horizontal output tube plate is illustrated. Loop is hung under the lead of the output tube's plate cap.

Fig. 7 (A)—A voltage sawtooth trace at the horizontal output tube grid. The ideal shape is determined by the type of oscillator used. (B)—This nonlinear pattern was caused by a change in the yoke blocking capacitor. (C)—A badly distorted sawtooth current waveform indicated a variation in the beam speed corresponding to the stretch and compression shown in the picture pattern.



Improve Your Skills By

# Building a Technical Library



## HOME AIR CONDITIONING INSTALLATION & REPAIR

By J. Derman, F. Makstein & H. Seaman. Both theory and practical construction designs are examined, along with maintenance techniques and procedure for determining size of air conditioner required. Covers motors, compressors, condensers, evaporators, regulating valves, circuits and other system elements. Soft cover, 160 pages. Price \$3.50.

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By Alexander Schure. This well written volume provides an excellent basis for understanding the theory and operation of the photo element. After covering fundamentals and photoemissivity theory, the text goes into photo tubes, both vacuum and gas filled, as well as photo tube amplifiers. Review questions are carried at the end of each chapter. Soft cover, 96 pages. Price \$1.80.

## SHOOT TV & RADIO TROUBLE FAST

By Harry G. Cisin. The first part of this book relates to symptoms, faults and remedies for ac-dc radios. The second part covers TV, with each practical test and repair explanation related to a specific problem. Printed circuits are discussed. Soft cover, 40 large pages. Price \$1.50.

## BASICS OF DIGITAL COMPUTERS (3 vols.)

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## IMPEDANCE MATCHING

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# Maintaining Two-Way Radio

*FCC Regulations Demand Technicians Know*

*Accurate Transmitter Checking Methods*

ALLAN LYTEL

## IN BRIEF

*In addition to servicing and preventive maintenance, mobile radio work has another aspect for the technician—periodic transmitter checks required by the FCC. These include measuring and recording carrier frequency, frequency deviation and power input when a transmitter is installed, when a change affects the operating frequency and at regular intervals.*

• The skill and "know-how" required for selecting and physically installing two-way radio systems is highly important. The knowledge necessary to maintain efficient operation, in accordance with FCC regulations, is equally significant.

## FCC

The Federal Communications Commission is the U.S. Government's agency responsible for regulating radio communications—licensing non-government radio stations, station operators and technicians.

The Commission's responsibilities are comprehensive but focus sharply upon providing maximum public use of the limited channels available. Careful regulation and control con-

centrates upon deriving maximum public benefits from instant communications facilities. The radio spectrum is one of our many natural resources, and maximum benefits can be realized from its use only through complete cooperation between user, equipment manufacturer and the FCC.

## Regulations

The FCC regulations maintain two essential types of control over mobile radio; one is licensing of transmitting equipment, operating and maintenance technicians, and the other is the establishment of technical standards and criteria for operation, adjustment, maintenance and repair.

All transmitters must be licensed by the FCC before being put into operation. A station license, allowing the station to operate on an assigned frequency, must be posted at the transmitter location. The licensee agrees to keep his station on the proper frequency and to prevent interference with other stations or services.

Application for a radio station license in the Public Safety, Industrial and Land Transportation Radio Services, is made on FCC form 400. There is no government charge for the station license. The licensee in the regular land mobile services may use any equipment in the FCC's "List of Equipment Acceptable for Licensing in the Radio Services other than Broadcast," as long as the equipment meets the technical specifications entered on the license.

## Responsibilities

Repairs and adjustments made on transmitters during installation,

servicing, or testing may be made by, or under the supervision of, a licensed radio operator holding a First or Second Class Radiotelephone license.

Operators of mobile transmitters in land mobile service (above 30 mc) do not require licenses where radio-telephone (voice) is used. But only properly authorized operators (Class 1 and 2) can make adjustments which affect the operating frequency or make any repairs to a transmitter.

Conformance to these regulations is the direct responsibility of the licensed person making the adjustments. Not only must he know the proper procedures but he also must know the accuracy of his instruments. The FCC monitors the operation of the transmitters and sends citations to all violators.

There are specific items included in the FCC requirements for maintenance. The important requirements are as follows: Carrier frequency, modulation deviation and power input.

## Operating Frequency

The FCC requires that the operating frequency of the aforementioned two-way radio transmitters be measured when: (a) the transmitter is installed, (b) a change is made in the transmitter which affects the frequency, and (c) at regular intervals. Regular intervals must not exceed one month when the transmitter is not crystal controlled, and 6 months when the transmitter is crystal controlled.

Below an operating frequency of 50 mc the tolerance is 0.01% and above 50 mc the tolerance is 0.005% of the assigned frequency for most transmitters. Closer tolerances for

## CHART I

### Commonly Used FCC Forms

- Form 400. Application for Radio Station Authorization in the Safety And Special Radio Services.
- Form 400-A. Request for Amendment of Radio Station Authorization.
- Form 401-A. Description of Proposed Antenna Structure(s), (Services other than Broadcast.)
- Form 405-A. Application for Renewal of Radio License.
- Form 456. Notification of Completion of Radio Station Construction.
- Form 505. Application for Citizens Radio Station Construction Permit and License.
- Form 753-1. Application for Restricted Radiotelephone Operator Permit by declaration.
- Form 756. Application for Commercial Radio Operator License or Permit.

transmitters have been proposed: 0.002 percent (25 to 50 mc) and 0.0005 percent (50 to 1000 mc.)

### Frequency Measurements

An accurate heterodyne or other type frequency meter is required to check the transmitter frequency. Accurate calibration means and excellent stability is an instrument prerequisite. Procedures outlined by the instrument manufacturer should be followed carefully. The general methods for measurements are:

- (a) Turn on the transmitter, without modulation, with its output connected to a dummy antenna load.
- (b) The heterodyne frequency meter should be adequately warmed up and a length of antenna attached. Length of the antenna will depend upon the signal strength, interference, noise level and the characteristics of the meter.
- (c) Carefully tune the meter to zero beat or null point of the frequency being radiated by the transmitter and note the dial setting. The difference between the frequency indicated by the dial setting and the assigned frequency can be considered the frequency difference. If difficulty is found in reaching the exact zero beat point, modulate the transmitter with a steady tone of about 500 cycles. The percentage of error or deviation

is given by:

$$f/F (100\%)$$

where  $f$  equals the difference between the actual carrier and the assigned frequency and  $F$  equals the assigned frequency.

For example, if the assigned frequency is 51.230 mc and the actual reading is 51.232 mc on the meter, then  $f$  is 0.002 mc (2kc), and the deviation from the correct frequency becomes approximately 0.0039%. If the frequency reads 51.233 mc or 0.003 mc difference (3kc), the deviation is approximately 0.0058% which is beyond the 0.005% allowable tolerance specified by the FCC.

### Modulation Checks

A modulation check is required by the FCC at the same time the frequency is measured. For FM transmitters the frequency of the carrier must not change more than 15 kc from the assigned center frequency; for AM transmitters modulation must be between 70 and 100% (negative peaks.)

There are several possible methods for measuring the deviation during normal modulation. One example given here is indicated in Fig. 1. The equipment for this method includes:

- (1) Modulation meter with a peak-modulation indication. The meter (a receiver-type instrument) should have direct-reading scales for the carrier frequency.

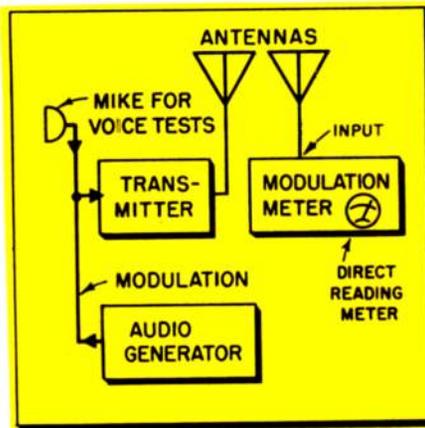


Fig. 1—Accurate modulation measurements of a transmitter can be made by voice-modulating, while checking with a meter.

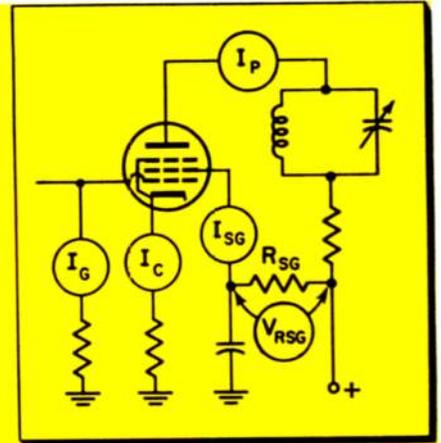


Fig. 2—Various points in a transmitter final amplifier where measurements can be made for computing the total input power.

- (2) Audio oscillator for the source of the modulating signal. (A normal voice-modulation check must also be made, as a signal generator will not show the voice peaks.)

Steps for making this measurement are:

- (1) Turn on the transmitter, modulation meter and audio oscillator. If the transmitter is not working into a dummy load, turn off the transmitter as soon as the test is completed to prevent interference.
- (2) Attach antenna of the proper length to the meter input. The antenna is cut at or near the resonant length for the center of the frequency of the transmitter.
- (3) Tune the modulation meter to the carrier frequency while the transmitter is not being modulated.
- (4) Modulate the transmitter with a 1000 cycle note from the audio oscillator. This will allow a preliminary adjustment of the transmitter modulation level, but normal voice transmission is the only way to check the actual voice peaks.
- (5) Adjust the transmitter so that modulation peaks do not exceed limitation prescribed by the FCC.
- (6) Use a normal speaking voice and a microphone to check voice peaks during voice

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**TEST EQUIPMENT**

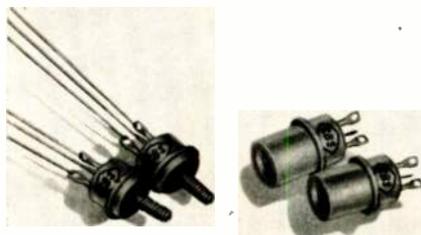
Hi-Fi Servicing with a Harmonic Distortion Meter	N. H. Crowhurst & Robert Cornell	1/59-32
Extend VOM or VTVM for Reactance Measurement	Al Diamond	1/59-36
Stereo Servicing with a Harmonic Distortion Meter	R. G. Middleton	1/59-40
Service & Lab Oscilloscopes	R. G. Middleton	2/59-34
Overcoming Pitfalls in Audio Measurements	N. H. Crowhurst	2/59-40
Sinewave Sweep Procedure for Oscilloscopes	R. G. Middleton	3/59-36
Practical Peak-to-Peak Scope Calibration Procedure	Robert Turner	4/59-36
Lissajous Patterns Aid Waveform Analysis	R. G. Middleton	5/59-32
Practical Transistor Testing	R. G. Middleton	7/59-34
Sweep Alignment for AM Radio	Jack Darr	7/59-40
Understanding Square Waves	R. G. Middleton	8/59-54
Hi-Fi Test Measurements Can Be Wrong	N. H. Crowhurst	10/59-38
Mobile Radio Universal Test Box	Larry Critchlow	10/59-42
Transistor Test Circuits	R. H. Bowden	10/59-44
Audio Troubleshooting with a Scope	R. G. Middleton	11/59-36

**"TOUGH DOG" CORNER**

Dynamic Voltage Divider	Robert Samodell	1/59-37
Screw Loose Hum	M. L. Levy	1/59-37
Low Volume & Noise	E. T. Roming	2/59-45
Shield That Tube!	M. E. West	3/59-39
Vertical Jitter	William Welsh	3/59-39
No High Voltage	W. G. Soppington	4/59-35
Annual Intermittent	Horace Lasher	5/59-37
Horizontal Hum	Peter Jentzen	5/59-37
Flux Troubles	L. A. Conner	6/59-64
No Vertical Sweep Due to Open Flyback	Ivan Ruggles	6/59-64
Sound Buzz Due to Open Capacitor	M. G. Goldberg	7/59-39
Visual High Voltage Arc Misleading	L. C. Huneault	7/59-39
Deceiving Vertical Sync	Jack Darr	8/59-49
Intermittent Negative Picture	F. A. Salerno	8/59-49
Heater Affects Vertical Deflection	G. L. Frichette	9/59-47
Variable Capacitor Deforms Raster	M. G. Goldberg	9/59-47
Inoperative New Tube	M. J. Downs	10/59-41
Retrace Hum Bar	F. A. Salerno	10/59-41
Over-Heating Flyback	H. E. Chace	11/59-39
Unstable Sync	F. A. Salerno	11/59-39
Intermittent Flashing	A. W. Coleman	12/59-48
Faulty CRT Kills Sound & Picture	R. F. Crocker	12/59-48

**CBS POWER TRANSISTORS**

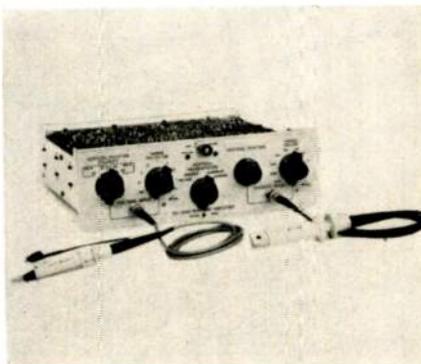
Eight complementary NPN-PNP power transistor pairs are mounted in TO-10 (male) and TO-13 (female) packages and are supplied with solder lugs or flying leads. They feature high voltages (up to 100 volts). Applications include audio, control, voltage regulation, servo and computer. Maximum



collector current of 3 amps, a minimum large signal current gain of 30 (for a collector current of 0.5 ampere), and a maximum thermal resistance of 3° C/W. CBS Electronics, Danvers, Mass. (ELECTRONIC TECHNICIAN 12-3)

**Hewlett-Packard AMPLIFIER**

Model 154A dual channel amplifier permits direct observation of both current and voltage waveforms, when plugged into the firm's model 150A/AR oscilloscope. It has a current-sensing probe which clamps around a wire providing fast measurement and observation of current from 50 cps to 8 mc; sensitivity is calibrated from 1 ma/cm to 1 amp/cm in a 1-2-5 sequence. Sen-



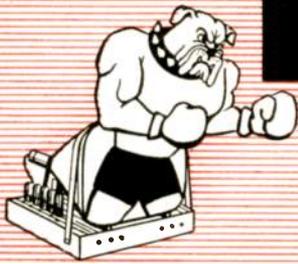
sitivity of the voltage channel is 50 mv/cm to 20 v/cm and bandwidth is dc to 10 mc. Price, including probe, \$430. Hewlett-Packard Co., 275 Page Mill Rd., Palo Alto, Calif. (ELECTRONIC TECHNICIAN 12-18)

**Stromberg-Carlson PA SYSTEMS**

A new line of public address equipment features a series of "Signet" amplifiers covering requirements as high as 70 watts of rated output. The series are available in 10, 22, 33 and 70 watt ratings. In addition to the 110 volt amplifiers, a completely transistorized amplifier for mobile applications, operates



from a 12 volt auto battery or dry battery pack. It has a rated power output of 8 watts, frequency response 100 to 10,000 cps and weighs only 3 lbs. Stromberg-Carlson, 1490 N. Goodman St., Rochester 3, N. Y. (ELECTRONIC TECHNICIAN 12-50)



# "Tough Dog"

# Corner



## Difficult Service Jobs Described by Readers

### Intermittent Flashing

A Westinghouse chassis, No. V-2372-27, was brought into the shop after all tuner, i-f and video tubes had been changed. The trouble symptom was horizontal streaks, 3

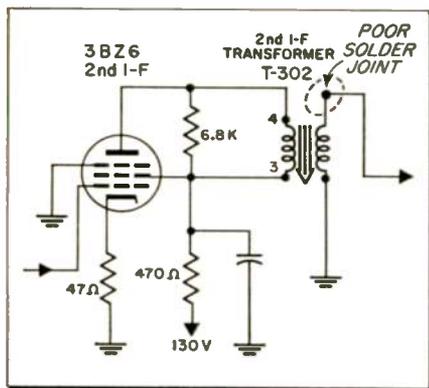


Fig. 1.—A difficult to locate intermittent fault in this TV was eliminated by resoldering a cold joint on the i-f transformer.

mained only the i-f section of the ailing set.

With an insulated tool I began probing for trouble among the i-f components on the printed board. It was difficult because the slightest vibration would start or stop the symptom. I realized it was necessary to develop the proper amount of vibration to definitely locate the trouble. After going over many components I came to T-302, the 2nd i-f transformer, shown in Fig. 1. The slightest disturbance of this transformer started and stopped the symptom. Examining all transformer contacts on the printed board showed no bad connections.

Going to the top side of the printed board, where T-302 is mounted, a careful check of the wiring indicated a poorly soldered connection of the feed-through wire from the bottom of the board to the coil tab. When this connection was

well soldered the set worked perfectly and no amount of vibration would cause the flashes to recur.—*Alvin W. Coleman, Greggton, Texas.*

### Faulty CRT Kills Sound & Picture

The set, a Zenith 15A25U, would operate with normal picture and sound for an indefinite length of time and then both would suddenly disappear—with only a raster remaining.

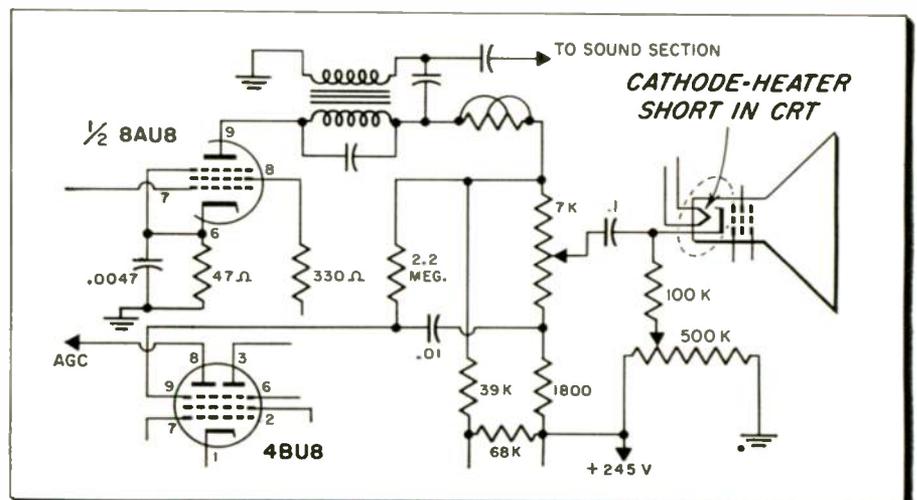
All tuner and video tubes, including the 4BU8 sync-agc, were substituted, without repairing the fault. A scope with demodulator probe showed little or no video from the first to the 3rd video i-f. A measurement of the negative voltage with a VOM on the grid of the 4CB6, 1st video i-f, with sound and picture on, showed approximately  $-5v$ . With

(Continued on page 78)

or 4 inches wide, across the screen.

With the chassis set-up on the bench and the antenna connected, I noticed that I could make the streaks come and go by slightly vibrating any part of the set. To eliminate the tuner as a source of trouble, I fed a signal from the tuner output of another nearby set, to the grid of the first i-f. The noise streaks were still there. I now disconnected the 1N64 video detector diode. The streaks disappeared. When the antenna was disconnected from the set no streaks appeared in the raster. This entire procedure not only eliminated the tuner as the source of the trouble but cleared the high voltage from suspicion as well. There now re-

Fig. 2—A heater-cathode short in the CRT caused a loss of both picture and sound.



# VACUUM TUBE VOLTMETER

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- Meter is isolated from the measuring circuit by a balanced push-pull amplifier.
- Uses selected 1% zero temperature coefficient resistors as multipliers.

**AS A DC VOLTMETER:** The Model 77 is indispensable in Hi-Fi Amplifier servicing and a must for Black and White and color TV Receiver servicing where circuit loading cannot be tolerated.

**AS AN ELECTRONIC OHMMETER:** Because of its wide range of measurement leaky capacitors show up plainly. Because of its sensitivity and low loading, intermittents are easily found, isolated and repaired.

### SPECIFICATIONS

• DC VOLTS — 0 to 3/15/75/150/300/750/1,500 volts at 11 megohms input resistance. • AC VOLTS (RMS) — 0 to 3/15/75/150/300/750/1,500 volts. • AC VOLTS (Peak to Peak) — 0 to 3/40/200/400/800/2,000 volts. • ELECTRONIC OHMMETER — 0 to 1,000 ohms/10,000 ohms/100,000 ohms/1 megohm/10 megohms/100 megohms/1,000 megohms. • DECIBELS — 10 db to + 18 db, + 10 db to + 38 db, + 30 db to + 58 db. All based on 0 db = .006 watts (6 mw) into a 500 ohm line (1.73v). • ZERO CENTER METER — For discriminator alignment with full scale range of 0 to 1.5/7.5/37.5/150/375/750 volts at 11 megohms input resistance.

**AS AN AC VOLTMETER:** Measures RMS value if sine wave, and peak-to-peak value if complex wave. Pedestal voltages that determine the "black level" in TV receivers are easily read.

Comes complete with operating instructions, probe, leads, and steamlined carrying case. Operates on 110-120 volt 60 cycle. Only **\$42.50**

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• Model 83 is not simply a rehashed black and white C.R.T. Tester with a color adapter added. Model 83 employs a new improved circuit designed specifically to test the older type black and white tubes, the newer type black and white tubes and all color picture tubes.

- Model 83 provides separate filament operating voltages for the older 6.3 types and the newer 8.4 types.
- Model 83 employs a 4" air-damped meter with quality and calibrated scales.
- Model 83 properly tests the red, green and blue sections of color tubes individually—for each section of a color tube contains its own filament, plate, grid and cathode.
- Model 83 will detect tubes which are apparently good but require rejuvenation. Such tubes will provide a picture seemingly good but lacking in proper definition, contrast and focus. To test for such malfunction, you simply press the rej. switch of Model 83. If the tube is weakening, the meter reading will indicate the condition.
- Rejuvenation of picture tubes is not simply a matter of applying a high voltage to the filament. Such voltages improperly applied can strip the cathode of the oxide coating essential for proper emission. The Model 83 applies a selective low voltage uniformly to assure increased life with no danger of cathode damage.

Model 83 comes housed in handsome portable Saddle Stitched Texon case—complete with sockets for all black and white tubes and all color tubes. Only **\$38.50**

# TUBE TESTER



★ Tests all tubes, including 4, 5, 6, 7, Octal, Lock-in, Hearing Aid, Thyatron, Miniatures, Subminiatures, Novals, Sub-minars, Proximity fuse types, etc.

★ Uses the new self-cleaning Lever Action Switches for individual element testing. Because all elements are numbered according to pin-number in the RMA base numbering system, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TW-11 as any of the pins may be placed in the neutral position when necessary.

★ The Model TW-11 does not use any combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible to damage a tube by inserting it in the wrong socket.

★ Free-moving built-in roll chart provides complete data for all tubes. All tube listings printed in large easy-to-read type.

**NOISE TEST:** Phono-jack on front panel for plugging in either phones or external amplifier will detect microphonic tubes or noise due to faulty elements and loose internal connections.

### EXTRAORDINARY FEATURE

**SEPARATE SCALE FOR LOW-CURRENT TUBES:** Previously, on emission-type tube testers, it has been standard practice to use one scale for all tubes. As a result, the calibration for low-current types has been restricted to a small portion of the scale. The extra scale used here greatly simplifies testing of low-current types.

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**SPECIFICATIONS**  
Employs the extra sensitive 1B85 Bismuth Type Geiger Counter Tube. Sensitivity is .05 Roentgens per hour (1 MR/HR=2,000 counts per minute). • Three counting ranges: 0-100/1,000/10,000 counts per minute. • Handy reset button. • Ideal for survey work because the complete unit weighs only 5 1/2 lbs. • Sight and sound indications by neon flashes and headphone. Then when an indication is obtained you switch to meter reading for exact measurements. • Decontamination easy with damp cloth applied to the weather-

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# SHOP HINTS



## Tips for Home and Bench Service

### CRT Focus Checker

Many manufacturers use a jumper strap on the CRT base for focus adjustment. This jumper is placed between pins 6 and 2 or between 6 and 10, whichever provides best focus. The change in focus in each position of the jumper is usually quite small, and selecting the best location of the jumper is difficult as the set is shut off during the jumper change. By constructing the unit shown in Fig. 1, the best position of the jumper can be readily determined as both jumper positions can be tried with a flick of the switch.

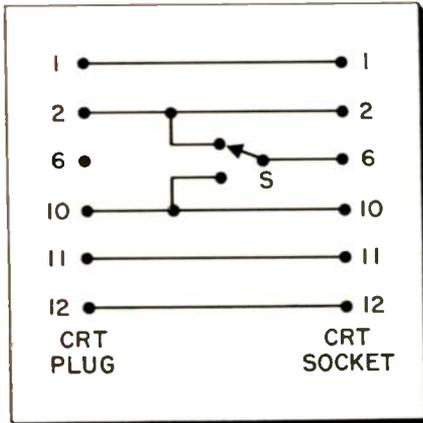


Fig. 1—A low-cost time-saving device selects proper CRT pin for focus jumper strap.

The cost of construction can be made very low by using a discarded CRT brightener. The switch positions should be marked with the respective CRT pin numbers.—Albert J. Krukowski, West Springfield, Mass.

### Fine Tuner Binding

If binding between the fine tuning cam shaft and the tuner detent shaft is experienced with some RCA 170-P-042 and "U" series TV receivers, slight enlargement of the hole in the fine tuning cam shaft will correct the condition. First, remove the spring grip washer holding the fine tuning cam gear and slide the gear

off the front end of the detent shaft, as shown in Fig. 2. Remove the tuner shield and the three screws

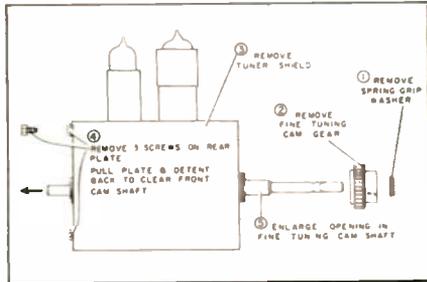


Fig. 2—Fine tuner binding on some RCA TV's can be corrected by enlarging hole in cam shaft with a 1/4" drill held in a tap wrench.

holding the back plate of the tuner. Slowly pull the plate and detent shaft to the rear until the shaft is just clear of the fine tuning cam at the front of the tuner.

Using a 1/4 inch drill, held in a tap wrench or pin vise, carefully enlarge the hole through the cam. Use extreme care not to damage the front wafer of the tuner. Remove all metal particles resulting from the drilling and any burrs that may be present on the detent shaft. Lubricate the detent shaft before reassembling the tuner.—RCA Service Company, Camden, N.J.

### Splicing Aid

Did you ever want to check a resistor or capacitor but hesitated to disconnect a flock of wires at a tube socket or other tie point because of difficulties in proper resoldering? Here is an easy way to overcome this problem, equally useful in handwired or printed circuit sets. Take a length of #22 bare tinned wire and two sizes of twist drills; one size to equal the thickness of the lead on one-half watt resistors and one size to equal the thickness of the lead on two-watt resistors. I use only two sizes. Wind the wire tightly on the shank of the twist drill, leav-

ing a small space between the windings. Make the spirals three eighths to a half inch long.

Now cut the lead on the resistor or capacitor to be checked, leaving an equal amount of lead on each side of the cut. Make the test you desire and then slide a spiral over one end of the cut, bring the ends together and then slide the spiral back so that it covers the cut, as illustrated in Fig. 3. Crimp both ends of the spiral lightly with long nose pliers.

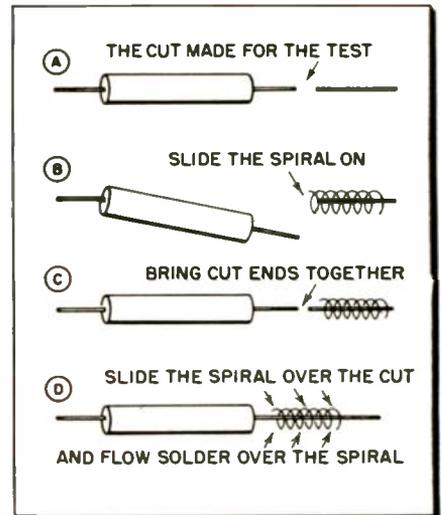


Fig. 3—After a lead is cut and component tested, slide a tight fitting tinned wire spiral over both ends, centering spiral over cut. Crimp spiral ends and solder.

Flow solder over the spiral and you are back in business in a minimum of time and effort with a neat, secure splice. I make up a few dozen in advance, having plenty on hand when needed.—Joseph J. Momeno, St. Louis, Mo.

### SHOP HINTS WANTED!

\$3 to \$10 for acceptable items. Use drawings to illustrate whenever necessary. A rough sketch will do. Photos are desirable. Unacceptable items will be returned. Send your entries to "Shop Hints" Editor, ELECTRONIC TECHNICIAN, 480 Lexington Ave., New York 17, N. Y.

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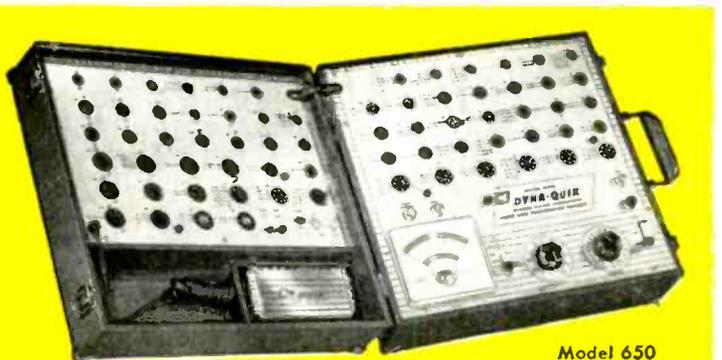
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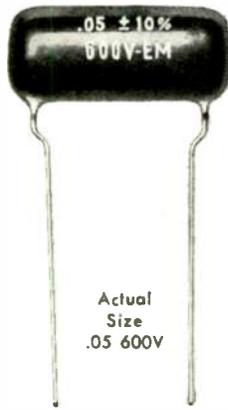


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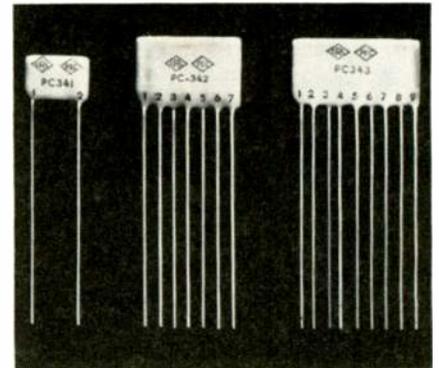
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For more information, write in **ELECTRONIC TECHNICIAN's** new product code number on coupon, on page 57.

### Centralab PACKAGED CIRCUITS

Three new packaged electronic circuits have been added to the firm's PEC replacement line. They are PC-341, PC-342, and PC-343 and have their primary applications in RCA and Philco



TV sets. The firm estimates that there are over 450,000 TV sets in the field in which these packaged circuits may be used. Centralab, Div. Globe-Union, Inc. 900 E. Keefe Ave., Milwaukee 1, Wis. (ELECTRONIC TECHNICIAN 12-5)

### Olson HEADPHONE ADAPTOR

SW-144 monaural headphone adaptor enables listening to any radio, TV, phonograph or amplifier through headphones without disturbing others. Two sets of phones can be connected at one time. Switch allows speaker to be turned off. Volume control adjusts level



of headphone volume. Comes with 20 feet of flat 3-conductor cable and instructions and two standard 1/4" phone jacks. 4"x2 5/8"x1 5/8". Price, less earphones, \$3.00. Olson Radio Corp., 260 S. Forge St., Akron, Ohio. (ELECTRONIC TECHNICIAN 12-38)

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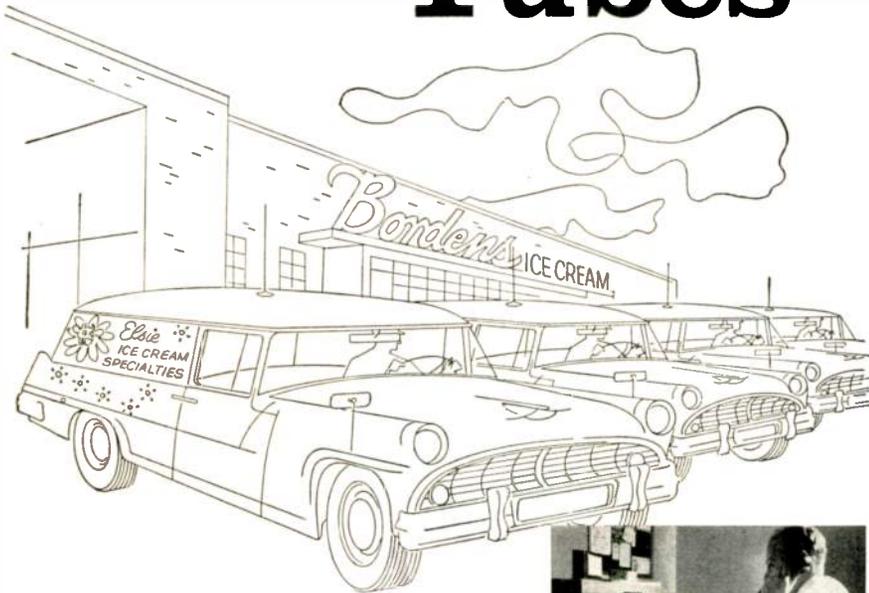
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**RADIO CORPORATION OF AMERICA**

Electron Tube Division

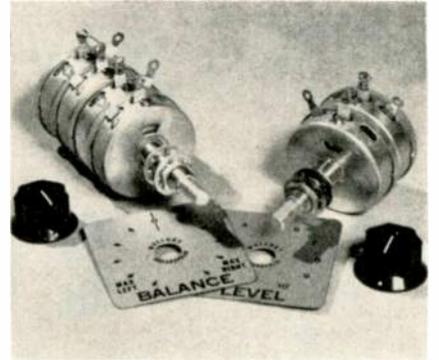
Harrison, N. J.

For the name of your nearest RCA Industrial Tube Distributor, call Western Union by phone number and ask for Operator 25.



**Mallory STEREO CONTROLS**

Two new series "L" controls are: "LA," a level control for monaural hi-fi equipment, available in ratings of 8 and 16 ohms; and "LL," a dual tandem design for stereo balance or master volume control for low level, low impedance audio circuits, available

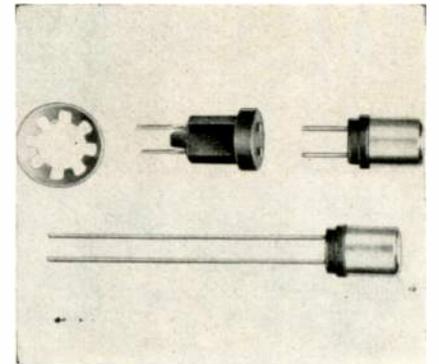


in ratings of 8, 16 and 50 ohms impedance. Each unit is packaged with wiring instructions, mounting nuts to permit adjusting bushing length up to 1", a knob and a two-faced dial plate. P. R. Mallory Co. Inc., P. O. Box 1558, Indianapolis 6, Ind. (ELECTRONIC TECHNICIAN 12-1)

**Littelfuse**

**SUB-MINIATURE FUSE**

Measuring 0.205" in diameter and 0.270" in length, the "Microfuse," with a new type of filament wire, permits close resistance tolerances and high reliability in blowing characteristics across the wide range from 1/500 amp



thru 5 amps at 125 volts. Blowing specifications are: Life—100% of rating; 0-10 seconds—150% of rating. Available in pigtail variety, for soldered connections, and in plug-in variety for chassis or printed circuit board mounting. Littelfuse, Inc., Des Plaines, Ill. (ELECTRONIC TECHNICIAN 12-2)

For more information, write in ELECTRONIC TECHNICIAN's new product code number on coupon, on page 57.

# 1

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10	WMF6S47	.047	600
10	WMF5P1	.1	600

All 40 pieces for only ~~\$140~~ **\$870**  
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**HERE'S THE PACKAGE:**

Typical of the quality C-D builds into every capacitor in their complete line, the assortment's sturdy, space-saving, clear plastic container fits easily into your tool kit. And, when the box is empty, it's perfect for holding small tools and parts you want at a moment's notice.



**HERE'S HOW TO GET IN ON IT:** First in a Series of C-D 50th Anniversary Deals, this limited-time offer is designed to save you money... help you do your job better, easier... keep your customers happy! Get the whole story—and the deal—from your C-D Distributor. Call him today! Get in on Cornell-Dubilier's 50th Anniversary Sales Celebration. (Also ask about C-D's complete capacitor line for industrial electronic maintenance.)

\*Du Pont Reg. T.M.

**CDE** **CORNELL-DUBILIER ELECTRIC CORPORATION**  
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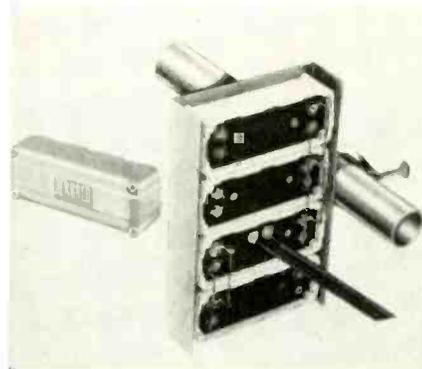
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a **C-D vibrator** for every  
make and model

The C-D brand name on a vibrator is your guarantee of dependable performance, long trouble-free service. Because C-D vibrators are built to last, you can use them with full confidence. That's why it pays to reach for a C-D when a vibrator replacement is called for.

Remember, too, that there's a C-D vibrator type for every make and model car on the road. And the C-D VIBRATOR REPLACEMENT GUIDE makes it quick and easy for you to select the exact type required. Ask your local C-D distributor for a free copy of VIB-3, or write to Cornell-Dubilier Electric Corp., S. Plainfield, N. J.

### Jerrold NETWORKS

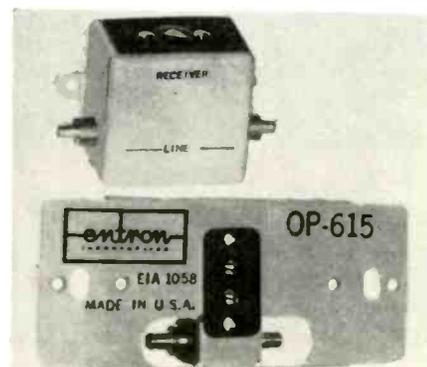
The new TX series antenna mixing networks provide multi-set homes with all-direction reception at the same time on one common line. The models, in the TX series, can be used individually or in any combination to reject unwanted channels and to bring in weaker sta-



tions. They will mix cut-to-channel antennas with a single broad band antenna, separate individual channels, mix or separate VHF and UHF, and mix or separate VHF, TV and FM . . . all without loss of signal. Jerrold Electronics Corp. 15th & Lehigh Ave., Philadelphia 32, Pa. (ELECTRONIC TECHNICIAN 12-24)

### Entron OUTLETS

Available are a series of flush mounting outlets; surface mounting outlets and a group of two-outlet riser line splitters in attenuations from 10 db to 30 db. All three series provide response flat from AM through VHF. The decorative finish OB series (surface mounting) and OP series (flush mounting)



measure 1-1/8"x2 1/16"x3". The flush or surface mounting two-outlet riser line splitters, available for RG-59 or RG-11 type cable, measure 5"x1-1/8"x1-5/8" and are finished in gold iridite. All are equipped with the firm's new "Tug-Plug" fitting for 75 or 300 ohms. Entron, Inc., P. O. Box 287, Bladensburg, Md. (ELECTRONIC TECHNICIAN 12-27)

For more information, write in ELECTRONIC TECHNICIAN's new product code number on coupon.



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# FREE LITERATURE

To receive the literature below without charge, simply circle the numbers on the coupon corresponding to the items of interest. Cut out and mail to **ELECTRONIC TECHNICIAN, 480 Lexington Ave., New York 17, N. Y.**

**1 Ceramic Capacitors:** Literature is available covering a complete new line of Elmenco disc ceramic capacitors. Designed for dependable performance and economy, they have higher voltage ratings, rugged phenolic coating, high temperature wax impregnation and are "space saving" in size. (1B12: Arco Electronics, Inc.)

**2 Two-Way Radio:** A new mobile radio dealer sales program is described in literature. The program has been planned to aid two-way radio service companies in their servicing and selling activities. (2B12: Bendix Radio)

**3 Two-Way Radio:** A new transistorized frequency meter, for servicing two-way radio, is covered in literature. The unit is portable, lightweight, compact and transistorized. Works on adjacent or split channel systems. (3B12: Allen B. Du Mont Labs.)

**4 Master TV Antenna System:** An illustrated four-page short form catalog lists features and technical data on the firm's newly developed master TV antenna system. The system is designed to provide studio monitor reception with one antenna in multi-set installations. (4B12: Entron, Inc.)

**5 Cartridges:** A new 16-page phonograph cartridge catalog and stock control record with a unique silhouette matching method

covers all the 51 cartridges in the firm's line. Includes list prices, voltages and suggested minimum quantity to stock. (5B12: Jensen Industries)

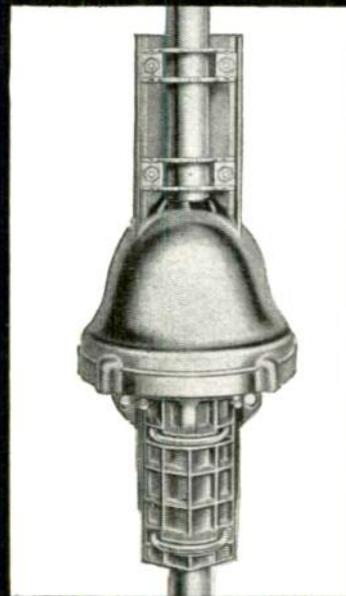
**6 Tube Testers:** A new handy pocket-size brochure, illustrated and printed in two colors covers the firm's complete line of tube testers. Includes two new units. Specifications and prices and full details are given. (6B12: Seco Mfg. Co.)

**7 Antennas:** "A Guide to the Proper Selection of TV Antennas" is the title of a new 12-page booklet. Illustrations, diagrams and a list of TV stations are included. (7B12: Technical Appliance Corp.)

**8 TV Knobs:** A first in the industry is a new wall chart showing 112 most-wanted TV replacement knobs. Photographs of knobs designed to handle over 80% of all TV replacement needs are shown. Information on TV set model numbers, replacement knob number and cross reference data are included. (8B12: TV Development Corp.)

**9 Antennas:** A colorful illustrated giant circular describes the new promotion on the firm's Color'Ceptor antenna line. In the promotion are sales kits, hanging signs, road signs, window decals etc. (9B12: Winegard Co.)

## Cornell-Dubilier Rotors



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your way

Whether you are after original installation business or replacement sales, you'll find the rotor best-suited for any job in the complete CDR line. Consider, the heavy-duty TR-4 recommended for areas where ice-storms, heavy snowfalls and strong winds impair the efficiency of antennas turned by ordinary rotors. Your CD Rotor distributor is ready to show you why the TR-4 and other CD Rotors are the easiest to install...most satisfactory in the long run. Write for catalog TVR to Cornell-Dubilier Electric Corp., S. Plainfield, N. J.

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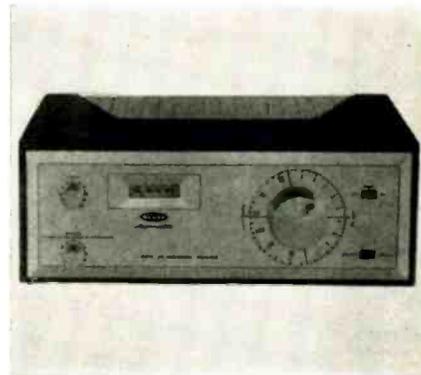
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## Scott FM TUNER

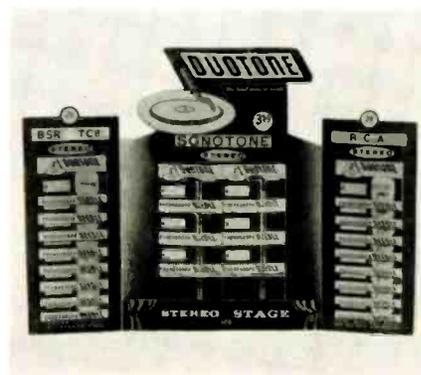
A new model of the 310 FM Tuner, designated as 310C, has increased sensitivity to 1.5µv for 20 db of quieting on 300 ohm antenna terminals. Like its predecessor, it incorporates wide-band design to insure drift-free reception, station separation, high sensitivity and



undistorted response. A local-distant switch has been added to give ultimate sensitivity in fringe areas. The tuner is instantly adaptable to multiplex. A new rotary knob and dial assembly make it easier to read and tune. H. H. Scott, Inc., 111 Powdermill Rd., Maynard, Mass. (ELECTRONIC TECHNICIAN 12-31)

## Duotone STEREO NEEDLES

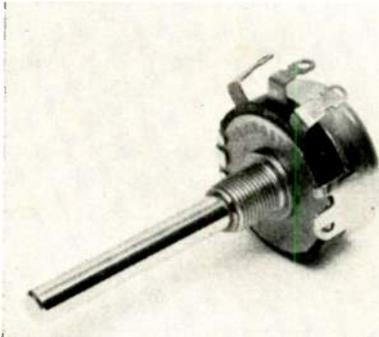
"Duotone 666," a new display unit for self-service, is in the form of a miniature stage with the proscenium lettered "Duotone Stereo Stage." Six best-selling stereo needles are lined up in a row on each of three panels. A wide center panel holds 6 needles for Sonotone stereo players. Each of two



side panels, form wings of the stage, and each hold 6 more stereo needles; one side for Ronnette the other side for RCA. Needle prices are indicated above each row. The display is free to needle dealers with the purchase of "Duotone 666" assortment. Retail list is \$51.00. Duotone Co., Keyport, N. J. (ELECTRONIC TECHNICIAN 12-35)

### Clarostat POTENTIOMETER

Type 45 wirewound potentiometer.  $1\frac{1}{8}$ " diameter size, features a power rating of 4 watts at 40°C., derated to zero at 135° C.; resistance tolerances of  $\pm 10\%$  or closer; one tap only at 50%  $\pm 2\%$  of resistance; 300° mechanical and electrical rotation, 280° effective.



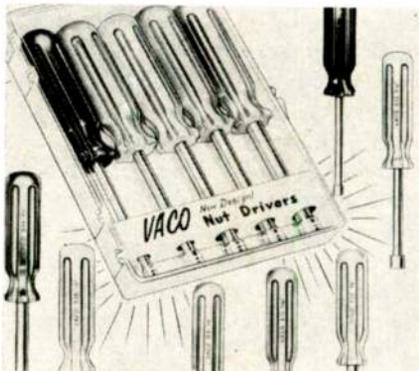
1.2 to 6 oz./in. torque. The new construction is suitable for ohmage from 1 to 10,000, linear, and compatible with resistance wire sizes and contact pressures well within safe limits. Clarostat Mfg. Co., Inc., Dover, N. H. (ELECTRONIC TECHNICIAN 12-4)

### Philco CAPACITOR KIT

A new ceramic case capacitor kit, part #320-8002, includes 70 ceramic case capacitors of 12 different types, a clear plastic "see thru" box and a two color description label. Philco Corp., Parts-Accessories, "C" and Westmoreland Sts., Philadelphia 34, Pa. (ELECTRONIC TECHNICIAN 12-15)

### Vaco HAND TOOLS

A new counter or window display, No. SP-500, consists of a "see-thru" two-tone plastic box containing five chrome-tone nut drivers in the most popular sizes. The box measures 5"x7"x1 $\frac{1}{2}$ " deep, with hinged lid. The nut drivers have color-coded handles:



3/16", black; 1/4", red; 5/16", yellow; 11/32", green; and 3/8", blue. Other features include: tempered sockets, high torque, hex size stamped on the dome and fully polished nickel-chrome shafts. Price, per set, \$4.95. Vaco Products Co., 317 E. Ontario St., Chicago 11, Ill. (ELECTRONIC TECHNICIAN 12-13)

the New

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The new *loose-leaf* Stancor TV Transformer Replacement Guide is just off the press. Its new format makes it the easiest-to-read, easiest-to-use guide ever published. This valuable service reference now lists complete transformer replacement data on over 17,000 models and chassis of 151 brands. It is kept up-to-date by regular mailings directly from Stancor to each registered owner of the TV Guide.

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**FRED BUTTNER'S YELLOW PAGES AD** (1/4-page reduced) features the important facts about his business, as well as some of the well-known brands he services. Buttner's has been a Yellow Pages advertiser since 1950.



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says Fred A. Buttner, Prop., Buttner's Service Co., Jacksonville, Fla.

"Yellow Pages advertising is indispensable to our TV and radio service business. First, our classified ad attracts nearly all our *new* customers—an average of eight a week, or about 400 a year.

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"As far as I'm concerned, no other advertising can compare with the Yellow Pages in reaching both old and *new* customers."

Fred Buttner's company has prospered with the help of Yellow Pages advertising. *Yours* can, too. The Yellow Pages man is ready to plan a Yellow Pages **AWHERENESS** program to match your needs. Call him at your Bell telephone business office today.

Nothing builds business like **AWHERENESS**—and nothing builds **AWHERENESS** like the Yellow Pages—the buying guide that tells people **WHERE** to buy.

## Photocells for TV

(Continued from page 35)

### TV Use

Each type has its proponents. Photocell circuitry used in conjunction with a TV set has been successfully applied by a photoconductive cell manufacturer.

The photoconductive cell's resistance varies with the light intensity, that is, the greater the light, the less the resistance. Since resistance is a common parameter in electronic circuits, replacing a critical resistor with a photoconductive cell will translate the circuit into a function of light.

"But how can light be used in conjunction with a TV set?" Well, if the manual contrast and brightness controls are adjusted for comfortable viewing in a semi-darkened room,

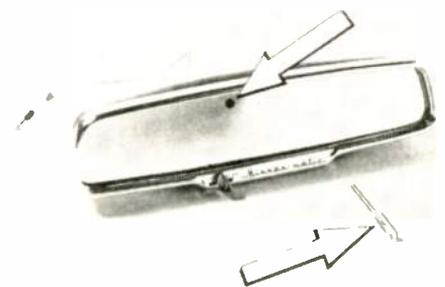


Fig. 3—A rear-view auto mirror employs a photocell to automatically adjust for annoying reflected light when driving at night.

the picture will have a "washed out" appearance if the room lights are turned on. This would require re-adjustment of these controls. If the lights are turned off, the picture would then be too bright for comfortable viewing and, once again, the controls must be adjusted.

Therefore, consider the practicality of a photocell—small, inexpensive and sensitive to light variations, employed in a simple circuit that automatically corrects for degrees of room illumination.

### Circuitry

Automatic picture control with illumination may be achieved by applying the output voltage of the photocell to the receiver circuit in a manner to vary the video voltage on the picture tube as well as its

bias. This may be accomplished in a number of ways. The video voltage may be controlled by varying the bias on a video amplifier or on an i-f amplifier outside the automatic gain control loop. It may also be varied by "bucking" the age voltage with the output of the photocell, thus varying the output of the video detector. The picture tube bias may be varied by connecting the output of the cell directly to the picture tube

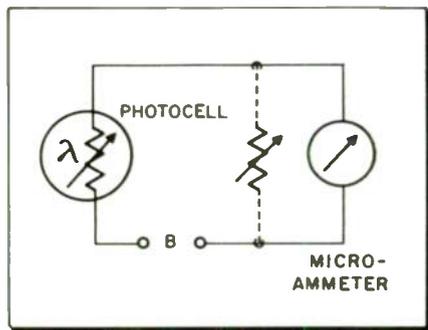


Fig. 4—A low voltage battery provides the supply for a photocell circuit which can be employed for exposure meters. A variable resistor is used for meter calibration.

grid, or a voltage proportional to its output to the cathode.

It is possible to select circuit parameters so that the peak black grid-cathode voltage at the picture tube remains essentially constant as the photocell output varies, while the peak white voltage varies.

Figs. 1 and 2 show two schematics illustrating the use of the photocell in this application. In each circuit the video signal is varied by controlling the bias on a video amplifier, while the picture tube bias is varied in a different way in each circuit. Peaking coils and other essentials have been omitted for simplicity.

In Fig. 1 the output of the photocell appears as a positive voltage across  $R_3$ . This is applied to the grid of the video amplifier, reducing its bias. An increase in room illumination increases the output of the photocell, thus increasing the gain of the video amplifier and decreasing its d-c plate voltage which results in a decrease in the positive voltage at the cathode of the picture tube via the resistance divider  $R_1, R_2$ . The values for  $R_1$  and  $R_2$  may be selected for optimum control of both contrast and brightness.

Fig. 2 is similar, except that the output of the photocell is applied directly to the grid of the picture tube.

(Continued on page 62)

1551 pages

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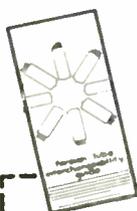
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A complete 14-watt hi-fi amplifier-preamplifier combination in one stylish unit . . . and at less than half the price you would expect to pay!  
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**14-WATT HI-FI ECONOMY AMPLIFIER (EA-3)**

From HEATHKIT audio labs comes an exciting new kit . . . New Styling, New Features, Brilliant Performance! Designed to function as the "heart" of your hi-fi system, the EA-3 combines the preamplifier and amplifier into one compact package. Providing a full 14 watts of high fidelity power, more than adequate for operating the average system, the EA-3 provides all the controls necessary for precise blending of musical reproduction to your individual taste. Clearly marked controls give you finger-tip command of bass and treble "boost" and "cut" action, switch selection of three separate inputs, "on-off" and volume control. A hum balance control is also provided.

**NOTE THESE OUTSTANDING SPECIFICATIONS:** HARMONIC DISTORTION, less than 2% (20 cps-20 kc) at 14 watts. I.M. DISTORTION, less than 1% (60 and 6,000 cps, 4:1) at 14 watts. FREQUENCY RESPONSE, 20 cps-20 kc,  $\pm 1$  db at 14 watts. HUM & NOISE, mag. phono input, 47 db below 14 watts, tuner and xtal phono input, 63 db below 14 watts. A truly remarkable buy for the beginning or advanced audiophile.

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Send for this free catalog describing over 100 easy-to-build kits in hi-fi-test-marine and amateur radio fields.

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(Continued from page 61)

A portion of this output is obtained across  $R_2$  and applied to the grid of the video amplifier to reduce its bias and increase its gain. Again, the choice of resistors in the divider  $R_1$ ,  $R_2$  sets the optimum relation of video voltage to bias at the picture tube.

Either circuit may be finally adjusted for correct operation by first setting the manual controls for an appropriate picture with the room darkened and then adjusting  $R_3$  for a duplication of the original picture with the room brightly illuminated. The illumination may be switched on and off a few times to check the adjustment.

**Other Uses**

High sensitivity, small size and weight and low cost yields a versatile component currently being used for an automatic automobile rear-

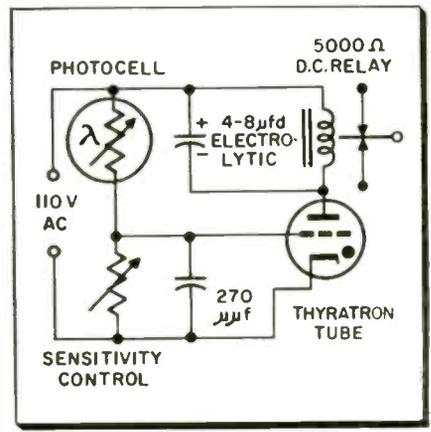
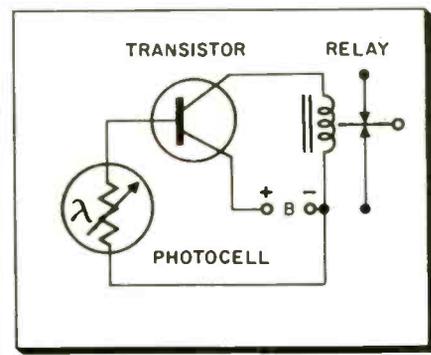


Fig. 5—In a circuit employing an RCA 5823 cold cathode thyatron and a relay, this selenium-type cell can be used as a burglar alarm or fire detector if covered with a red-sensitive filter, such as a Wratten #87.

Fig. 6—The small size of a photocell can be combined with transistor circuitry to provide compact units for a variety of uses.



view mirror, shown in Fig. 3, a headlight dimmer and street light controls, among others.

Fig. 4 illustrates a simple circuit which can be employed for exposure meters, densitometers, etc. A low voltage battery, for example one mercury cell, may be used. A variable resistor shunted across the ammeter is used for calibration purposes. The meter sensitivity needed will depend upon the battery voltage employed and the light sensitivity required.

Burglar alarms and fire detectors are good examples where photocells can be used. Fig. 5 illustrates a circuit using a cold cathode thyatron and a relay.

The compact size of the photoconductor cells makes it a good partner for transistors. A simple transistor circuit is shown in Fig. 6.

#### Characteristics

Cadmium sulphide, cadmium selenide and lead sulphide are just some of the materials used to form the semiconductor cells. Time constants are usually in the millisecond range.

Research is intensive in this field and their full potential is still to be realized. They are being used successfully, as evidenced by its numerous applications. A recent consumer product using photocells is the home motion picture camera with automatic exposure made possible by this component. Other products will surely take advantage of its properties as time progresses. •

Illustration and information credit: Clairex Corp., New York, N. Y.



# AVR

## the NEW PERMA-POWER



Model D-200

## Automatic Voltage Regulator will make you money and save you grief

**It's easy to sell.** There have been units similar to this on the market before—at prices upwards of \$75.00. The new PERMA-POWER Automatic Voltage Regulator has a list price of \$9.95—so *any* TV set owner can afford it . . . and any customer plagued by picture flutter, shrinking, flop-over, loss of brightness, and other similar disturbances will *want* it.

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**It's easy to install.** You plug it in, and it's ready to work; goes on and off with TV set. Compact and lightweight, it has no tubes, ballasts, relays, or other moving parts to fail; and it's fully guaranteed for one year. Can be used on any TV set or appliance rated up to 300 watts. See it at your distributor today.

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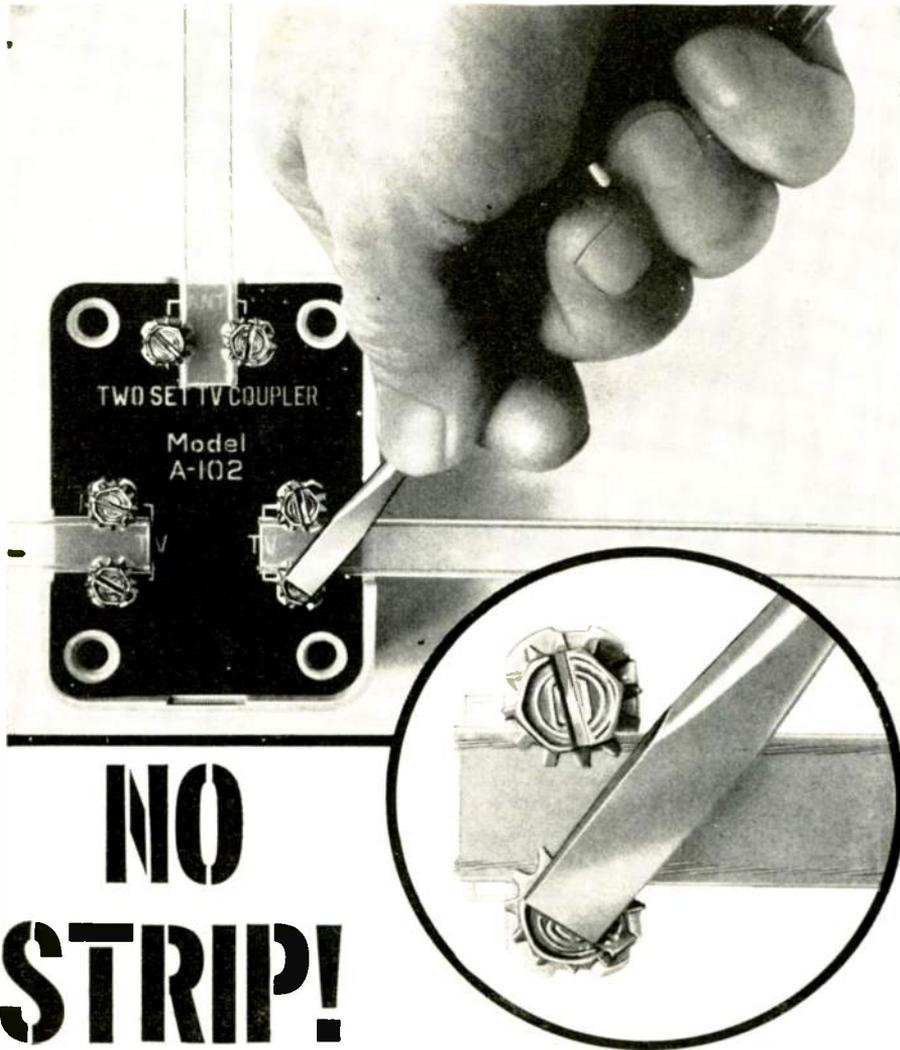
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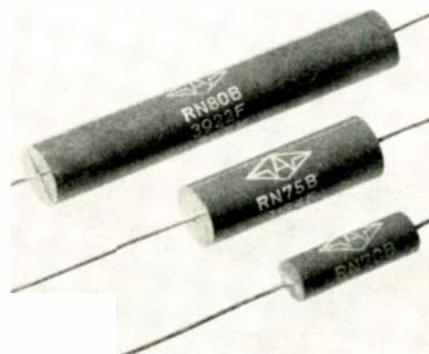
Higher voltage ratings, rugged phenolic coating and high temperature wax impregnation are some of the features in a complete new line of "space-saving" sized disc ceramic capacitors. The standard line has  $\pm 10\%$  tolerance and a 1,000 VDCW rating, with a capacitance range of  $5\mu\text{f}$  to  $30,000\mu\text{f}$ . Also higher voltage ratings are available;



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5 megohms in the  $\frac{1}{2}$  watt size, 10 ohms to 10 megohms in the 1 watt size and 30 ohms to 20 megohms in 2 watt size. Designed for full load at  $70^\circ\text{C}$  and derated to zero load at  $150^\circ\text{C}$ , these resistors meet and exceed the insulation resistance requirements of MIL-R-10509C. Aerovox Corp., Hi-Q Div., Olean, N. Y. (ELECTRONIC TECHNICIAN 12-6)

# Maintaining 2-Way Radio

(Continued from page 45)

transmission. The voice wave-shape is complex and has peaks which do not occur in a pure sine wave. For this reason the voice check is suggested.

### Power Input

FCC rules and regulations state: "The licensee of each station shall employ a suitable procedure to determine that the plate power input to the final radio frequency stage of each base station or fixed transmitter... does not exceed the maximum figure specified on the current station authorization." This check must also be made at the time previously specified for other checks.

The power input to the final r-f stage of a transmitter is the product of plate current and plate voltage:

$$\text{Power input} = \text{plate voltage} \times \text{plate current};$$

where power input is in watts, plate voltage in volts, and plate current in amperes. If a milliammeter is not in the plate circuit of the output tube, or cannot be inserted conveniently, the plate current may be derived from the cathode current by means of the following formula:

$$I_p = I_c - I_{sg} - I_g$$

where  $I_p$  is the plate current,  $I_c$  the cathode current,  $I_{sg}$  the screen grid current, and  $I_g$  the control grid current. If screen grid current ( $I_{sg}$ ) cannot be metered conveniently, then it can be calculated by:

$$I_{sg} = V_{rsg} / R_{sg}$$

where  $V_{rsg}$  is the voltage across the screen resistor, and  $R_{sg}$  is the resistance of the screen resistor. See Fig. 2.

### Publications

A complete list of the Commission's rules and other publications may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington 25

D.C., at nominal cost.

A list of FCC Forms most commonly used by customers of communication service companies, is shown in Chart 1.

### Outlook

There is a strong possibility that "Ionospheric scatter" or "beyond the horizon" transmission techniques will eventually make available more channels for longer distance communications purposes.

The FCC is constantly encouraging more effective and wider application of radio; promoting greater and more equitable utilization of available frequencies.

In view of this, the technician should periodically review FCC operating frequency bands and measurement requirements. Remember, the person making these measurements and checks must sign his name and address in the station log. He is then responsible for the accuracy of the measurements. •

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**RADIO CORPORATION OF AMERICA**  
Electron Tube Division  
Harrison, N. J.

## Aligning FM Tuners

(Continued from page 37)

create a false "zero" level. Use the absolute minimum marker amplitude, and remove it to make sure it is not affecting the shape (Fig. 3E and 3F).

The side markers, indicating width, can best be inserted by a Marker Adder (Fig. 4). This avoids putting the marker signal through the tuner and enables you to have a clear marker without interfering with the response. After making sure you are measuring true response, and what scale you are looking at, proceed to align the i-f.

Some i-fs are built with critical coupling, some under-coupled and some over-coupled. In theory best overall performance can be achieved by using some of each. But some designers find this method more difficult to align. So they use all under-coupled types, and stagger them to get a similar effect.

### Over-coupled I-Fs

Aligning an over-coupled i-f can be difficult because you never know exactly where each circuit is tuned. Off-tune settings will either have the bumps too far apart, or one will be higher than the other (Fig. 5A, 5B). As you tune one winding through the same frequency the other is tuned to, one bump will be approaching the other, then the other bump will start moving away. Nearest point to coincident tuning is when the two bumps are closest together. Some superimposed traces are shown in Figs. 5C, 5D, 5E.

If the dip frequency does not happen to be at the right point indicated by the marker, both circuits need adjusting in the direction noted. Adjust until moving the setting of either primary or secondary starts to widen the spacing of the bumps, and they are located so that the dip is at the required frequency.

With critical or under-coupled i-fs, tuning either winding can make the bumps coincide, and it is much easier to get an idea of which way the adjustment has to go. If the set has all critical or under-coupled i-fs, then the tuning needs staggering, unless you are tuning to mini-

mum bandwidth to win sensitivity for fringe area reception.

The curve shaping may change as you alter level. This happens because the response of some i-f stages change with different levels, due to Miller effect of the following tube. When this happens, adjust the response so that its average shaping is what it should be, with minimum deviation if level is varied above or below the ideal point.

#### I-F Section

Having tuned each i-f by itself, so you know they are at least approximately correct, start at the last one, and move the input connection back stage-by-stage until you have the response of the whole i-f section, doing some final trimming to get the right shape as you go along. Each time you add an extra stage, you will need to turn the input down to avoid overloading, because you now have more gain. If you don't find this reduction in input necessary at some stage, check carefully to make sure the stage is functioning. The tube may not be amplifying, or the i-f transformer may have one of its windings way off tune.

The objective is to get the top of the response curve as near flat as possible, with the side as near vertical as possible (Fig. 5F). True, the limiter will flatten the top; but the overall performance will be better if the response approximates flat before limiting. Limiting should only have to care for transmission fluctuations in amplitude, not for effects due to mistuning.

#### Stagger Tuning

If you are making the best of under-coupled type i-f's, first note which transformer is capable of giving the sharpest response. This is the best one to spread in a stagger (Fig. 5G, 5H). Readjust it so the double humped effect is achieved, with the dip at the nominal i-f frequency. You will find double humping results in considerable loss of gain, so the result has to be a compromise in this type tuner. When you have one circuit double-humped, leave its tuning alone, and try adjusting the overall response with the other circuits. If you need to readjust the double humped one, do it on its own, and then go back to adjusting the overall response with the rest.

#### Discriminator Curve

Aligning the discriminator or ratio detector on its own is also a must. Adjust primary and secondary so the curve has its zero point right on the i-f frequency, indicated by the crystal marker, and is balanced on either side of it. Here is where a marker adder is very useful. At the zero point, when correctly adjusted, the circuit has no gain—and very little immediately on either side. So adding a marker to the

input signal means the marker signal needed to make it visible may be enough to upset the response over the whole curve—especially when you include the i-f's in the final overall check.

Adding it to the output does not produce a null at zero, but avoids overloading the tuner circuits. However, the true tuning is in fact aided by the fact a null occurs, because the marker pip should be split into two equal parts (Fig. 6).

(Continued on following page)

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In Canada: Atlas Radio Corp., Ltd., Toronto, Ont.

(Continued from preceding page)

When you align the whole i-f and detector section, don't adjust the detector (discriminator or ratio type) without checking back to just that circuit by itself. Sometimes wrong tuning of an i-f may throw the discriminator curve off balance. Maybe adjustment of the discriminator transformer can bring it back, but it's the wrong way to do it. The result compounds distortion, even though it may look like a better curve.

If you use the "quick" method, always align the discriminator first. Then, without further touching the discriminator, you proceed to align earlier successive i-f stages.

You may have to switch the marker off to see the exact shape of the discriminator (or ratio detector) curve. It should be a straight line where it slants through the zero point, and for full fidelity reception, at least 100 kc (.1 mc) either side of it. It should be balanced on each side—not one side larger than the other. It should also hold its shape over a considerable range of input level change. But if it does not there is not too much you can do about it—except to achieve the best compromise settings of all the i-fs. It means the circuit is basically susceptible to level changes; something that has to be designed out, it cannot be aligned out.

## Front End

If you have a generator with FM carrier frequencies you can use it to align the front end, having already set the i-fs. If not, you may be able to use a couple of stations in the area, one near either end of the band. Trim to get maximum limiting on each station.

The service technician using an average service sweep generator must usually be content with getting to know the feel of his equipment, so he knows what is "good enough" to give good reception in the area where he operates, and can tell which way work is progressing when he has a tuner on the bench.

Watch out for "silly" things. When you turn down the input and the output does not drop to correspond, either you are measuring something "foreign"—possibly the output of the marker generator—or stray pickup is bypassing your input control. •

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## Association News

### California

RTASCV, Santa Clara Valley, reports members participating in a lively and informative discussion regarding service call charges. "Acting on information brought to light in the discussion, the association states that members agreed \$7.50 would be recognized as a legitimate service call charge, although individual firms were left to decide for themselves what charge schedule and method they would set. . . . Several members indicated they would move into the seven dollar area immediately." The group also announced the election of the following officers: Pres., Russell J. Hamm; V.P., Herb Lewis; John C. Murphy was retained as Sec'y-Treas.

### Illinois

NATESA, Chicago, executive director, Frank Moch, in answer to an EIA report said to blame independent service technicians for "killing" the second set market, accused the manufacturers of buck-passing. Said the NATESA director: "The EIA charge that the second set market has been killed by incompetence, both technical and in public relations, of independent service people, is very unfair. This is proved by the annual Roper Surveys which allegedly show that the public is exceptionally well satisfied with both the service rendered and the attitudes of servicers."

ARTS, Chicago, elected: Chairman, Joseph Ehlinger; Vice-Chairman, Harold Nueschen; Sec'y-Treas., Yuki Minaga; and Sgt.-at-Arms, Delmar Kotrba.

### New York

ARTSNY, New York City, elected the following officers to serve in 1960: Pres., Edward Eisen; V. P., Charles Edwards; Exec-Sec'y., Herbert Schneider; Treas., Philip Goldfarb; Corres.-Sec'y., Peter LaPresti; Record'g Sec'y., Jacob Allen; Sgt.-at-Arms, Henry Ruscoll.

### Ohio

ETAT, Toledo, reports over 100 delegates attended the TESA of Ohio convention in Akron recently. NATESA's Frank Moch addressed the group and stressed the importance of a concerted effort to force set manufacturers to abandon their plans of invading the service business. Competition from manufacturers was vehemently attacked, especially the activities of the RCA Service Co. Russ C. Hanson of RCA

Service Co. pointed out his company's stand on that issue, which is unacceptable to TESA members. The following TESA officers were elected: Pres., Vern LaPlante; 1st V.P., Don Sisk; 2nd V.P., Raymond Braun; 3rd V.P., Paul Lecoy; Sec'y., John Graham; and Treas., Marvin Miller.

### Pennsylvania

ESDA, Pittsburgh, presented the NATESA citation and ESDA achievement awards to KDKA TV, at its third annual "All Industries" banquet here.

### Texas

TEA, San Antonio, denies rumors that it has sought affiliation with NATESA or any other national association.

### Washington

TSA, Seattle, reports a formal request has been made to Mayor Gordon Clinton for a full and genuine investigation of the do-it-yourself tube tester question. The request was based on lengthy evidence previously submitted to the City Council, including replies received from five major tube manufacturers.

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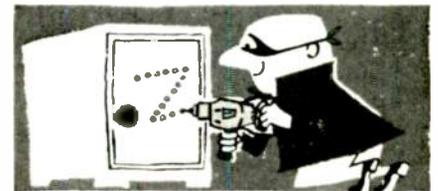
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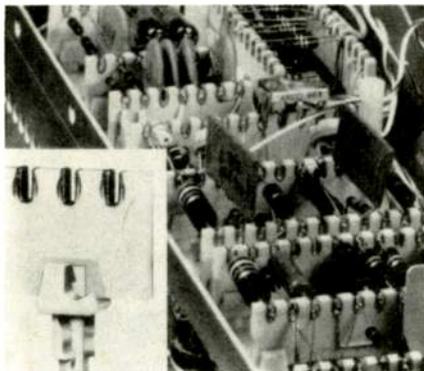
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### Tektronix TERMINAL STRIPS

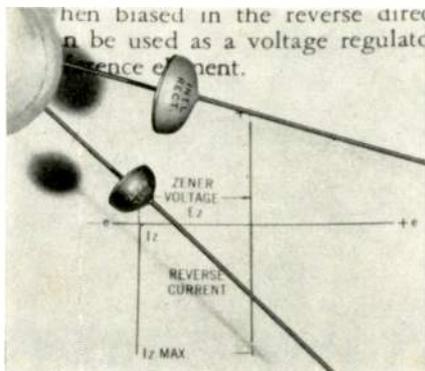
A new line of ceramic terminal strips is available in seven standard sizes with from one to eleven silvered notches, pre-tinned for instant soldering. They may be mounted even over tube sockets to conserve space. Originally developed for use in the assembly of the firm's oscilloscopes and auxiliary equipment to reduce the required area



and the depth of the chassis, the strips come with one or two nylon yokes assembled, depending on size. Three sleeve heights are available to vary clearance of strips over chassis. Connection will not break or let go when subjected to shock or vibration. Tektronix, Inc., P. O. Box 831, Portland 7, Oregon. (ELECTRONIC TECHNICIAN 12-14)

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in the sealing of zener diode junctions, a 3-layer seal, termed "Tri-Sealed", to assure high resistance to humidity, shock, vibration, temperature extremes and other adverse environmental conditions. This new series is covered in the firm's bulletin SR-257. International Rectifier Corp., 1521 E. Grand Ave., El Segundo, Calif. (ELECTRONIC TECHNICIAN 12-10)

### Pyramid CAPACITORS

The fourth in the firm's current series of special promotions for radio and TV service technicians is the special V.I.P. assortment. It includes five each of the following TD-25-25, TD-20-150, TD-150-300, TD-8-450, TD-20-450, and TDL-5030-150. Retail value of these thirty capacitors is \$51. The attache case, a \$2 value, looks and



feels like top grain leather and is offered free. Complete assortment, valued at \$53., is available to service technicians for \$19.95. A serviceman may also personalize the case by sending 10¢ to Pyramid for each gold initial ordered. Initials are 18 kt. gold plated. Pyramid Electric Co., 507 26th St., Union City, N. J. (ELECTRONIC TECHNICIAN 12-16)

## UPPER STRATA STRATEGY!

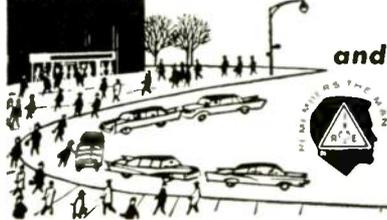
Friend of ours who always attends the sessions in the lecture halls, starts on the Fourth Floor with Production Items . . . and works his way down to Components on the First Floor. Says his feet tell him it's easier to come down than to go up! And he never misses a trick this way. Sounds like good engineering logic. Why don't you join him this year . . . and see if it doesn't work for you!

*Will Copp*  
Show Manager

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## RCA TUBES

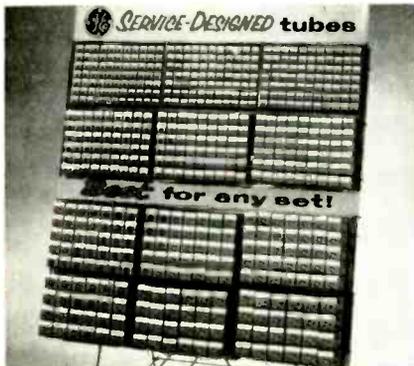
Two new beam power, 9 pin miniature, tubes are: 7551 for use in mobile communications equipment operating from 6-cell storage-battery systems; the 7558 is designed primarily for use in fixed-station and other communications equipment using 6.3-volt heater supplies. In such communications equipment, these tubes are particularly



useful in class C rf-amplifier, oscillator, and frequency-multiplier service, and can be operated at full ratings up to 175 mc. They are also useful in modulator and af power-amplifier applications. Also announced are the 7552 and 7554 hi-mu triodes featuring ceramic-metal construction and space-saving pencil-tube design, and especially suited for uhf service in portable field equipment, missile-guidance systems, and satellite communication applications. Radio Corp. of America, Electron Tube Div., Harrison, N. J. (ELECTRONIC TECHNICIAN 12-8)

## GE TUBE DISPLAY RACK

665 receiving tubes, in a typical stock complement, are held in a new rack, which stands approximately 5 feet high and 3½ feet wide, or can be wall mounted. It consists of a wrought iron



frame designed to hold twelve cases of identical size. Each case holds from 24 to 77 tubes depending on tube size. General Electric Co., Receiving Tube Dept. Owensboro, Ky. (ELECTRONIC TECHNICIAN 12-17)

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7. SEPARATE FILAMENT VOLTAGES — Including the very latest 2.35 volt and 8.4 volt types as well as the older 6.3 volt types.
8. TESTS, REPAIRS AND REACTIVATES 'SF' PICTURE TUBES — found in the newest Sylvania and Philco TV sets. These picture tubes have different base pin connections than standard picture tubes and there is always an element of risk that the tube may be burned out when tested with ordinary picture tube testers. The CRT-2 is designed to accommodate this new base pin arrangement and will test the tube with no danger of damage.

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- ✓ for life expectancy

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- ✓ Will clear inter-element shorts and leakage
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- ✓ The unique controlled 'SHOT' (high voltage pulse) method of reactivation provided by the CRT-2 will restore picture tubes to new life in instances where it was not possible before. Furthermore the high voltage is applied without danger of stripping the cathode as you always have perfect control of the high voltage pulse.
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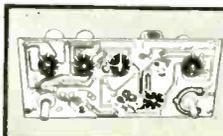
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**Catalogs & Bulletins**

**COMPONENTS:** Bulletin #59-6 is an 8-page, 2-color catalog covering dials, drives and mechanisms. Specifications are included. National Radio Co., Malden, Mass. (ELECTRONIC TECHNICIAN B12-7)

**PANEL INSTRUMENTS:** A new, colorful, 8-page brochure, bulletin #2059A covers the firm's stock panel instruments. Illustrations, specifications and prices are included. Simpson Electric Co., 5200 W. Kinzie St., Chicago 44, Ill. (ELECTRONIC TECHNICIAN B12-11)

**ANTENNAS:** Loose-leaf data sheets, fastened into a sturdy cover, provide information on some of the firm's more popular antennas and equipment. Included are illustrations, diagrams, specifications and prices. Telrex Laboratories, Asbury Park, N. J. (ELECTRONIC TECHNICIAN B12-12)

**DIODES:** A technical bulletin describes the new semiconductor compensating diode, RCA-IN2326. This unit offers improved AF amplifier performance over wide range of temperature and voltage variations. Radio Corp. of America, Semiconductor Div., Somerville, N. J. (ELECTRONIC TECHNICIAN B12-18)

**SOLDERING IRONS:** A 2-color catalog sheet describes a new line of soldering irons with built-in magnastat temperature control. Illustrations, performance chart, specifications and prices are given. Weller Electric Corp., 601 Stone's Crossing, Easton, Pa. (ELECTRONIC TECHNICIAN B12-19)

**TRANSISTOR EQUIPMENT:** "Servicing Transistor Equipment," Bulletin PA-217, recommends tools and equipment for use in servicing transistors. It describes current and voltage measurements and includes a section on balancing output transistors. CBS Electronics, Information Services, 100 Endicott St., Danvers, Mass. (ELECTRONIC TECHNICIAN B12-2)

**DIGITAL TAPE HANDLER:** A new 3-color, 8-page brochure covers the FR-400 digital magnetic tape handler. The booklet includes complete specifications on the machines which are available with  $\frac{1}{2}$ -,  $\frac{3}{4}$ - or 1-inch tape, providing up to 32 data channels. Ampex Corp., Instrumentation Div., 934 Charter St., Redwood City, Calif. (ELECTRONIC TECHNICIAN B12-1)

**HI-FI & STEREO EQUIPMENT:** A new 2-color catalog, "Altec, the True Sound of Music," reviews the firm's line of hi-fi equipment, illustrates custom mono and stereo installations and provides a special section which diagrams the proper placement of speakers and other components in a room. Altec Lansing Corp., 1515 S. Manchester Ave., Anaheim, Calif. (ELECTRONIC TECHNICIAN B12-15)

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**HOW TO USE METERS (2nd edition)** by John F. Rider & Sol D. Prensny Engineers, laboratory and service-technicians—everyone who uses meters in their daily work—will find this revised, expanded and modernized version of the fabulously popular original text absolutely indispensable.

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Explains in detail the construction and operation of all types of electrical meters to use for making different kinds of measurements in electronic and electrical equipment and industrial applications. Also explains how to make measurements... namely, where to connect the meters. A section is devoted to multi-phase circuit measurements. #144, \$3.90.

**HOW TO INSTALL AND SERVICE AUTO RADIOS (2nd edition)** by Jack Darr. The 2nd edition of this extremely informative and practical book brings auto radio installation and servicing right up to date. All the new tricks of the trade are to be found here. The techniques applicable to the most modern auto radios—signal-seeking tuners, hybrid auto radios, transistor auto radios, conversion from 6 to 12 volt operation, and many more new things are explained in great detail. The author, an expert in this field runs a very successful auto radio and mobile radio installation and service shop. This 2nd edition contains practical, proven solutions and is really a money making "tool" #159, \$3.25.

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**LABORATORY WORKBOOK**, 32 pp. #161-2, \$.95.  
**TV PICTURE TUBE-CHASSIS GUIDE**, by Rider Lab Staff. This easy-to-use TV tube type chassis guide covers all picture tube types used in TV receiver production from 1946 to February 1957—over 7,000 listings. Organized by chassis number, and in some cases, by models so that the technician can immediately locate the correct picture tube type simply by knowing the chassis number, #204, Only \$1.35. Dept. ET-12



## New Books

Book marked with an asterisk (\*) may be obtained prepaid from Electronic Marketers, Book Sales Division of Electronic Technician

**\*TWO-WAY RADIO.** By Allan Lytel. Published by McGraw-Hill Book Co. 304 pages, hard cover. \$9.50.

The growing field of two-way communications is explored for technicians in this compact volume. Written in a straightforward manner, the author covers both mobile and fixed base radio transmitters and receivers. Transmitter theory is thoroughly discussed with a minimum of mathematics. Antennas, Selective Calling, Power Supplies, Test Equipment and Servicing chapters provide the reader with a good overall picture of two-way radios. Generous use of photographs, drawings and charts further enhance this informative guide.

**GE TRANSISTOR MANUAL.** Published by General Electric Co., Semiconductor Products Div., Charles Bldg., Liverpool, N. Y. 277 pages, soft cover. \$1.00.

Unlike receiving tube manuals, transistor manuals for technician use are relatively rare. GE's fourth edition helps to fill this void. Completely rewritten in an effort to bring fast-moving transistor applications up-to-date, the text includes some of the following chapters: basic semiconductor theory, transistor radio servicing techniques, hi-fi circuits, audio amplifiers. In addition, there is a revised listing of American JEDEC-registered transistor types, with basic specifications and interchangeability information.

**ADDITIONAL 1959 TV SERVICING INFORMATION.** Vol. TV-16. Compiled by M. N. Beitman. Published by Supreme Publications, 1760 Balsam Road, Highland Park, Ill., 192 pages, soft cover. \$3.00.

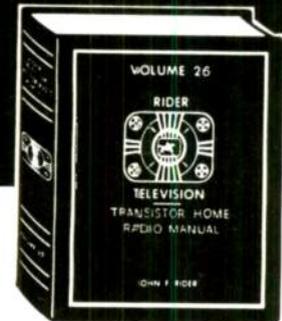
As the title implies, this volume is a compilation of TV schematics and servicing information covering 1959 TV receivers not included in a previously published volume. It includes alignment, waveforms, CRT removal, etc.

**\*PRINCIPLES OF ELECTRONICS.** By M. R. Gavin and J. E. Houldin. Published by D. Van Nostrand Co., Inc. 348 pages, hard cover. \$5.75.

The basic principles of tube, transistor and other electronic devices are thoroughly covered in this text, together with their applicable circuits. The book is intended for the mature technical student as a background prior to specializing in a particular college-level phase of electronics. Though the mathematical treatment rarely uses calculus, a good knowledge of pre-engineering math is necessary to fully appreciate the broad electronics foundation to be garnished from the text.

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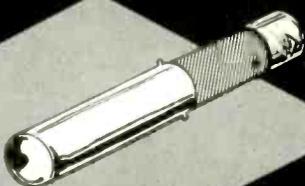
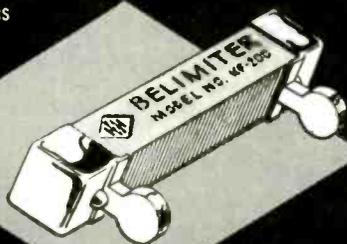
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## Damper Faults

(Continued from page 41)

instance, a blocking condenser in the yoke circuit changed capacity, causing the trouble.

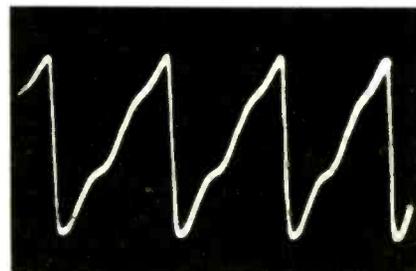
Another example is damper ringing. Fig. 8A shows a raster with three bright vertical bars, and a thin bright edge at the extreme left. Fig. 8B illustrates a sawtooth current trace from the yoke. Note the slow beginning of trace, creating

Fig. 8A—Vertical "ringing" bars in the raster caused by a wide change in value of the boost capacitor. (B)—Unlinear sawtooth current waveform indicates points where beam slows. (C)—A normal voltage waveform at the horizontal output tube plate. Some residual oscillation appears. (D)—A distorted base line between the damper voltage pulses directed attention to faulty boost network.

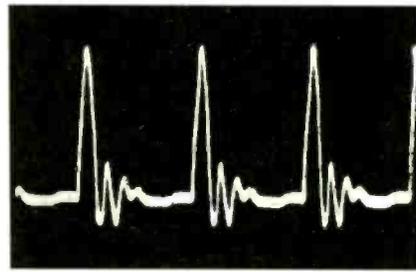
(A)



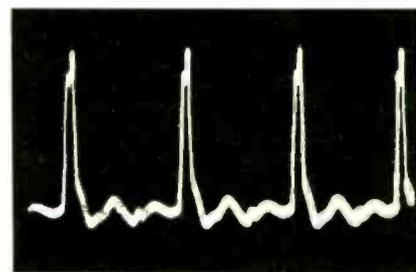
(B)



(C)



(D)



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the narrow bright strip on the extreme left. Observe the two major dips in the trace, corresponding to the brightest bars on the screen. The dim vertical bar in between is evident on the scope when a single cycle is traced and with horizontal gain lowered. A scope waveform taken at the horizontal output plate appeared normal, as shown in Fig. 8C. The voltage pulse at the damper high side, indicated in Fig. 8D, reveals ripple distortion on the base line. This pointed to trouble directly in the damper circuit. A wide capacity located in the boost network caused the "ringing" by upsetting the boost ripple phasing.

**Isolating Boost Circuits**

It is generally agreed that a look at the manufacturer's circuit schematic is one of the best ways to begin a bench job. This pause gives the technician a chance to reason, and therefore formulate a better method of attack. In this case, attention is directed first to circuits taking voltage from B + boost.

Some technicians are occasionally awed by horizontal oscillator circuits operating from B + boost. A quick answer to this question is a substitute power supply. Circuit patching (taking proper boost voltage from another TV on the bench or a power supply) is utilized by many technicians not having modern "analyst" equipment, including built-in substitution functions. The patched voltage, should, of course, be properly fused.

Substituting a voltage equal to the original boost at the horizontal oscillator quickly clarifies the question, "which failed first, oscillator or the boost?"

Many sets employ boost voltage to vertical sweep circuits. Checking the manufacturer's schematic reveals this fact. Disconnecting the boost supply line to the vertical circuit, while observing boost voltage on a VOM, will immediately orient the fault—often saving wasted time in probing wrong areas. Other circuits operating from B + boost are treated in a similar manner.

A number of situations arise where insufficient high voltage is being produced to provide a raster. Sawtooth voltage at the horizontal output tube grid is normal. Scope probing at the high side of the damper, and a series

(Continued on following page)

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(Continued from preceding page)

current probe at the low end of the horizontal deflection coils will often point the way to the trouble area.

### Case Histories

A group of RCA direct drive sets, using 6CD6's showed insufficient width, burned up 6CD6's, damaged flybacks and critical agc. Investigating the damper boost circuits revealed nothing more startling than: (a) some linearity coils had previously overheated, lost most of the wax outer coating, absorbing considerable moisture during humid weather; (b) other linearity coils were in good condition but had been misadjusted by do-it-yourselfer's; (c) some coils had one or more turns shorting under load.

In more than half of this entire group, the horizontal output transformers were damaged from overheating. All customers complained of frequent replacement of expensive output tubes. After damaged components were replaced the following adjustments were made: Horizontal drive was set at or as near to manufacturer's specifications as possible. Width and linearity coils were adjusted while observing the yoke sawtooth current waveform on a scope. Adjustments were made to give best linear sweep. In addition, with a milliammeter in the cathode of the horizontal output tube, the linearity coils were retouched to resonance—consistent with lowest cathode current and best linearity. No similar complaints were received from any of the set owners since repairs were made.

Considerable difficulty was observed with boost problems in Dumont sets, RA166 through 171. A special semi-polarized 10  $\mu$ f boost capacitor is specified. Therefore, when ordinary electrolytics were substituted they failed in short order.

Another group of RCA sets, with 12" and 17" screens (many are still in use as second or third sets in play rooms, bedrooms and home basements), generally develop two damper faults: (1). Two cables from the damper tube heater terminals to the transformer tie point, break down to chassis. Cables should be replaced at the first opportunity when the sets come in for other repairs. Good high voltage cable should be used. (2). The damper 6.3 volt heater trans-



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former built into the power transformer fails. Replacement can be made with a separate unit, mounted under or on top of the chassis. Room on the back of the high voltage cage is sometime available. The transformers should be insulation-test-rated at 10,000 volts.

### Tough Dog

How many technicians, overlooking a symptom detail, have been stuck with faults similar to this one, now included in the list of "dog" classics?

In this case the horizontal oscillator, vertical oscillator and vertical output are supplied by B + boost. Vertical sweep has collapsed to a line about one half inch high. Horizontal sweep appears normal—but not quite. Width is insufficient by a bare half inch on one side. After spending two hours disconnecting and checking coupling and bypass condensers in the vertical oscillator and output sections, a bad 20  $\mu$ f electrolytic decoupling capacitor tied to B + boost is found.

The vertical blocking oscillator was critical to a small voltage change, primarily because of a relatively high decoupling resistor in the plate circuit. The horizontal oscillator was only slightly affected. The symptom pointed to trouble on the boost line, because of width discrepancy, and called for investigation at the beginning.

Time appears to be the only real tangible asset the technician has. The success of his business depends largely upon rapid troubleshooting and effective repair. Localizing circuit faults before detailed voltage and resistance checks is the key to becoming a real "pro". This can be done successfully only by initial review of manufacturers schematics and precise interpretation of fault symptoms, aided of course by remembering hard-earned experiences. •

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Printed forms, measuring 4"x5½", for use by firms engaged in TV set rentals, provide space for all the information needed to cover each rental. Dealer's name and address can be printed on the forms. Available in pads of 100 rental slips. Kelly's Workshop, 1865 Western Ave., Albany 3, N. Y. (ELECTRONIC TECHNICIAN 12-29)

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## Faulty CRT

(Continued from page 48)  
sound and picture off, voltage at this point would jump to about  $-10v$ . Pin 9 of the agc section of the 4BU8 indicated higher than normal negative reading.

I wondered if the agc pot or some of the bias resistors in this circuit could be intermittent? A check of the 750k ohm pot and associated resistors, including the 1.2 meg bias resistor, showed no faults here.

Using the scope again, with low capacity probe to pin 9 of the 8AU8 video output plate, no video appeared; but some a-c was present. Moving to the arm of the contrast control showed even more a-c. With the probe to the .1 $\mu$ f video coupling condenser, connected to the cathode of the picture tube, an a-c peak to peak reading of about 17 volts appeared. Then it occurred to me. How about the picture tube? A check of the CRT showed a high resistance heater-to-cathode short, indicated in Fig. 2.

A 6.3 volt isolation transformer was installed and the set worked normally. As this set has a series heater string, a 10 ohm, 10 watt resistor was used to bridge the break in the heater line.—Richard F. Crocker, Fresno, Calif.

### Raytheon TUBES

Nine new receiving tube types have been added to the firm's replacement line. 5CM8, a TV amplifier; 5EA8, an oscillator mixer in VHF sets. Both are nine pin miniature triode-pentodes with controlled heater warm-up characteristics. 6EH5, a seven pin miniature pentode for audio output applications. 6EX6, a high-power horizontal deflection tube in 110° TV receivers, is an octal beam-power pentode that can serve as a replacement for the 6CD6GA. 6FV6, a seven pin miniature tetrode, is used as an RF amplifier in at least 18 models of TV receivers, 8EM5, a nine pin miniature beam-power tube, for use as a vertical-deflection amplifier. 12DU7, a nine pin miniature duo-diode-tetrode, for auto radios in late model 12-volt cars. 7027A, an octal based beam-power pentode is an improved version of 7027. 7189, a nine pin miniature pentode, is used in many commercial hi-fi systems. Raytheon Co., 55 Chapel St., Newton 58, Mass. (ELECTRONIC TECHNICIAN 12-7)

### ERRATUM

Circuit Digest Issue 86  
October, 1959.

Circuit Digest #527.

Sylvania Chassis designation should read:  
1-541-7, -8 and 1-541-9, -0; not 1-541,  
1-547, 1-548, 1-549, 1-550.



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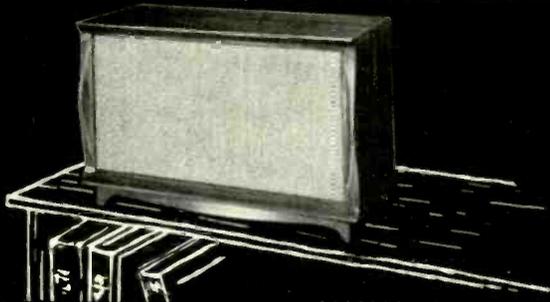
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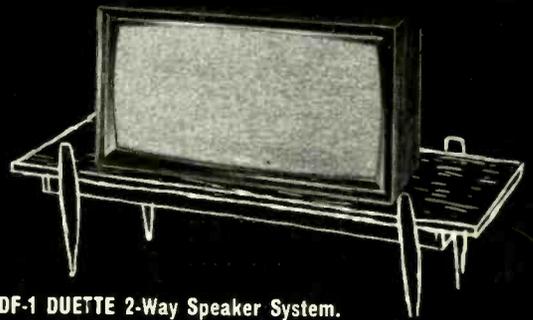
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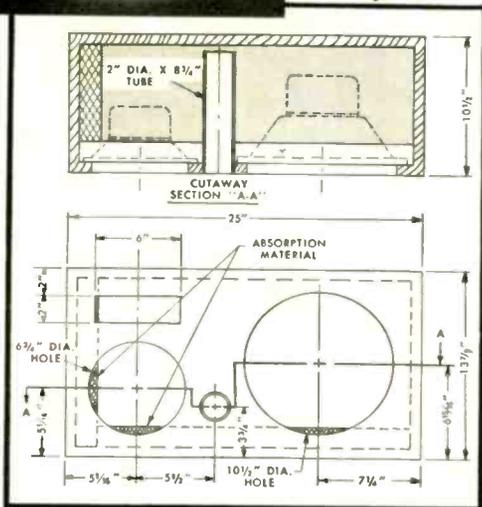
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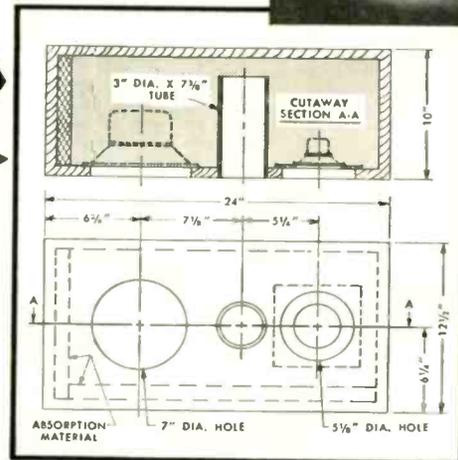
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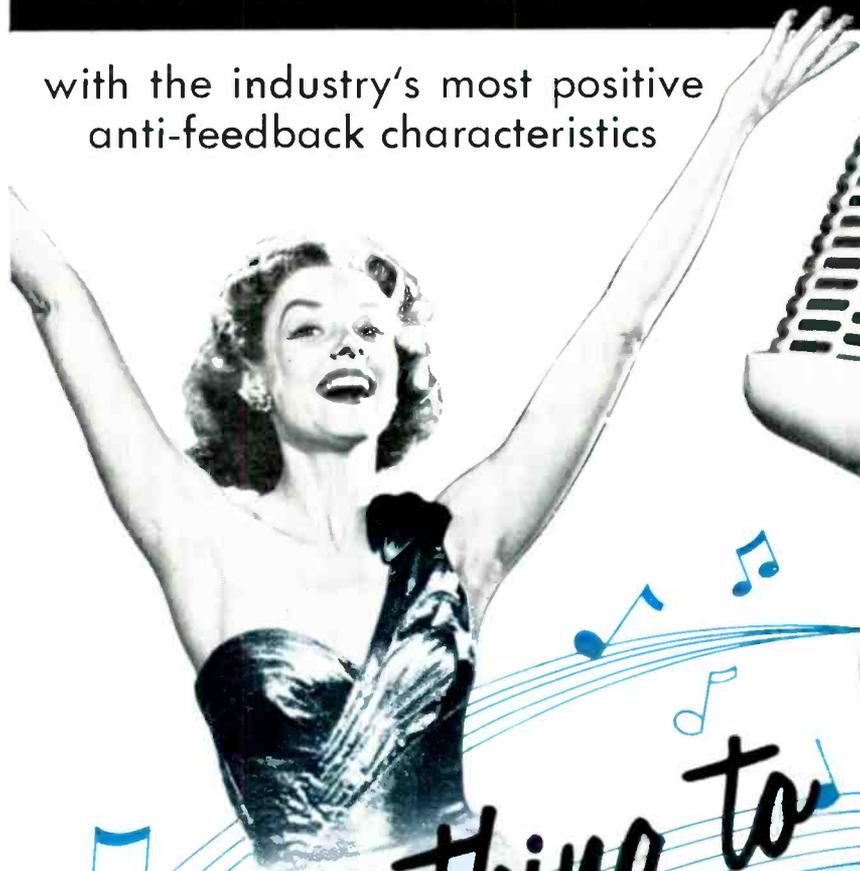
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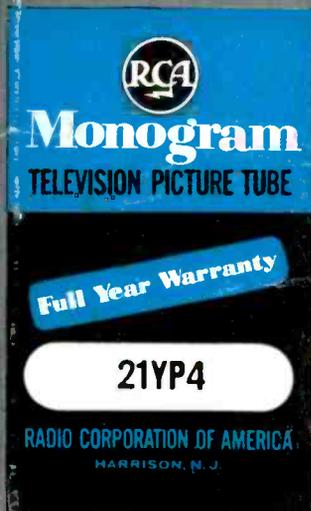
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