

# TECHNICIAN

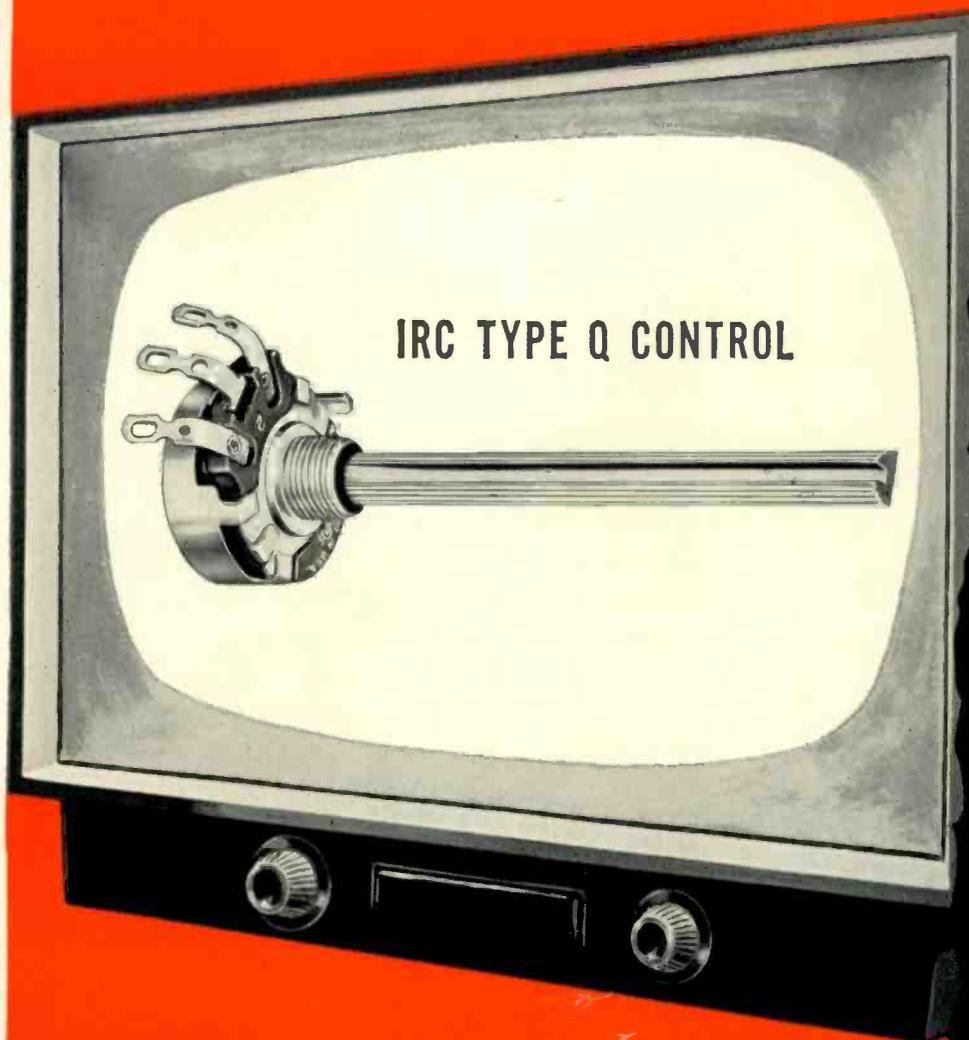
*& Circuit Digests*

Audio  
Servicing

In 2 Sections  
Section 1

June • 1955

# Preferred for modern set servicing



## IRC TYPE Q CONTROL

Service technicians get greater coverage with less investment; more practical service features; and easier, faster installation with the IRC Type Q Control. Here's a dependable, basic control that is directly designed for modern set servicing. For appearance, performance and price . . . there's none better. So why settle for less? Tell your Distributor you want Q Controls . . . most servicemen do.



This 8 page catalog gives you all the facts . . . Send for your free copy now—

### INTERNATIONAL RESISTANCE CO.

Dept. 574, 401 N. Broad St., Phila. 8, Pa.

In Canada: International Resistance Co., Ltd., Toronto, licensee

Send me Q Control Catalog DC1D.

Name \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

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

#### KNOBMASTER FIXED SHAFT

Q Control standard shaft is knurled, flatted and slotted — fits most knobs without alteration.

#### INTERCHANGEABLE FIXED SHAFTS

Exclusive IRC convenience feature—provides fast conversion to "specials", with FIXED shaft security. 15 types available.

#### 1/4" LONG BUSHING

Accommodates all small sets, yet handles large set needs perfectly.

#### 7 STANDARD TAPERS

Full coverage of all taper requirements is provided in the Q Control.

#### 94 RESISTANCE VALUES

For TV, AM and FM coverage, 94 values of plain and tapped controls are furnished.

#### QUALITY APPEARANCE

The handsome professional appearance of IRC Q Controls lets you point to your work with pride.

#### CUSHIONED TURN

The smooth, quality of "feel" of a Q Control contributes to customer confidence.

#### TYPE 76 SWITCHES

Either of two type IRC switches attached as quickly and easily as a control cover—meets all your requirements.



Wherever the Circuit Says 

# TECHNICIAN & Circuit Digests

TELEVISION • ELECTRONIC • RADIO • AUDIO • SERVICE

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JUNE, 1955

## FRONT COVER

What sound "looks" like is shown in the magnified grooves of a phonograph disc and a length of magnetic tape. Center line of the grooves (bottom of V-cut) follows the pattern of sound-signal voltage waveforms as they would appear on an oscilloscope. The ordinarily invisible tape impressions are magnetic fields, observed by passing tape through a suspension of carbonyl iron. With evaporation of the suspending fluid, the extremely fine particles settle on the most strongly magnetized portions.

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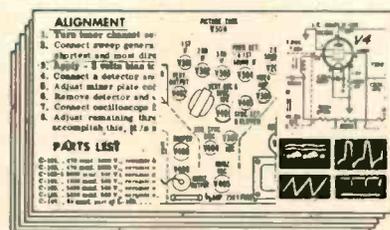
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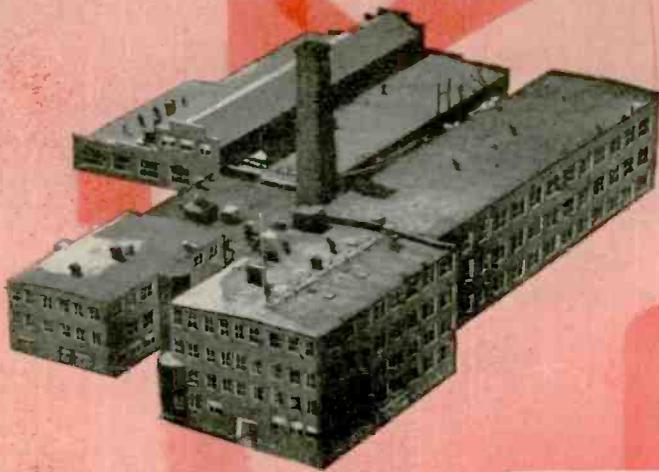
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 PACKARD-BELL: TV Chassis T-10



Raytheon's Receiving Tube Plant No. 1 — Newton, Mass.



Raytheon's Microwave and Power Tube Plant No. 1 Waltham, Mass.

# RAYTHEON LEADS THE WAY

## In TUBES and SEMICONDUCTORS

### Here are a few reasons why:

**RAYTHEON** employs 18,000 people. Approximately 10,000 of them work in Raytheon's modern tube and semiconductor manufacturing plants.

**RAYTHEON** has more than 1,000,000 square feet devoted exclusively to the manufacture of Raytheon quality tubes and semiconductors.

**RAYTHEON** employs over 500 engineers and scientists who work exclusively in the electron tube and semiconductor fields.

**RAYTHEON** has had 33 years' experience in the manufacture of electron tubes.

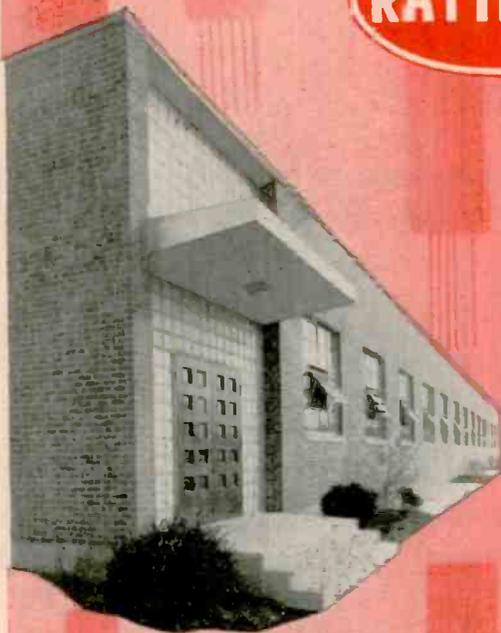
**RAYTHEON** has made tubes of every type of construction — Standard Glass, "G", GT, Bantal, Lock In, Metal, Miniature and Subminiature Tubes.

**RAYTHEON** Receiving and Cathode Ray Tube Operations have produced more than a third of a billion tubes and semiconductors.

**RAYTHEON** perfected the first practical rectifier tube types (BA and BH) to eliminate the need for "B" batteries to operate home radios. This revolutionized the design of home radio sets. Raytheon later developed the cold cathode rectifier tube for auto radios and has produced more of these tubes than all other companies combined.

**RAYTHEON** developed the famous 4-pillar construction that strengthened internal structure resulting in sturdier tube design.

**RAYTHEON** developed and was first to mass-produce the octal button stem receiving tube — today's most imitated construction for premium TV performance. Raytheon was first to make millions of these tubes as far back as 1946. These tubes featured a planar button stem and 8 straight leads (8-pillar) which go directly into a standard octal base. Raytheon's Patent Numbers 2310237, 2321600 and 2340879 apply to this invention.



Raytheon's Research Center Waltham, Mass.



Raytheon's Semiconductor Plant No. 2 and Raytheon's Special Tube Plant No. 2 Boston, Mass.



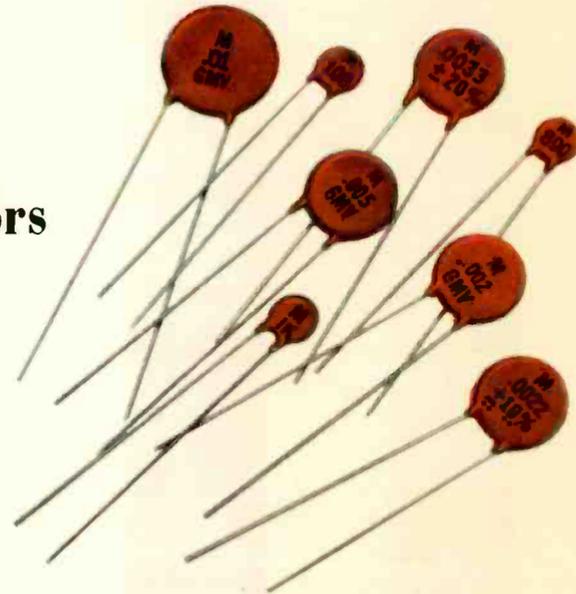
Raytheon's Cathode Ray Tube Plant Quincy, Mass.



# New, improved components from Mallory

## Every Replacement is Right When You Use Mallory Ceramic Capacitors

When you use one of these new disc type Mallory Ceramic Capacitors, you *know* the job is going to stay sold. From basic materials to final testing, they are built for the best in stability and precision.



### STABLE ON THE INSIDE

Mallory selects and blends high grade ceramic materials, and processes them under the most rigid control. Capacitance stays steady over a wide temperature range.

### STABLE ON THE OUTSIDE

Finished capacitors are protected by a special coating that has high resistance to moisture.

### EVERY CAPACITOR IS TESTED

100% inspection checks capacitance tolerance and ability to take rated voltage . . . on every unit before it leaves the plant.

### FULL RANGE OF RATING

The new disc capacitors are supplied in values from 10 to 20,000 mmfd.; for 500, 1000 and 2000 volts. Both temperature compensating and general purpose coefficients are available. Three tolerances:  $\pm 5\%$ ,  $\pm 10\%$  and  $\pm 20\%$ .

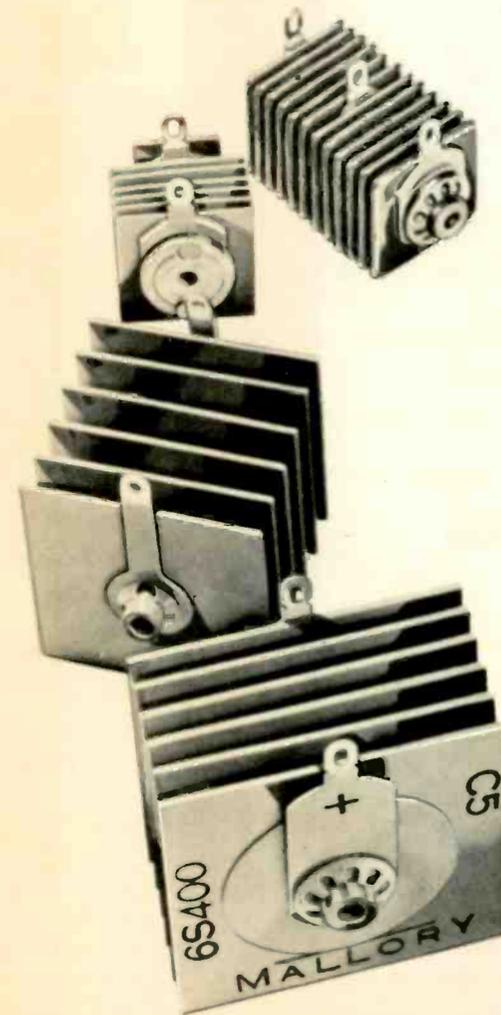
### OTHER MALLORY CERAMIC CAPACITORS

that your distributor carries include tubular, trimmer, feed-through, stand-off and high voltage types.

## Order your stock TODAY

from your local Mallory distributor and be ready to serve your customers with Mallory quality, in all ceramic capacitor replacements.

## Here's the New Standard of Performance in Selenium Rectifiers



A completely new line of Mallory selenium rectifier stacks now gives you *performance that equals or surpasses* original equipment specifications to a degree of uniformity never before attained.

The secret is new Mallory designs and manufacturing methods developed to produce superior characteristics . . . and to maintain these standards on *every* stack.

The new Mallory stacks are noted for unusually long service. Exceptionally low forward voltage drop gives them high efficiency throughout their long, dependable life.

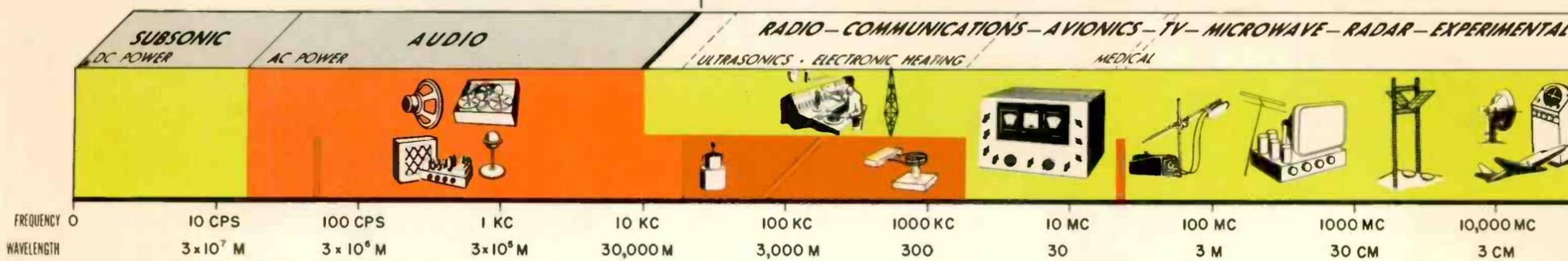
Make sure you use these new rectifiers on all your replacement jobs. You can connect them and forget them . . . with the assurance that *every* stack will turn in long, reliable service.

A complete selection of values, all conservatively rated, is available to fit every possible application. Ask your Mallory distributor to send you the stock you need.

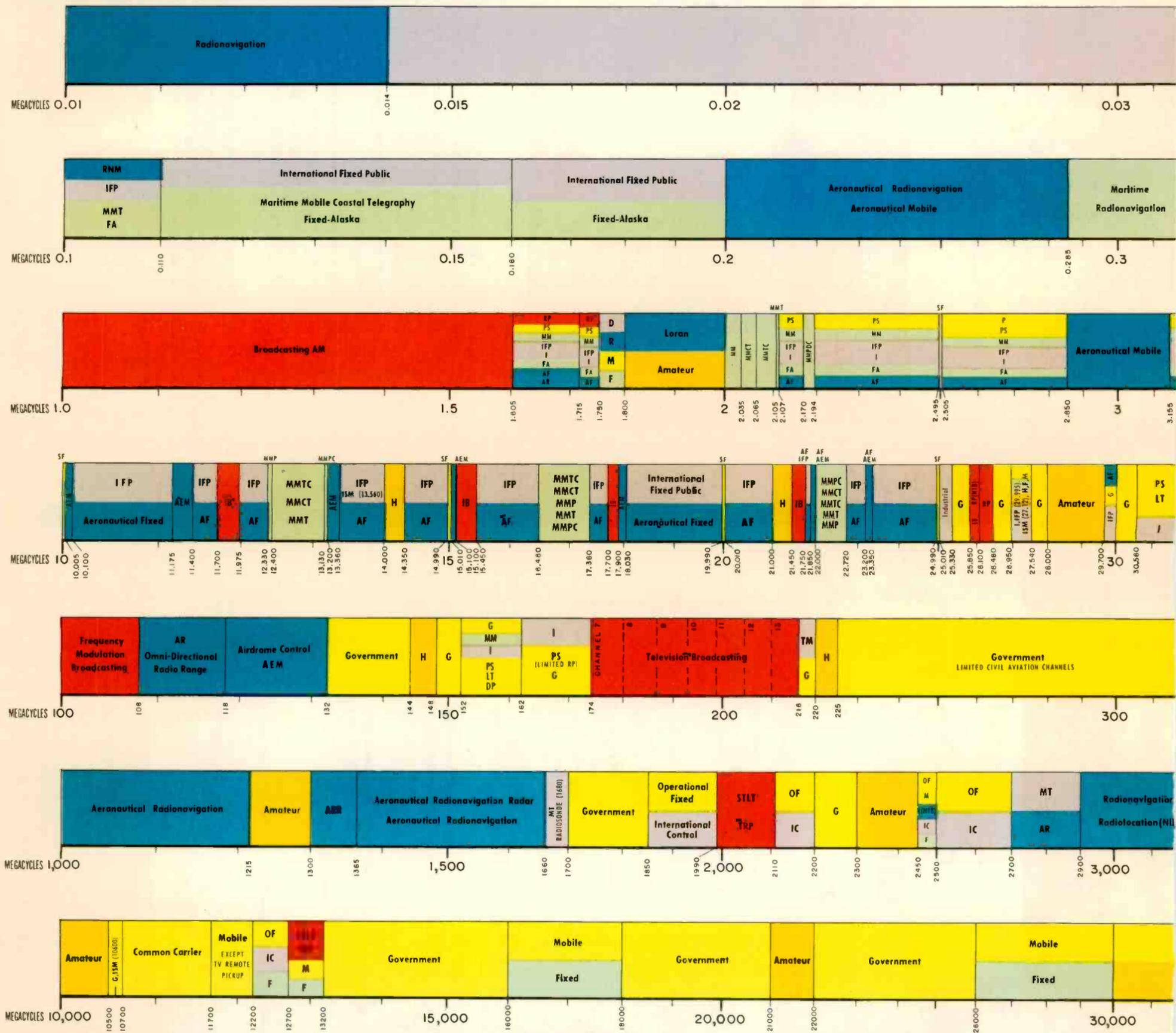
# The ELECTROMAGNETIC SPECTRUM and

## ELECTROMAGNETIC SPECTRUM

FCC ALLOCATIONS (See details below)



## 1955 FCC FREQUENCY ALLOCATION SPECTRUM



Section Two of  
**TECHNICIAN**  
 & Circuit Digests  
 June 1955

MILITARY DESIGNATIONS of FREQUENCY BANDS	FREQUENCY BAND NOMENCLATURE
P-band - 225-390 MC (133.3-76.9 cm)	VLF to 30 kc
L-band - 390-1550 MC (76.9-19.3 cm)	LF 30-300 kc
S-band - 1550-5200 MC (19.3-5.77 cm)	MF 300-3000 kc
X-band - 5200-10,900 MC (5.77-2.75 cm)	HF 3000-30,000 kc
K-band - 10,900-36,000 MC (2.75-0.834 cm)	VHF 30,000 kc-300 mc
Q-band - 36,000-46,000 MC (0.834-6.52 cm)	UHF 300-3000 mc
V-band - 46,000-56,000 MC (0.652-0.536 cm)	SHF 3000-30,000 mc
	EHF 30,000-300,000 mc
	<b>UNITS OF LENGTH</b>
	1 meter = 3.281 feet
	1 inch = 2.540 centimeters
	1 cm = 10 <sup>8</sup> angstroms (Å)
	1 cm = 10 <sup>4</sup> microns (μ)

**Index to Abbreviations and Key to FCC**

MARINE	BROADCASTING	AERONAUTICAL & RADIONAVIGATION
AC Aldrome Control	D Disaster	IC International Co
AF Aeronautical Fixed	DP Domestic Public	IFP International Fix
AEM Aeronautical Mobile	EX Experimental	ISM Industrial Scient
AR Aeronautical Radionavigation	F Fixed	L Loran
ARR Aeronautical Radionavigation Radar	FA Fixed-Alaska	LT Transportation
ARGP Aeronautical Radionavigation Glide Path	FM Frequency Modulation Broadcasting	M Mobile
BA/M Broadcasting AM	FMI FM Intercity Relay	MM Maritime Mobile
C Coast	G Government	MT Meteorological A
CC Common Carrier	H Amateur	MDC Mobile Distress I
CR Citizens Radio	I Industrial	MMP Maritime Mobile
	IB International Broadcasting	MMT Maritime Mobile

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Publishers also of "MART, Including Price-Fax"

# TECHNICIAN & Circuit Digests

With Complete  
Electromagnetic  
Spectrum Chart

Showing All  
1955 FCC  
Frequency Allocations

CALDWELL-CLEMENTS, INC. ★ 480 LEXINGTON AVENUE, NEW YORK 17, N.Y.

## Exact Duplicate DUAL CONTROLS available TWO ways

**D**O you prefer ready-to-use dual controls? Or would you like a small stock of control sections, switches and shafts that you can assemble quickly for the combination you need?

Either way, with Mallory, you can be sure of duplicating the exact electrical characteristics of the controls in practically any popular TV set.

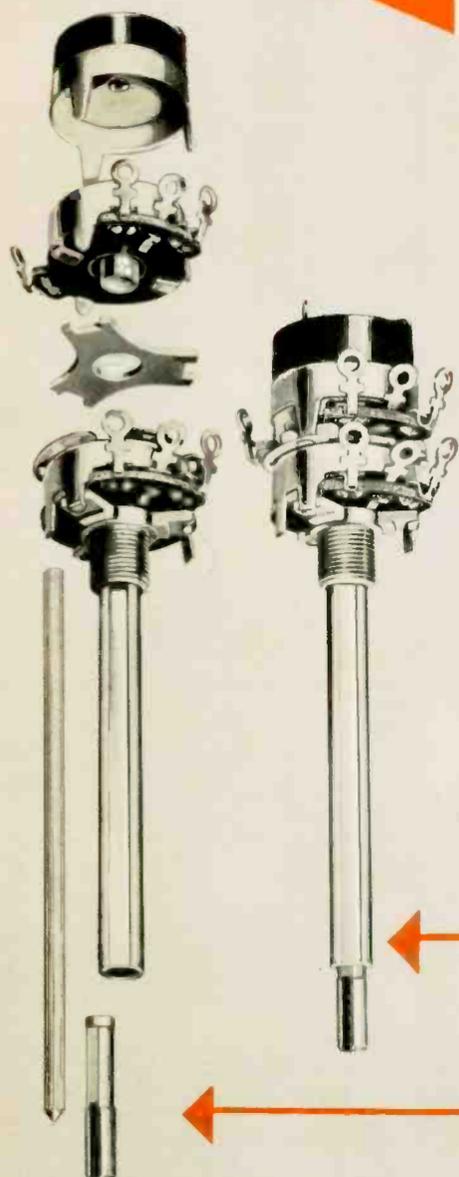
Either way, with Mallory, you can equal or exceed the performance of the original equipment control. You can count on accurate resistance values, smooth tapers, quiet operation and long life.

Either way, with Mallory, you can be sure the job is right the first time... without profit-cutting "come backs."

Either way, your Mallory distributor has what you need. Call him today!

Exact duplicate, ready-to-use, dual control... factory-made with all the resistance values, tapers, taps, switches and shaft lengths needed for most of the popular TV sets.

Exact duplicate, dual control kits. With a small stock of factory-assembled control sections, you can make 10,000 different combinations. No soldering or special tools required. Assembly takes less than five minutes.



### MALLORY

CAPACITORS • CONTROLS • VIBRATORS • SWITCHES • RESISTORS  
RECTIFIERS • POWER SUPPLIES • FILTERS • MERCURY BATTERIES  
APPROVED PRECISION PRODUCTS

P. R. MALLORY & CO. Inc., INDIANAPOLIS 6, INDIANA

**THERE IS  
NO  
SUBSTITUTE**

**MALLORY**  
APPROVED PRECISION PRODUCTS

**MALLORY**  
APPROVED PRECISION PRODUCTS

**MALLORY**  
APPROVED PRECISION PRODUCTS

**MALLORY & CO. INC.**  
INDIANAPOLIS 6, INDIANA  
MADE IN U.S.A.

**FP 234**  
10 Mfd.  
10 Mfd.

All FP Capacitors are Mallory. There are imitations, but no substitutes. Only Mallory FP Capacitors have these features... developed by Mallory and accepted for years as the industry's standard of performance by manufacturers and service men:

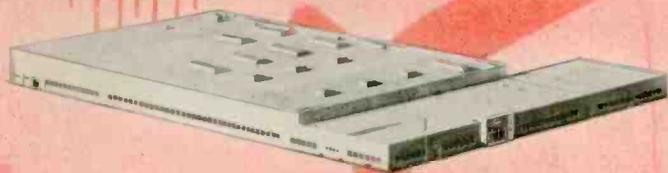
- Genuine fabricated plate anode
- 85° C. temperature rating
- Long life on the shelf and in service
- High ripple current capacity
- Simple, speedy twist-prong mounting

Don't settle for anything less than the best. Always specify Mallory FP Capacitors by brand. They outperform all others... yet cost no more.

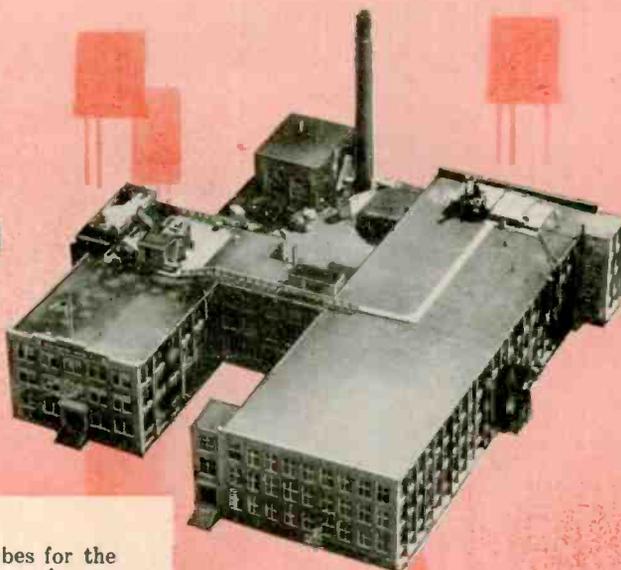
### MALLORY

CAPACITORS • CONTROLS • VIBRATORS • SWITCHES • RESISTORS  
RECTIFIERS • POWER SUPPLIES • FILTERS • MERCURY BATTERIES  
APPROVED PRECISION PRODUCTS

P. R. MALLORY & CO. Inc., INDIANAPOLIS 6, INDIANA



Raytheon's Receiving Tube Plant  
No. 2 — Quincy, Mass.



Raytheon's Semiconductor Plant  
Newton, Mass.  
(Being Assigned to Semiconductor  
Division starting Dec. 1, 1955)

**RAYTHEON** developed and first mass-produced subminiature tubes for the hearing aid industry — the forerunners of the fuse tubes which made possible the famous proximity fuses of World War II. There are more commercial Raytheon subminiature tubes in use today than all other makes combined.

**RAYTHEON** developed a method of mass producing magnetrons (the power tube that is the heart of radar) early in World War II, that broke a serious bottleneck, and continues to produce more magnetrons than all other manufacturers combined.

**RAYTHEON** is the largest producer of klystrons and has manufactured more than all other companies combined.

**RAYTHEON** was the first commercial producer of Transistors — the "mighty mite" — a Raytheon achievement that revolutionized the hearing aid industry.

**RAYTHEON** first commercially produced fusion-alloy RF Transistors, expected to revolutionize the portable radio, auto radio and computer industries.

**RAYTHEON** has produced many more transistors than all other manufacturers combined — nearly 2,000,000 in use.

**TODAY, RAYTHEON** makes Receiving and Picture Tubes, Reliable Miniature and Subminiature Tubes, Semiconductor Diodes and Transistors, Nucleonic Tubes and Microwave Tubes.

*These facts and figures show why you can use Raytheon Television and Radio Tubes with complete confidence that they are Right . . . for Sound and Sight — Right for you and your customers, too.*



Raytheon's Microwave and  
Power Tube Plant No. 2  
Waltham, Mass.

**A Company second to none in**

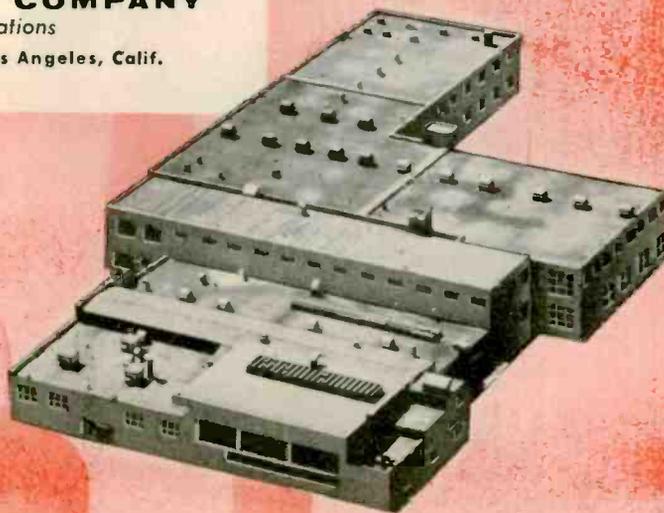
*Excellence in Electronics*



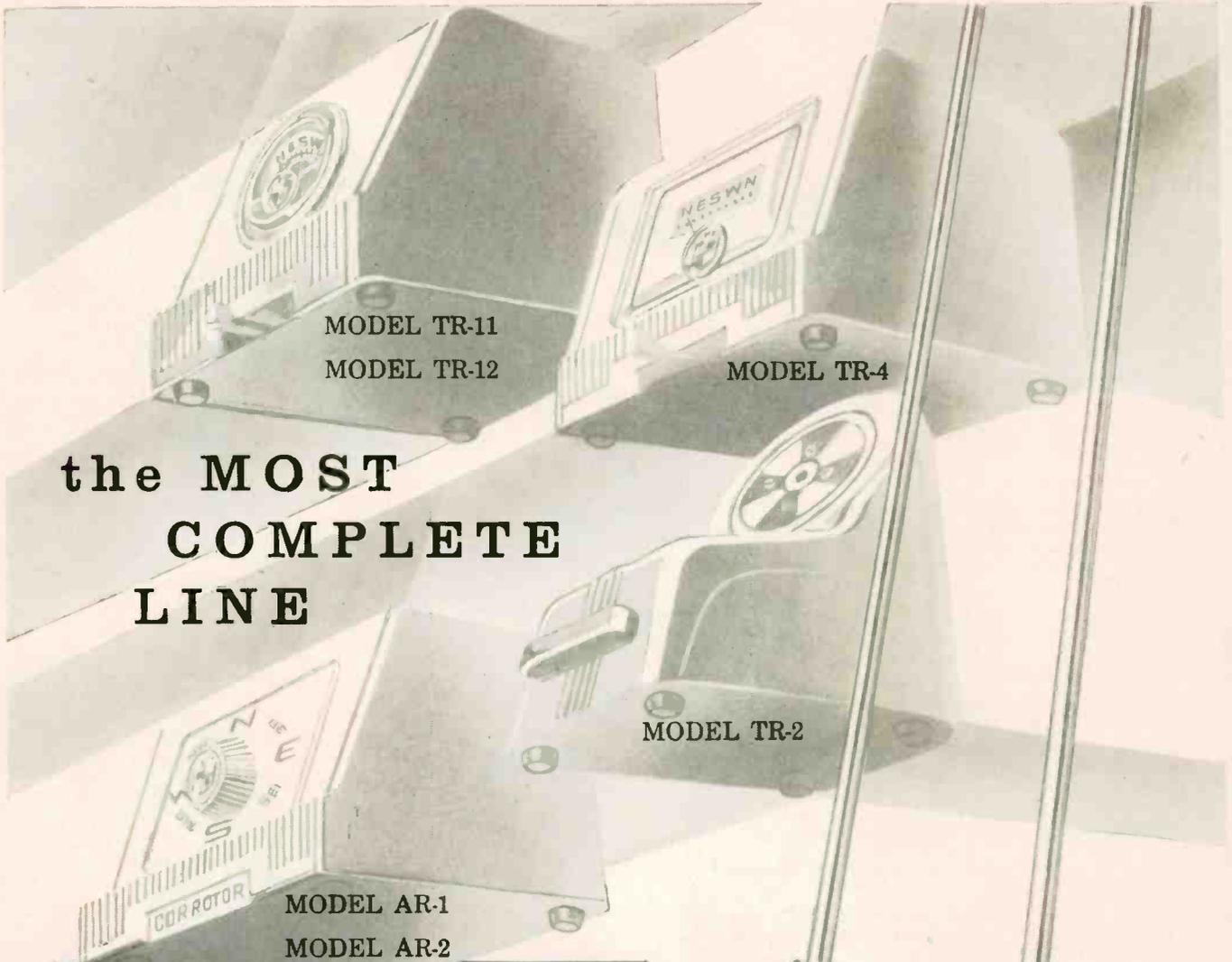
**RAYTHEON MANUFACTURING COMPANY**

Receiving and Cathode Ray Tube Operations

Newton, Mass. • Chicago, Ill. • Atlanta, Ga. • Los Angeles, Calif.



Raytheon's Special Tube Plant No. 1  
Newton, Mass.



the MOST  
COMPLETE  
LINE

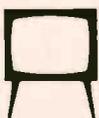
**C·D·R**  
**ROTORS**

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*featuring the SHARPEST tuning  
Automatic Rotor*

with the GREATEST TURNING POWER

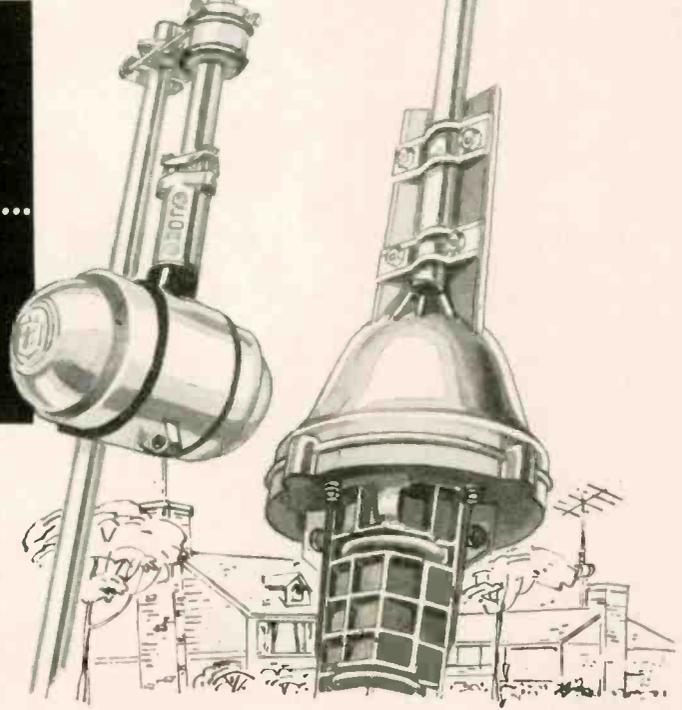
Here is everything anyone – distributor . . . dealer . . . serviceman – could ask for in rotors . . . all in the ONE line . . . the CDR ROTOR LINE! A model for every need . . . ALL FIELD TESTED AND PROVEN to be dependable and superior in every respect!



*Pre-Sold* for you to millions every week with regular announcements in every leading rotor market across the nation.



**CORNELL-DUBILIER**  
SOUTH PLAINFIELD, N. J.



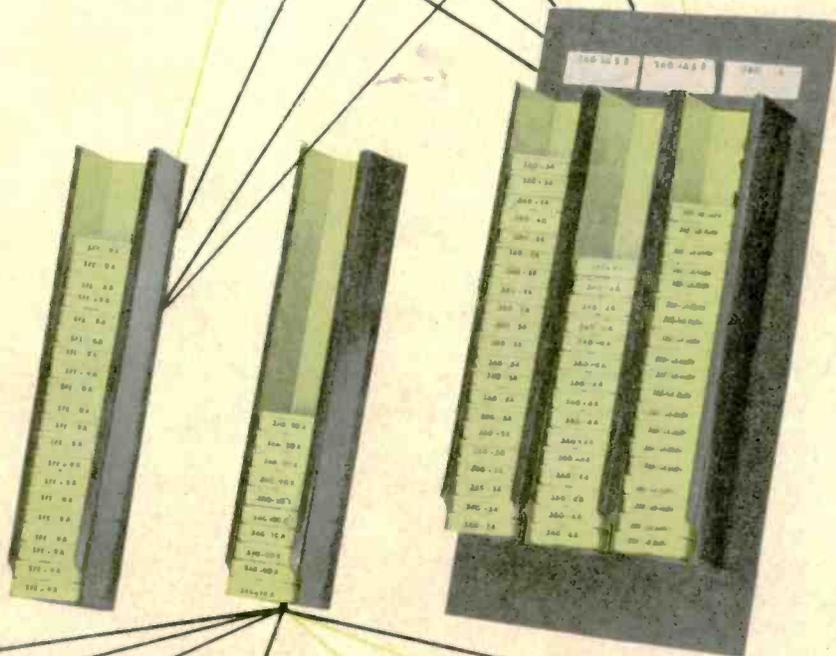
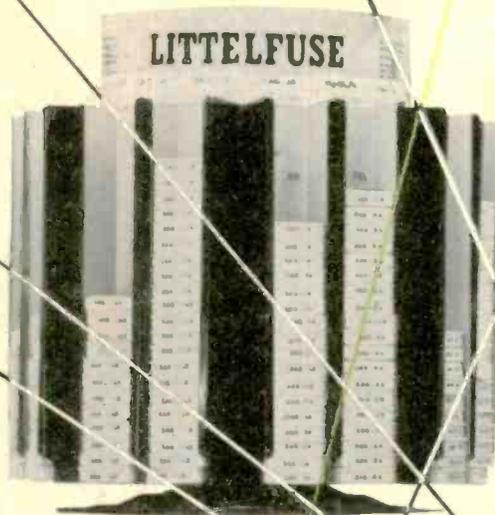
**THE RADIART CORP.**  
CLEVELAND 13, OHIO

# AGAIN — LITTELFUSE

Services for your profit have always been a first thought with Littelfuse... the one call kit, the snap on TV fuse holders in a box, the serviceman's box, the revolving drum, fittings in Sams' Photofact folders.

And now, again... single channel dispensers for you to mount in any multiple arrangements you need right above your bench.

Ask your jobber.



BURTON BROWNE ADVERTISING

LITTELFUSE Des Plaines, Ill.



SPEAKERS



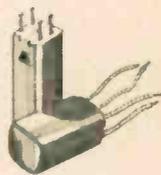
AUTO RADIO AERIALS



VIBRATORS



CONTROLS



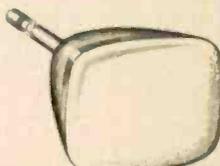
COILS



CAPACITORS



RECEIVING TUBES



PICTURE TUBES



CONDENSERS



TRANSFORMERS

**DELCO  
ELECTRONIC  
PARTS**  
A GENERAL MOTORS  
VALUE

*Here's help that is  
Made to Order  
for your  
electronics business*

Sales assistance is always welcome in a business as new and as fast-changing as electronics. But the help that Delco and General Motors can give you is probably the most exceptional in the industry.

It's unique because Delco is the sole source for that vital group of special application parts used for original equipment replacement in Delco auto radios . . . representing a ready-made market of 13,500,000 car radios! In addition, Delco is an important source for the most-used universal electronic replacement parts.

Of course Delco's service to customers goes beyond ready availability of parts. Both Delco and General Motors are well-known for customer assistance. Current bulletins and field schools, which keep the industry posted on new developments, are but a small part of the many advantages in handling Delco's fine line of electronic parts. Check your Delco Electronic Parts Distributor today and get all the details on how Delco is set up to help you and your business!

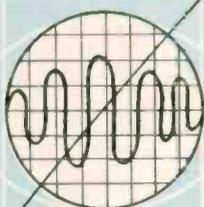
Visit our Electronics Parts Show Exhibit — Booth 783, Conrad Hilton Hotel — Chicago, May 16-19.

A GENERAL MOTORS PRODUCT

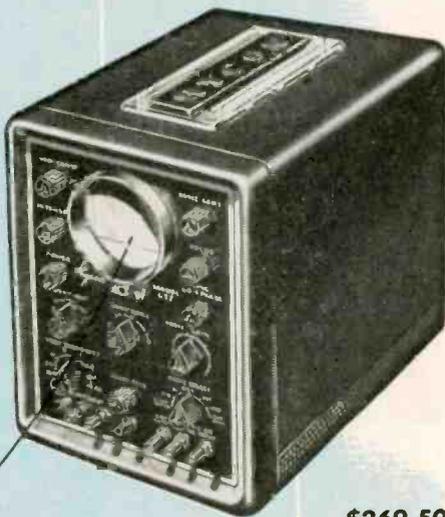


A UNITED MOTORS LINE

**FULL VIEW FULL VALUE**



WITH A  
**HYCON  
OSCILLOSCOPE  
MODEL 617**



**\$269.50**

SHARP UNDISTORTED TRACE EDGE TO EDGE

You get *more* for your scope dollar in a Model 617 Oscilloscope, because Hycon's special flat face 3-inch tube eliminates fringe distortion. You pay for a 3-inch scope—you get 3 inches of sharp, usable trace.

And this precision scope meets all requirements for color TV servicing. So before you buy any scope, compare it to the Model 617 feature by feature.

For full view—full value you'll buy Hycon... setting the standards "where accuracy counts."

- 4.5 MC BANDPASS WITHIN  $\pm 1$  DB (VERTICAL AMPLIFIER)
- HIGH DEFLECTION SENSITIVITY (.01 V/RMS PER INCH)
- INTERNAL CALIBRATING VOLTAGES
- EDGE LIGHTED BEZEL
- STURDY, LIGHTWEIGHT CONSTRUCTION



See Hycon's line of matched, bench-stacking test instruments at your Electronic Parts Jobber's.



*Service facilities in your area.*  
**Hycon Mfg. Company**

2961 EAST COLORADO STREET PASADENA 8, CALIFORNIA  
"Where Accuracy Counts"

## LETTERS To the Editors

### "Two-Fisted Action"

EDITORS, TECHNICIAN:

We cannot have too much publicity of this kind. We are of the opinion the big stick and a tough policy is the only weapon left to fight the bait advertiser and the crooks in our industry.

We are reprinting the article in the May issue of TV Flashes.

ERNEST S. COPLEY

TV-Radio Assoc. of Alameda County  
Oakland, California

• Reference is to our May editorial, "Two-Fisted Action," suggesting how legitimate service operators can combat cut-throat competitors, including jobbers who sell to all.—Ed.

EDITORS, TECHNICIAN:

Your editorial is well appreciated. It is hard to believe that our efforts to get through to the manufacturer are finally approaching some point of achievement. It is nice to see, every now and then, an editorial giving an understanding lift to the problems of the serviceman.

BERTRAND G. DESMARAIS

Syracuse TV Technicians Assoc.  
Syracuse, New York

EDITORS, TECHNICIAN:

Congratulations. . . . I have long felt that serious problems with very grave implications for the entire industry exist and only by facing up to them can we eliminate them. It will bring down the wrath of the offenders, but what good is living if one is not man enough to stand up for honesty and fair dealing?

FRANK J. MOCH

Nat'l Alliance of TV & Electronic  
Service Assns.  
Chicago, Illinois

EDITORS, TECHNICIAN:

Would this not be called boycotting and be illegal? Otherwise very good.

Okla. City TV & Radio Service Ass'n.  
Oklahoma City, Oklahoma

EDITORS, TECHNICIAN:

I am in perfect accord with your editorial "Two-Fisted Action." However, not understanding the law in such matters, the average technician is reluctant to act for fear of violating some legal statute, such as restraint of trade, price-fixing, or naming an individual or company. I feel a good article on how the law protects the honest serviceman would do much in getting fair play.

ALBERT C. W. SAUNDERS  
Radio-TV Technicians Guild  
of New England

Belmont, Massachusetts

• More information on the legal aspects of our proposals will appear in next month's issue.—Ed.

**A must for after-dark TV servicing**

# **G-E SERVI-SPOT**

  
*Electronic*  
TUBES

- **FIND HOUSE NUMBERS!**
- **READ STREET SIGNS!**
- **CHECK OUTDOOR ANTENNAS!**

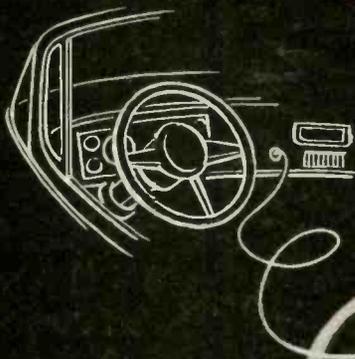
\* \* \*

Plugs into the lighter socket on your dash.

Pre-focussed beam carries  $\frac{1}{4}$  mile.

Compact, weighs only 6 oz., 12-ft. cord.

Manufactured by General Electric,  
world leader in lamps.



Get your SERVI-SPOT from your G-E tube distributor! General Electric Company, Tube Department, Schenectady 5, N. Y.

\* \* \*

Now G-E SERVICE-DESIGNED TUBES  
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Ask your G-E tube distributor for them!

**GENERAL**  **ELECTRIC**

161-1A3





# SYLVANIA SILVER SCREEN 85

## The picture tube with Selling Power!

That's right! Sylvania's "Silver Screen 85" puts powerful, profitable salesmanship behind your personal TV service. That's because "Silver Screen 85" is the picture tube TV America knows and asks for by name.

Every week Sylvania's "Beat the Clock" show builds greater consumer recognition and demand for the "Silver Screen 85." Every week dealers benefit at the payoff point.

Put the "Silver Screen 85's" selling power to

work for you. This booklet tells your customers the benefits of Sylvania's "Silver Screen 85." Leave a copy on every service call. Order a free supply now from your Sylvania Distributor.

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University Tower Building, Montreal  
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TELEVISION • ATOMIC ENERGY



"Installing a 'Silver Screen 85' sure increases the value of a trade-in set and speeds turnover."



"'Silver Screen 85' sales are up over all other brands."

"TV service volume increased by 'Silver Screen 85' tie-in advertising"



# SYLVANIA<sup>®</sup>



... fastest growing name in sight

# TECHNICIAN

## & Circuit Digests

CALDWELL-CLEMENTS, INC., 480 LEXINGTON AVENUE, NEW YORK 17, N. Y.

## Get Started in Color TV Now!

*"If the trumpet give an uncertain sound, who shall prepare himself in battle?"*

Worded in another way, this biblical quotation might be expressed: "Who will do anything positive if the leaders are hesitant and afraid?" The question rings perfectly true in reflecting the status of color TV. The magnificent challenge of putting it across has been clouded by doubt and hesitation on the part of many TV industry leaders, broadcasters, dealers and service technicians—the very people who stand to benefit most by the full establishment of color TV.

One of the finest prospects for starting color TV on its way, in a mass commercial sense, has been largely overlooked. It's the 60,000 local servicing outlets. Each technician who gets started now in color TV will benefit, not only over the long run, but immediately through increased black-and-white business, plus profit from color.

### Here's how . . .

As with any bold profit-making business venture, you must make a capital investment. It will pay you back manifold. First, invest in a color TV receiver and basic color test instruments. (If you want more information on where to get the set wholesale, just write to the TECHNICIAN Reader Service Dept. We'll provide you with all the data you need.)

Sell color aggressively to commercial establishments, which are very important display places for educating the public on color's appeal. Bars, hotels, theaters, restaurants and the like are prime prospects. Their purchases of color sets are tax deductible. Push the idea of color TV providing business with added interest . . . and more customers. In addition to the sales profit, earn more by arranging your own service contract to keep the color set in peak operating condition.

A color set in your shop serves several functions. You will learn more about the construction of these

units, adding to the knowledge gained from technical articles published on the subject. Also, by staying open on certain evenings to give demonstrations (network color TV program schedule is published every month in TECHNICIAN'S "Tuning In" section) you will be creating plenty of interested store traffic. And of course, when you sell a set, there's a nice profit to add to your regular income.

From an industry-wide viewpoint, one color set in each of 60,000 shops will create a production demand, resulting in lower prices and increasing the prospective sales market . . . and the snowball will really be rolling.

### Ground Floor Start

Before long, the technician who has made the necessary capital investment will be known as the local color expert, and he'll be right on the ground floor when increased color sales start paying off in big profits. Late-comers will have to content themselves with his leftovers. Being known in the community as a color expert will also bring more black-and-white business to you now. The public will certainly feel confident that the technician capable of fixing a complicated color set will be able to handle a black-and-white troubleshooting job right in his stride.

Follow up your color TV advantage with strong promotion. Banner headlines on your truck, window and advertisements reading "Color TV Servicing Center" will catch plenty of attention . . . and new customers. And whenever you're on a house call (particularly when the customer is financially well situated) talk up color for a second set. Play up the dramatic effects, the beautiful hues, the hours of enjoyment, and the social prestige.

Now is the time for technicians to show their leadership, and increase their profits in the process. Get started in color TV now. "Give the trumpet a certain sound!"

# Tuning In the

**SALES OF PORTABLE RADIOS** are well ahead of last year's figure. One seer (CBS-Col. radio sales mgr. R. Windt) expects a 10 percent jump over the entire year as compared to 1954. The trend would seem strange, in view of the fact that this radio type has been with us for many years, but the upswing seems to be part of the trend toward more leisure hours, private home ownership and suburban living. The tip-off: sales of outdoor grilles and light summer furniture are also climbing. In radio receiver types, portable sales are outranked only by those of clock radios.

**ELECTRONIC ENGINE ANALYZER** developed by the Socony-Vacuum Oil Company will be manufactured and sold by Du Mont under a recently concluded licensing agreement. The unit, with self-contained oscilloscope, looks like a portable TV set, and is powered by the car battery for use in road checks or alternately by a 110-volt source. The analyzer will pinpoint nearly all ignition system faults, as well as many reflected into the ignition system, and including defects that are elusive under ordinary check methods. Typical picture patterns of about 65 different engine ailments have been observed and identified.

**AUTOMOBILE HI-FI**—Preview of audio system for the cars of tomorrow is seen in this two-way speaker system installed by Ralph P. Glover, vice-president of Jensen Mfg. Co., Chicago, in his Ford Thunderbird. The compression driver and horn-loaded tweeter (circled, below dashboard) and special 6x9 in. woofer (behind top opening of instrument panel, area circled) are connected to the auto radio. Ford may include a hi-fi arrangement of this type in their forthcoming super deluxe Continental.

Automobile Hi-Fi



**STEREOPHONIC HI-FI** may soon be getting solid promotion. Some tape recorder makers are busy on designing twin-track jobs adapted for binaural use that will be aimed at the home machine market. Big obstacle to stereophonic systems is the almost-doubled cost factor in most home installations, where nearly two completely separate but identical audio reproducing channels are required.

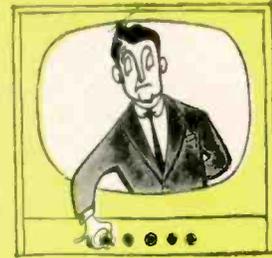


"I mustn't forget to take my tools with me tonight. My girl invited me to her house for dinner—and that can mean only one thing."

**ALONG THE BUSINESS FRONT:** TV set sales are down from earlier months, but are estimated to be better at the retail level than they were this time last year. . . . Plenty of planning and money-spending along the pre-recorded tape front. A big business is ahead in this field, and technicians need to keep their hands in on recording and playback instruments. . . . Hi-Fi is slowly but surely getting across to the layman-consumer, and plenty of stores are investing pioneering money in stocking and pushing high fidelity equipment. In many spots throughout the country one sees some magnificent outside-of-store signs advertising Hi-Fi. . . . In attempts to capitalize on the "magic" word "discount"—"magic" so far as consumers are concerned—some service shops are using the term to sell service, tubes, parts, etc.

**PUNCH-LINES AND SLOGANS BEING CURRENTLY USED** by service shops in their advertising include such phrases as "Old established" . . . "90 Percent of Repairs Made in the Home" . . . "24-Hour Emergency Service" . . . "If We Can't Fix It—Throw It Away" . . . "All Your Money Back Service Policy" . . . "Large Enough to Serve You—Small Enough to Know You." In some sections of the country, shops use classified sections of phone books with multi-listings, alphabetized under all of the well-known makes. One of such advertisers tells us that this is most effective since many customers seeking repairs look for the make of their set in the directory.

# Picture .....



**FM BROADCASTING** is in a healthy condition, if a recent survey in the New York area is any indication. The report was made by an independent research outfit for WQXR, which transmits both on AM and FM. More than 2 million homes in the N. Y. area own FM sets. Of these, about a million were in active use during the week when the survey was conducted. This marks an increase of 18 percent in homes with FM sets as compared to last year. The upward trend, which shows no sign of leveling off, has been in evidence since 1948, when the surveys first began. At that time, more than seven years ago, there were only 130,242 FM homes in the area. The amount has increased more than 17 times in that period!

**REPAIR VOLUME HAS SLOWED** down in some areas, mostly because of the season. Big-city shops are fighting hard to keep jobs rolling in because so many outfits are now in the picture that business is cut up between large numbers of shops, and few are getting the big slices they had this time last year.

**TRANSISTORS IN FLIGHT** applications are showing more and more versatility. The first successful airplane flights with all-transistorized automatic navigation and landing systems have been announced by Bendix Aviation Corp. This is the same organization that disclosed, a few months ago, the first flight of a plane controlled by a transistorized automatic pilot.

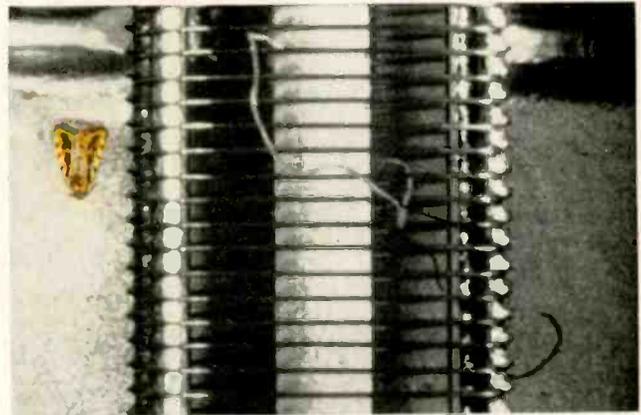
**TUBES, TUBES, TUBES.** After surveying 150 different TV receivers put out during 1954 and '55, GE's tube department comes up with the fact that 119 separate tube types were used in the sampled chassis. If you've been having trouble keeping a stock of all those you need, you know why now. Or did you already? Incidentally, the 150 representative sets surveyed had a total of 2,950 sockets. That's just short of a 20-tube-per-set average.

## JUNE 1955 NETWORK COLOR TV SCHEDULE

<b>SATURDAY, JUNE 4:</b>			
9:00—10:30 PM (EDT)	NBC	"Max Llebman Presents—	Chocolate Soldier" (Live)
<b>SUNDAY, JUNE 5:</b>			
6:00— 7:00 PM (EDT)	DuMont	"Sunday Supplement"	(Film)*
<b>THURSDAY, JUNE 9:</b>			
8:30— 9:30 PM (EDT)	CBS	"Shower of Stars"	(Live)
<b>SUNDAY, JUNE 12:</b>			
6:00— 7:00 PM (EDT)	DuMont	"Sunday Supplement"	(Film)*
<b>SUNDAY, JUNE 19:</b>			
6:00— 7:00 PM (EDT)	DuMont	"Sunday Supplement"	(Film)*
<b>SUNDAY, JUNE 26:</b>			
6:00— 7:00 PM (EDT)	DuMont	"Sunday Supplement"	(Film)*
<b>MONDAY, JUNE 27:</b>			
8:00— 9:30 PM (EDT)	NBC	"Producers' Showcase"	(Live)

\*DuMont color film series, over WABD, will be suspended for three weeks while extended program is being prepared. Suspension dates not available at press time.

## WHAT IS IT? (See page 48)



**NEW CHALLENGES TO THE INGENUITY** of the TV technician are in the offing. Immediately, of course, there's color TV, and on the way the installation and maintenance of electronic cooking ranges. Then, too, consider the likelihood of working on electronic room air conditioners and refrigerators.

**OUR TECHNICIAN'S DUMB GIRL FRIEND** is getting the tables turned on her, at last, by her not-so-dumb technician boy friend. Suspecting her of two-timing him, he made a threat that has her worried. He says he'll get the truth out of her by hooking up a 6AL5 as a lie "detector." He also has her thinking that there can be no true equality in this country until the Foster-Seeley discriminator is outlawed—and that the daughter of the fellow who discovered Ohm's law is called Meg Ohm.

**WAVE OF TRANSISTOR PRICE CUTS**, noted in this space in March, continues unabated. Radio Receptor announces a price range from 75 cents to \$4.50, where transistors were \$8.00 each a little over a year ago. "Within 2 years," says prexy Hugo Cohn, "transistors may be below 50 cents." The company is now making transistors that are only 0.2 in. square and one-eighth in. thick.

## CALENDAR OF COMING EVENTS

June 6-8:	The Fourth Annual Convention and Trade Show for the National Community Television Assoc., Inc., Park Sheraton Hotel, New York, N. Y.
Aug. 19-21:	National Alliance of Television & Electronic Service Assoc. National Service Show, Hotel Morrison, Chicago.
Sept. 30- Oct. 2:	1955 Hi-Fidelity Show, Palmer House, Chicago, Ill.
Oct. 3-5:	Eleventh National Electronics Conference, Hotel Sherman, Chicago, Ill.
Oct. 12-15:	1955 Convention, Audio Engineering Society, Hotel New Yorker, New York, N. Y.

# Practical Approach to

## An analysis of the troubles common to all tuners—

W. J. WILLIAMS

• At the TV frequencies—54-220 mc., and even higher in UHF—lead lengths, and parts placement become very critical. The inductances in tuned circuits approach a straight piece of wire with the increase in frequency and also, the capacities in the vacuum-tubes themselves become a serious problem. This effect accounts for the compact design of TV tuners and the accompanying service difficulties. Which brings up this extremely important point: Bear in mind when working on TV tuners that any difficulties presented result almost exclusively from the mechanical layout. The circuits themselves are very simple.

### Tuner Functions

The basic functions of the tuner are shown in Fig. 1. Tuned circuits are usually found at the points indicated by A, B, C, & D. A, the antenna input of the r-f amplifier stage, is tuned to the band of frequencies of the TV channel being received. B, the grid circuit of the mixer stage, is tuned to the same frequencies. C, the local osc. coil, is tuned above the r-f carrier frequency by an amount equal to the i-f frequency of the receiver. The tuned circuit at D, the output of the converter stage, is tuned to the i-f frequency.

Before discussing the causes of the various troubles, it may be well to review the different types of tuners which are encountered. Despite the

dissimilarities in their outward appearances, all commercially available tuners fall into one of these three basic groups: the turret-type, examples of which are the Standard Coil and the Zenith; the wafer-switch type, which includes nearly all RCA-built tuners, and the Sarkes-Tarzian, to mention only two; and the continuous-type, both variable-inductance and variable-capacity forms, which takes in the Mallory (used in earlier DuMonts), and the General Instrument tuner.

The basic difference in tuner construction is in the method by which the various circuits are tuned, and the manner of selecting channels.

In the turret tuner, individual tuned-circuits for each channel are mounted on a drum. The drum is turned by the selector shaft to switch in the desired coils.

In the switch-type, several sets or decks of 12-contact switch wafers tap off portions of an inductance as the selector is rotated from channel to channel. This type is sometimes referred to as an "incremental inductance" tuner.

Continuous tuners use spirally-wound inductances with wiper-arms which move along the coils to change the frequencies of the tuned-circuits. Another popular form uses ganged variable-condensers, in an arrangement similar to A.M. radio construction.

Most tuner troubles will come under one or more of the following headings. They are listed in the order of their occurrence.

1. Noisy, intermittent or microphonic
2. Dead, i.e., no signal passing through
3. Incorrect oscillator frequency, or "drift"
4. Poor gain (snowy reception)
5. Interference pickup.

### Noise

By far, the most commonly-encountered complaint is the noisy, or intermittent tuner. In at least 75% of these cases, it means that the switch contacts or moving wipers have become corroded or oxidized. These surfaces, which carry r-f as well as dc potentials, must be cleaned and lubricated. There are a number of fine preparations on the market today made specifically for this purpose. They are inexpensive, and only a trifling amount need be used on each job. Do not use pure carbontet alone, unless followed up by the special contact cleaner, as it tends to hasten re-oxidation. In the case of the Standard Coil turret tuner, a cloth moistened in the contact cleaner, and rubbed briskly over each set of insert contacts is usually sufficient to do a good job. On any switch type, a drop on the contact point of each wiper arm will do. Variable-inductance tuners—the Mallory, for example—should receive a drop on any wiping or sliding contact surface. Variable-capacity tuners usually have a slide-switch mechanism, which should also receive the cleaning. Do not use

Fig. 1—Block diagram. Tuned circuits are usually found at A, B, C & D.

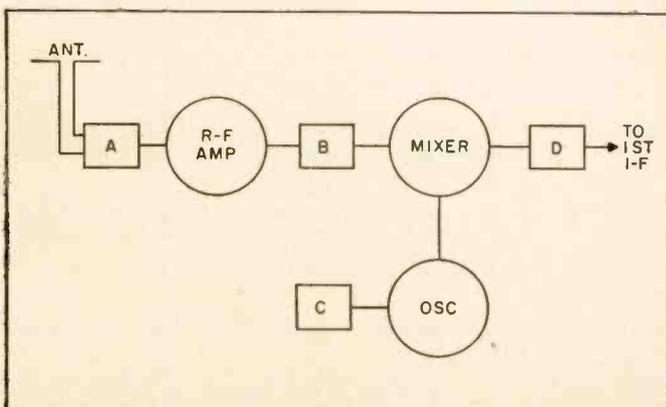
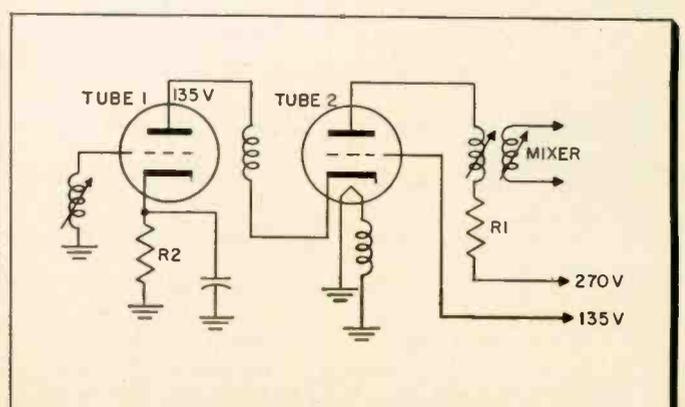


Fig. 2—"Runaway" current is a problem in cascode r-f amplifier stages.



# Troubleshooting TV Tuners

with the specific corrective measures for individual types

an excessive amount of the cleaning solution, or allow it to drip on any other parts in the tuner.

In the "dead" tuner, where no signal whatsoever is passing thru to the i-f's, it generally means that the local-osc. is not functioning. This may occur only on certain channels, or on all. To determine whether the oscillator is functioning, check the "injection" voltage. Many tuners have a special test-point brought out just for this purpose, located physically close to the osc. or converter tubes. If no test point is seen, apply a vtvm probe with an isolating resistor to the grid of the osc. tube or the converter tube. The presence of a  $-1.5$  to  $-2$  v. or more indicates that the osc. is functioning—though not necessarily on the correct frequency. (More about wrong-frequency troubles later.) Since the osc. circuit itself usually contains only a few components, simple voltage checks, along with resistance readings (coil continuity, etc.) will generally disclose the defective part. A schematic diagram is practically a necessity, incidentally, especially in determining values of parts to be replaced. One word of caution: exact replacement parts must be used, particularly in the case of ceramic capacitors in the osc. circuit. Also, lead length and dress must be exactly the same as the original, otherwise it may be impossible to realign to the correct frequency.

## Oscillator Correction

The next most common complaint is inability to tune in a channel on its correct number, or the loss of either pix or sound and oscillator-drift, which is a related defect. If the appropriate osc. slug-adjustments or new tubes fail to bring the osc. back into "tracking," it generally means that the top-frequency-determining element in the tuned-circuit has changed value. This element is usually a small ceramic capacitor of the temperature-compensating type (to make up for drift during warm-up), connected from grid to cathode or ground at the osc. tube socket. A defective capacitor of this type will also account for many of the excessive drift problems encountered

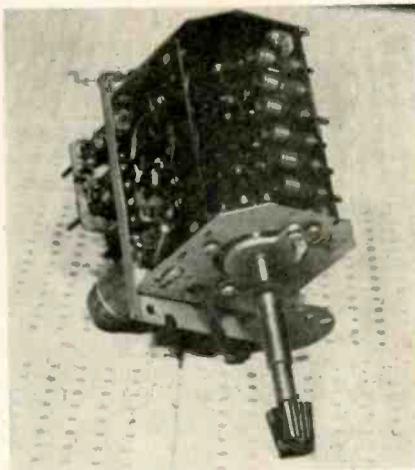


Fig. 3—RCA KRK-2, found in early 630 sets.

(need for constant readjustment of the tuning control). A hot soldering gun tip held near such parts will probably make the trouble show up more definitely. A sudden "jump" in frequency after warm-up where a channel may skip one or more numbers away will usually mean that this capacitor is bad. Rocking the osc. tube in its socket will often induce this trouble. Incidentally, be sure to tighten the socket contacts with a sharp pick before jumping to conclusions—especially in the case of intermittents. After going "round and round" with an intermittent tuner recently, the author found (with an ohmmeter, finally) that a socket contact was broken inside the socket, between the exposed metal parts!

In switch-type tuners, inability to "track" frequency on any one channel may be due to a slug-adjustment screw turned in too far, and shorting the respective inductance out of the circuit. Incidentally, in some tuners, several osc. tubes may have to be tried before one is found that will hit correct frequency. This is especially true of tuners which do not have individual slugs for each channel.

## Gain

Poor gain in a tuner, evidenced by excessive "snow" in the pix, when the signal is known to be strong, generally is traceable to defects in

the r-f amplifier section, or the antenna-input coupling devices, traps, elevator coils, etc. In some rare cases, weak osc. injection voltage may be the cause, and a meter reading at the previously-mentioned test point will confirm this. But, concerning the r-f tube circuit itself, some voltage measurements made with the aid of a test-socket adapter may be very revealing. Again, a schematic will prove valuable with voltage data.

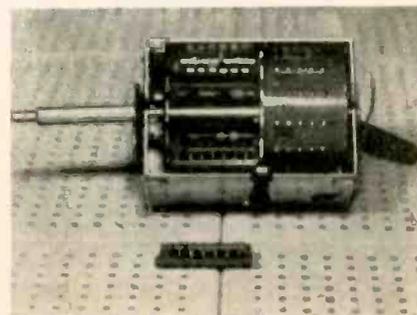
Before digging too deeply into the r-f stage itself, make this simple check for troubles in the input devices: Connect one leg of the shop antenna directly to the input grid of the r-f tube at the socket through a small capacitor (about 50 mmf.), and ground the other leg of the antenna. If the snow disappears, and the signal increases noticeably, you know that the fault lies in the coupling devices.

## Cascode Amplifiers

Cascode r-f stages seem to be more troublesome, in general, than the other r-f amplifier circuits, and deserve special attention. The cascode circuit used in most late-model tuners consists of two triode amplifier stages. The signal is fed into the grid of the first triode and its plate is direct-coupled (thru a broadband tuned circuit) to the cathode of the second triode, which is operating as a grounded grid amplifier. The output of this second stage is transformer coupled to the mixer stage, using tuned circuits. A high dc potential, about 270 v.) is applied to the plate of the second stage, and the

(Continued on page 40)

Fig. 4—"Standard Coil" slugs are removable.



# Service Technician's Guide

## Advantages and Disadvantages of Wet and Dry Types;

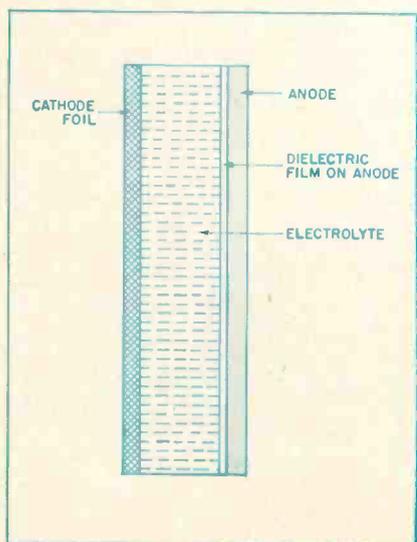
SOL HELLER

• The electrolytic condenser is an important component in radio and TV receivers. There are many factors concerning its choice and use with which service technicians may not be too familiar. This article will discuss such factors. A brief review of the purpose and construction of the electrolytic condenser will give us a helpful peg on which to hang some comments later.

The electrolytic condenser provides a relatively enormous capacitance per unit of space it occupies. Bulk, weight and cost per microfarad are thus greatly reduced. These advantages are obtained through the use of an extremely thin dielectric—one many times thinner than a thin sheet of paper.

Three basic components are present in the electrolytic capacitor; the anode, the dielectric film and the electrolyte (see Fig. 1). The anode (made of high-purity aluminum) is used as one plate of the capacitor; it also serves as a base for the dielectric film, which is developed on the anode by electrochemical action. The electrolyte—either a liquid or paste-like material—forms the second plate of the capacitor.

Fig. 1—Internal construction of electrolytic capacitor. Electrolyte and cathode foil make up one plate; anode acts as the other plate.



### Types of Electrolytic capacitor.

There are two types of electrolytic capacitor: the dry and the wet. The dry electrolytic uses the paste-like electrolyte; in the wet type, the electrolyte is in a water solution. The anode in the wet type is suspended in a can that holds the electrolyte. The can, which is usually made of aluminum, provides the needed electrical connection with the electrolyte. In the dry-type capacitor, a piece of aluminum foil referred to as the *cathode foil*, or *cathode*, makes contact with the electrolyte.

### Dry vs. Wet Electrolytic Condensers.

Servicemen should know something of the relative merits of wet vs. dry electrolytic types, since they sometimes substitute one for the other. Due to the relative large separation of the electrodes, as well as other construction factors, the wet electrolytic condenser is not likely to become permanently short-circuited. It is much better suited than the dry electrolytic to withstand the frequent voltage surges and short-duration overloads that characteristically occur in rectifier filter circuits, particularly in the input filter section.

Another advantage of the wet electrolytic condenser—in certain applications—is its higher leakage current. This is generally a drawback, rather than an asset, since the dc flow through a filter capacitor loads down a power supply, and reduces output voltage. During the first minute or so after a radio or TV set is first turned on, however, leakage in the filter condensers is beneficial, since it reduces the B voltages, which tend to be excessive and dangerous during this period. This is so because the cathodes of the receiver tubes do not immediately become hot enough to pass their normal currents. As a result, the power supply is not properly loaded down at first.

The wet electrolytic condenser tends to have a substantially greater leakage during the set's warm-up period than the dry type; after the set has warmed up, this leakage cur-

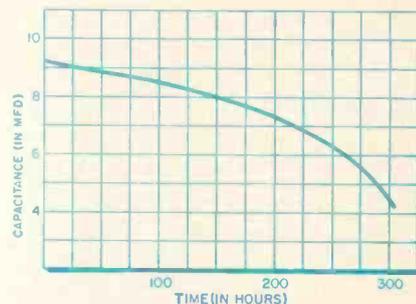


Fig. 2—High temperatures reduce capacitance, also increase condenser's series resistance, thus reducing bypassing efficiency. Motor-boating or low-freq. oscillation may result.

rent falls, although it still remains larger than that of the dry capacitor. Some wet type condensers are primarily used in radio receivers because they provide voltage regulation of the kind just described.

The advantage of the dry-type electrolytic lies in its greater mechanical adaptability. It can be readily mounted in the receiver, and it generally requires less space. The wet electrolytic, on the other hand, must be mounted vertically; in practically all cases, this necessitates a top-of-chassis mounting. The vents present in such a condenser must be unobstructed, to permit the escape of gases.

Service-wise, we can draw the following conclusions: Replace wet electrolytics with equivalent wet types, to maintain the same assurance of trouble-free operation originally present in the set. In cases where dry electrolytic condensers fail prematurely, due to voltage surges and related conditions, a wet electrolytic capacitor may be substituted for a dry one (if space permits).

Some of the wet electrolytic condensers used in older radio receivers have large power factors. Power factor is a measure of power losses in a capacitor. A condenser with a large power factor acts as if it had a relatively large resistor in series with it. The capacitor's bypassing action is effectively reduced and, if it is located at the input side of the choke, the B voltages are correspondingly lower. In cases where every bit of B-plus that can be

# to Electrolytic Condensers

## Pitfalls Often Overlooked in Choosing Replacements

scraped together is desired in one of these older receivers, substitution of a dry-type electrolytic for the wet one present may achieve this.

**Effects of Heat.** Excessively high temperatures are bad for electrolytic condensers. They cause the electrolyte to dry out, and the power factor to increase (see Fig. 2). Also, dc leakage current in the condenser goes up (see Fig. 3). Since the increase in leakage current creates a larger heat dissipation in the condenser, which, in turn, further increases the leakage current, a vicious cycle may be started which destroys the condenser's usefulness. Such a cycle, which tends to begin when the capacitor's temperature gets beyond 90 degrees centigrade, is a frequent cause of premature failure.

The condition just described is apt to occur in sets which are operated for long periods of time without proper ventilation. Compact receivers should not, for this reason, be placed in bookcases or similar locations, where there is no free circulation of air. Console radios and television sets should not be placed flush against a wall, nor should ventilation openings be obstructed in any way.

When the serviceman is replacing a dry electrolytic condenser in a receiver (particularly a cramped ac-dc midget set) which functions in very hot surroundings—say in the kitchen

of a restaurant—a condenser with a metal can is more desirable than a unit with a cardboard container. The metal-can condenser will radiate away more of its internal heat than the cardboard type, and will thus be in a better position to withstand the rigors of life near a hot stove. When a hermetically-sealed metal-can construction is employed, the loss of electrolyte (which is promoted by heat) is minimized, and longer life is assured for this reason as well.

Leakage current (excessive amounts of which are dangerous to electrolytic capacitor life, as we previously pointed out) increases not only with increase in temperature, but also with increase in operating voltage. When the operating voltage is lower than the condenser's rated working voltage, the leakage current is correspondingly smaller. To assure longer life for a condenser that must be exposed to undue amounts of heat, use a unit rated at 50 or 100 v higher than the voltage to which it will be exposed.

It is hardly necessary to point out that electrolytic condensers should be installed in the coolest part of the receiver, away from high-wattage resistors, very hot tubes, etc.

**Ripple Current.** The rms ripple current flowing through an electrolytic condenser is important when the condenser is used as the input filter in a power supply, since this current is relatively high (much higher

than in the case of the output filter condenser, which is in series with the choke.) Ripple current tends to have two damaging effects: 1—It causes the condenser to heat up. 2—It tends to produce a film on the cathode of the capacitor, which reduces the capacitance of the unit (the film acts as a condenser in series with the original capacitance). The permissible ripple current increases with capacitance—a 32 mfd 450 v capacitor, for instance, can take a maximum of 100 ma at 70° C., whereas certain 8 mfd 450 v units will say "Uncle" when the ripple current at the same temperature exceeds 10 ma. (The condensers referred to are etched-foil types; plain-foil 8 mfd 450 v units can stand up to higher ripple currents.)

In view of these facts, it is wise not to use a condenser whose capacitance rating is less than that of the original unit it is replacing. It is also not too advisable to connect a small-capacitance unit across an aging larger unit that has lost capacitance, in an attempt to effect an economical repair; the smaller unit may conceivably be damaged as the original condenser ages further.

**Preventing Rectifier Damage.** Improper choice of a filter condenser replacement may destroy a rectifier prematurely. Every rectifier has a maximum plate current rating that  
(Continued on page 42)

Fig. 3—Effect of temperature on leakage for 8-mfd, 450-v capacitor.

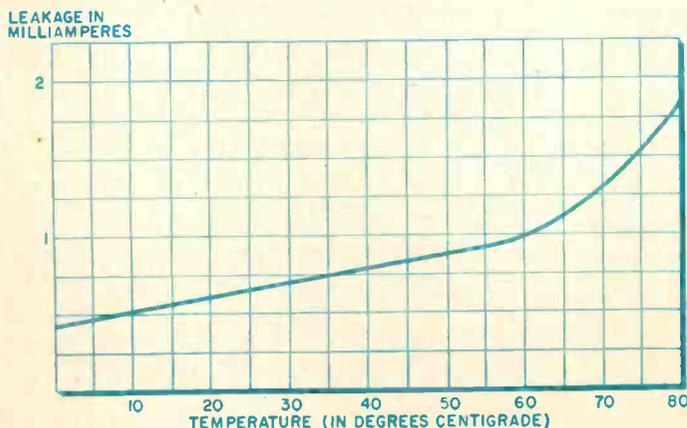
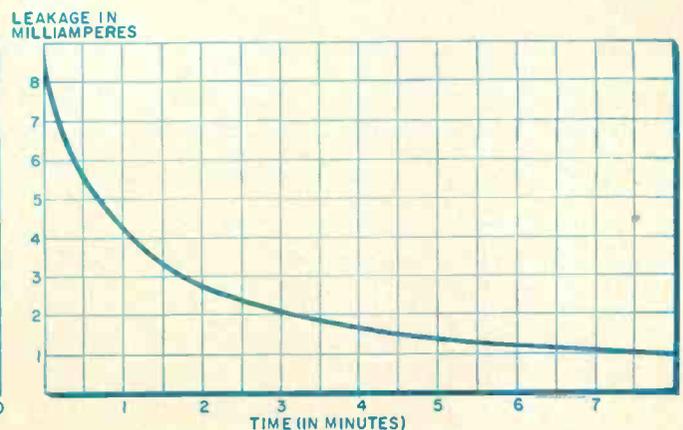


Fig. 4—Leakage of 8-mfd, 450-v capacitor after 40 days shelf life.



# Let's Look At Circuits

## No. 2: The Basic Multivibrator ; an Oscillating See-Saw

SIDNEY C. SILVER  
MANAGING EDITOR, TECHNICIAN

• Probably the most frequently used deflection oscillator in TV receivers today is the multivibrator. In one form or another, it has been pressed into service in either or both the horizontal and vertical sections of TV deflection systems. The particular version generally used is not the one shown here; however, our choice lends itself to the best explanation of how multivibrators operate in general.

In looking at the schematic, imagine that the portions shown in broken lines do not exist: like most oscillators, this one does not need an input anyhow to perform its function. As we shall see, the application of operating voltages is enough to start it and keep it going. With the broken lines out of the way, we have a neatly symmetrical layout involving two resistance-coupled triodes tied to each other in a rather strange way, since the output from the second section is fed back to the grid of the first stage (through C2).

The impression of symmetry is supported by the values of circuit components: the respective plate load resistors, R1 and R3, are equal. So are the grid return resistors, R2 and R4, and the coupling or feedback capacitors, C1 and C2.

### Unbalance

Despite this balanced arrangement, the circuit actually depends on a small amount of unbalance to get itself started. Any small difference in characteristics between the two triodes, or in any of the matched pairs of resistors or condensers, answers the purpose. In any case, due to this initial unbalance, one of the triodes begins to conduct more heavily than its almost identical twin when operating voltages are applied.

When B-plus is present at the plates of V1 and V2, and before either tube conducts the coupling capacitors C1 and C2 will charge up to the full supply voltage through the cathode and grid circuits of the respective tubes. In terms of electron flow, there will be accumulation of electrons on the grid side of the

capacitors, proportional to the full supply voltage.

Now, let's assume that, due to the slight unbalance, V1 starts to conduct before (or more heavily than) V2. The current then passing through its plate load resistor, R1, will cause a voltage drop. Since B-plus is fixed, and more of it is being dropped across R1, less is available at the plate of V1. C1, which was initially charged up to the full supply voltage, must now discharge some of its accumulated electrons. Its charge-path, through the cathode of V2, is closed; so it discharges the electrons to ground through R4, biasing the grid of V2.

With the V2 grid voltage thus lowered, this second tube tends to conduct less than it would in the ideal state of perfect symmetry. The sequence of conditions now set up for V2 is the reverse of the sequence for the first triode: with its grid tending to be somewhat more negative, current through the tube is kept down; the drop across its load, R3, is thus reduced; more of the fixed B-plus voltage is available at the plate of V2 itself; and finally, this increased positive value is returned to the grid of V1 through C2.

With the V1 grid thus being made more positive, its conduction increases still further. The drop across load resistor R1 also continues to build up; the plate voltage drops still further. This dropped voltage is sensed by the V2 grid (through C1),

and the latter stage conducts still less. Conditions during the build-up of this cycle may be summarized as follows: For V1, there is increasingly positive grid voltage, increasing plate current and decreasing plate voltage. For V2, conversely, there is decreasing grid voltage, decreasing current and increasing plate voltage.

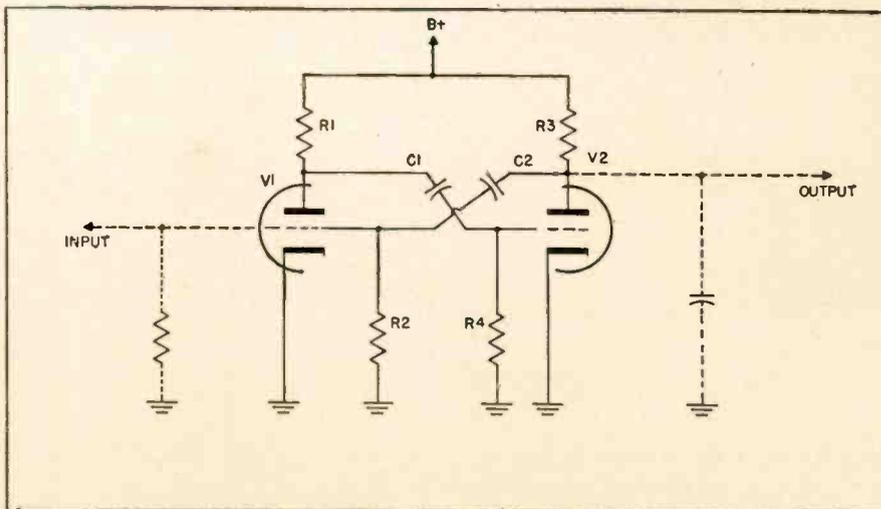
The runaway cycle continues until the V2 grid goes so negative that the tube is cut off completely. The unfortunate triode is now saddled with a healthy negative charge at its grid that has no place to go. But wait! Although the tube cannot help itself out, its mate, which has just come close to strangling it, suddenly comes to the rescue.

### Tube Resistance

How so? Well, a tube is often described as a variable resistor. When it is cut off, no current can go through it, and it therefore has infinite resistance. At the other extreme, when it is conducting heavily (and electrons are streaming through it in force), it looks like so low a resistance as to be almost a short. V1 is in just such a "shorted" condition. The charge at the V2 grid can now back up through C1, to the plate of V1, and find its way to ground right through the tube. It does so almost instantaneously, since the R-C time constant that controls this action is extremely short due to the extremely

(Continued on page 44)

The basic multivibrator. Disregard input and output connections in considering operation.



# Cater to The Hard of Hearing

No Special Equipment Needed. Here's How—Including Contacts

By ALBERT J. FORMAN  
CONSULTING EDITOR, TECHNICIAN

• More than 15,000,000 people in the U. S. suffer from hearing impairment, including 1,000,000 who wear hearing aids and 2,000,000 more who really need such aids. Each one of these people is an excellent prospective customer for you.

In addition, many churches and theaters wishing to make special provision for the hard of hearing are

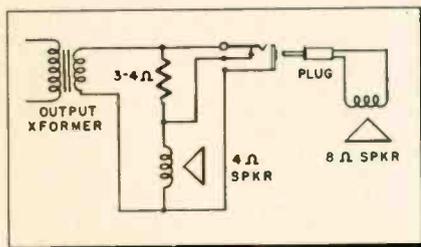


Fig. 1—Extra 8-ohm speaker at viewer's chair plugs into matched 4-ohm audio output.

in need of your services to install and repair their specialized hearing equipment. For example, in New York City alone there are over 90 churches and 11 theaters so equipped.

Here is how you can contact the hard of hearing. Through the joint efforts of the American Hearing Society and TECHNICIAN magazine, the hard of hearing are being informed to contact the local chapters of their society. These chapters will refer them to technicians in the community who are interested and qualified to install supplementary audio and visual aids, excluding the actual hearing aid which is usually factory serviced.

Now it's up to you to put your

name on file with the American Hearing Society group in your vicinity by contacting the proper chapter listed in these pages. If your area is among those not listed, write to the Society's national headquarters or the editors of TECHNICIAN for the address of the chapter nearest you.

The hard of hearing require a variety of devices to make their home lives safe and comfortable. Some examples are signal lamps. They may be connected to the telephone (the phone company takes care of this), to the door bell and to the appliance timer. Also vibrator units are connected to the alarm clock for use under the pillow.

## TV Listening

In recent years, the problem of listening to TV programs has presented itself. This situation was never too critical with radio since the hard of hearing listener could sit right next to the speaker. However, TV requires that high level sound be brought some 10 or more feet to the viewer's chair without raising the volume high enough to shake the neighbors.

This may be accomplished in several different ways. The simplest method is to place an extension cord on the hearing aid microphone and locate the unit next to the TV set. The trouble here is that the long cord from the hearing aid receiver to the earpiece is easy to trip over.

A second, and slightly risky technique is to connect the hearing aid earphone to the speaker leads either directly or through an isolating capacitor. Don't do it. Not only is the high impedance earphone an im-

proper match to the set's output transformer, but even these relatively low voltages in the ear can be dangerous, or even lethal. Capacitors have been known to break down. In addition, remember that these voltages are present near the brain.

A third method employs a wireless microphone next to the TV set playing through a radio next to the viewer. This is safe enough, but the audio quality can be pretty bad.

We recommend one of the two following methods. The first is to connect an extra speaker to the TV set, and locate the added speaker at the viewer's chair. (See Fig. 1.) (Details on how to do this are given in "Adding Extra Speakers," March 1955 TECHNICIAN, Page 23.) Here the hearing aid receiver controls the earphone volume. Additional volume control may be obtained at the extra speaker alone by inserting a low resistance variable control in series with it. If the extra speaker is mounted in a small box and the hearing aid receiver placed on top of it, the *air sound conduction* will be sufficient to produce a high sound level in the earphone without excessive volume from the extra speaker, to annoy other listeners in the room who have normal hearing capabilities.

## Inductive Pickup

The second method, and a very desirable one, utilizes *electromagnetic induction*, instead of air conduction, to carry the TV sound to the hearing aid user. This system takes advantage of the induction coil pickup (Continued on next page)

Fig. 2—Induction coil plate across output transformer provides signal for hearing aid. Quieting switch and dummy load are optional.

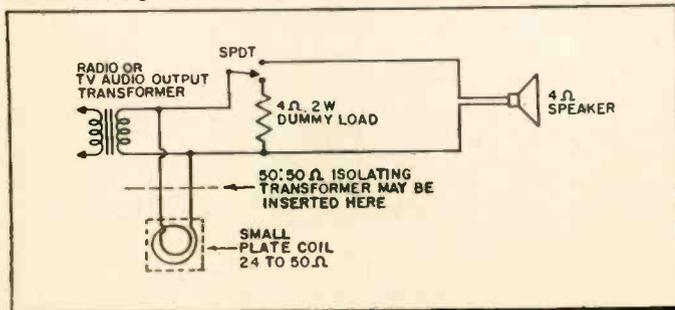
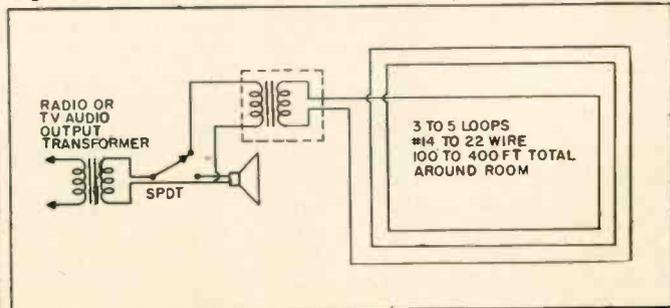


Fig. 3—Inductive wiring for entire room allows free movement of hearing aid wearer about room while he listens to TV sound output.



which comes with many types of hearing aids for listening to telephone conversations. On hearing aids of this type, the selector switch position marked "T" is usually used for induction coil pickup.

There are two variations of the induction system. One uses a flat plate a few inches square with a built-in coil. These units are available commercially, and often have a 24-ohm dc resistance. (See Fig. 2.) After connection to the TV speaker output, the coil plate may either be placed in the same pocket of the hearing aid or on an adjacent table under the aid when in use. The coil plate may be connected directly across the speaker leads in ac operated radio and TV sets, but should preferably be connected through an isolation transformer in ac-dc sets where line voltage may present a shock hazard. The high impedance of the plate coil or isolation coil (about 50:50 or 100:100 ohms) causes very little extra power drain.

#### "Wired" Room

The second variation of the induction system (one to be highly recommended) uses a few loops of wire around the room baseboard, under the rug or on the back of a sofa. In this manner the hearing aid user actually may walk or sit anywhere in the room, or even the next room, and still receive the TV sound. (See Fig. 3.) If the speaker is switched out, only the hearing aid wearer with an induction coil pickup will hear the program, since the inductive field is otherwise inaudible. Volume is adjustable with either the regular set volume control or the hearing aid volume control.

One system of this kind which works very well employs three loops of No. 20 wire around a 10 by 10 ft. area. This coil (of about 1 ohm) is matched to the 4-ohm speaker output by a 1:5 ohm transformer. An extra couple of loops raises the inductive signal level somewhat, but are not really needed. Even with only three loops, the signal can be received two rooms away.

These are some of the opportunities available in specialized audio installation. And don't forget, a customer satisfied with the completely wired inductive room is also an excellent prospect for regular TV repairs. So cater to the hard of hearing. Contact the nearest chapter of the American Hearing Society and let them know that you are qualified and ready to install supplementary audio aids. ●

### American Hearing Society

817 14th St., N.W., Washington 5, D.C.  
Selected Local Chapters

#### CALIFORNIA

Hearing Center of Metropolitan Los Angeles  
215 West Fifth Street, Los Angeles 13

Sacramento Hearing Society  
910 Twenty-first Street, Sacramento 14

San Diego Hearing Society  
3843 Herbert Street, San Diego 3

San Francisco Hearing Society, Inc.  
Community Chest Bldg., Steiner and Pine Sts.,  
San Francisco 15

#### COLORADO

Denver Hearing Society, Inc.  
1556 Emerson Street, Denver 5

#### CONNECTICUT

Hartford Hearing League, Inc.  
252 Asylum Street, Hartford 3

#### DISTRICT OF COLUMBIA

Washington Hearing Society  
1934 Calvert St., N.W., Washington 9

#### FLORIDA

Miami Hearing Society  
128 S. E. 3rd St., Miami

#### ILLINOIS

Chicago Hearing Society  
30 West Washington St., Room 615, Chicago 2

#### INDIANA

Hearing Society of St. Joseph County  
511 W. Colfax Ave., South Bend 1

Indianapolis Speech and Hearing Center  
615 North Alabama Street, Indianapolis

#### IOWA

Des Moines Hearing Society  
615 Locust Street, Des Moines 9

#### LOUISIANA

New Orleans League for Better Hearing  
165 Elk Place, New Orleans 13

#### MAINE

Portland Hearing Society  
653-A Congress St., Portland 3

#### MARYLAND

Baltimore Hearing Society  
322 North Charles Street, Baltimore 1

#### MASSACHUSETTS

Boston Guild for the Hard of Hearing  
283 Commonwealth Avenue, Boston 15

Springfield Hearing League  
1694 Main Street, Room 209-11, Springfield 3

Worcester Hearing League  
214 Day Bldg., 306 Main Street, Worcester 8

#### MICHIGAN

Constance Brown Society for Better Hearing  
316 Commerce Bldg., 111 N. Rose St.,  
Kalamazoo

Detroit Hearing Center  
4464 Cass Ave., Detroit

Grand Rapids Society for the Hard of Hearing  
1230 Madison Ave., S.E., Grand Rapids 7

Michigan Association for Better Hearing  
408 Hollister Building, Lansing 8

Muskegon Society for Better Hearing  
c/o Mrs. E. W. Boyer, 1505 Terrace Street,  
Muskegon

#### MINNESOTA

Minneapolis Society for the Hard of Hearing  
1722 Hennepin Avenue, Minneapolis 3

St. Paul Hearing Society  
496 Endicott-on-Robert Bldg., St. Paul 1

#### MISSOURI

Kansas City Society for the Hard of Hearing  
1 W. Linwood Blvd., Room 203, Kansas City 2

St. Louis League for the Hard of Hearing  
4527 Westminster Place, St. Louis 8

#### NEW JERSEY

Newark Hearing Society  
53 Washington Street, Newark 2

Paterson League for the Hard of Hearing  
182 Ellison St., Paterson 1

#### NEW MEXICO

New Mexico Hearing Society  
405 Freeman Ave., N.W., Albuquerque

#### NEW YORK

Nassau Hearing Society  
Nassau Hospital, 1st St., Mineola, Long Island

New York League for the Hard of Hearing  
480 Lexington Avenue, New York 17

Rochester Hearing and Speech Society  
800 East Main Street, Rochester 5

#### OHIO

Cincinnati Speech and Hearing Center  
616 Walnut Street, Fourth Floor, Cincinnati 2

Cleveland Hearing and Speech Center, Inc.  
11206 Euclid Avenue, Cleveland 6

Columbus Hearing Society  
137 East State Street, Columbus 15

Dayton Hearing Society  
1400 East Third Street, Dayton 3

Toledo Hearing League  
2313 Ashland Avenue, Toledo 10

Youngstown Hearing Society  
69 Illinois Avenue, Youngstown 4

#### OREGON

Portland Center for Hearing and Speech, Inc.  
Education Center Bldg., 220 S.W., Alder,  
Portland 4

#### PENNSYLVANIA

Philadelphia Society for Better Hearing  
2019 Spruce St., Phila. 3

Pittsburgh Hearing Society  
Granite Bldg., 6th Ave. at Wood St.,  
Pittsburgh 22

#### RHODE ISLAND

Providence League for the Hard of Hearing  
42 Weybosset Street, Providence 3

#### SOUTH CAROLINA

Columbia Hearing Society  
Forsythe Bldg., 915 Main St., Columbia

Greenville Hearing Society  
25 A South Main Street, Greenville

#### TENNESSEE

Nashville League for the Hard of Hearing  
120 21st Avenue S., Nashville 4

#### TEXAS

Dallas Hearing Society  
4222 Lemmon Avenue, Dallas 4

Houston Speech and Hearing Center  
610 Gray Avenue, Houston 3

#### WASHINGTON

Seattle Hearing and Speech Center, Inc.  
1229 10th Avenue, N., Seattle 2

#### WISCONSIN

Milwaukee Hearing Society  
352 W. Wisconsin Avenue, Milwaukee 3

# You Can Service Hi-Fi

## Your Present Skills and Equipment Will Carry You a Long Way

LUTHER B. HOFFMAN

• If you are a radio-TV service technician, you are qualified and probably equipped to test even expensive amplifiers and other Hi-Fi devices extensively. Besides regular hand tools and a meter, you will need a scope and an audio generator. Neither needs special calibration.

An important point that must be kept in mind applies equally to other types of electronic equipment: Keep

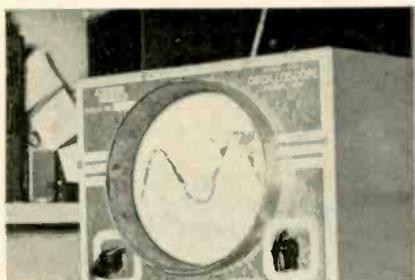


Fig. 1—Input waveform drawn on face of crt.

a wholesome respect for impedance matches. For test set-ups, observe the rule that you can feed from a low to a high impedance without introducing distortion, suffering only some loss of signal. Feeding from high to low results in both distortion and loss.

Since a signal generator is a feeding device, its terminal impedance should be on the low side. On the other hand, an oscilloscope is a receiving device, so its input impedance should be rather high, at least as high as any part of the system under test. With these basic facts understood, you are prepared to go into a testing procedure for amplifiers, that is simply a method of comparing one waveform with another.

Connect the audio generator firmly to the input of the amplifier. This connection is not changed during the test. Warm up the generator, the amplifier under test, and the scope, then make a pattern check at the input of the amplifier at any desired frequency.

Trace the wave pattern on a piece

of draftsman's tracing paper, or trace it directly on the face of the crt with a soft china-marking pencil. See Figs. 1 and 2. This is your master pattern.

With the scope probe, trace the signal through the amplifier, starting at the input. The approximate gain can be noted by the AMP and MULTIPLIER settings on the scope.

The shape of the wave, then, at any stage of the amplifier, compared to the master pattern (Fig. 3), is a measure of the fidelity up to that point. Any departure in wave shape represents a loss of fidelity, or introduction of distortion, as in Fig. 2.

When distortion is encountered, go no further until it is cleared up, since it will be present through the remaining stages anyway. Any signal at the screen grids, in the case of pentodes, is an indication of poor bypassing or filtering. No signal at the cathodes, in the case of cathode-bias circuits, is a strong indication of a shorted cathode bypass condenser.



Fig. 2—Input waveform traced on transparent paper, compared to distorted amplifier trace.

Next make a voltage check of the distorted stage and compare readings with the tube's operating specifications, being doubly sure that the grid voltage is no higher than zero in the resistance coupled circuits. The best way to perform this check is to remove the tube. Then, any positive potential found at the grid is an indication of a leaky coupling capacitor, a prime cause of distortion.

When in doubt about a tube, always substitute a new one. I've seen slightly gassy tubes upset the linearity of an amplifier and still test very

good on a good tube tester.

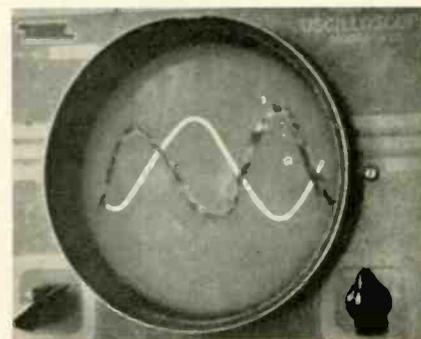
Repeat this comparison test through at least three frequency settings; low, middle, and high. Of course, after ironing out the kinks at one frequency, you will, in most cases, only have to check the output pattern against the input at the other two settings.

### Servicing Phono Pickups

For phono pickup testing, the test record is your most useful accessory. It is usually a perfect sine-wave cutting. Good quality, low inertia pickups will reproduce a symmetrical scope pattern; that is, the negative peak will be the same distance from the time axis as the positive peak. A worn stylus or an unbalanced armature may reproduce a half-wave pattern (Fig. 4), while an extremely worn stylus will often record adjacent-groove patterns on the scope, which is connected directly to the phono output lead. If distortion is present in the pickup, no amplifier made will correct it. When in doubt, consult the chart furnished with the test record. Use the record sparingly on defective phono equipment; it is easily subject to permanent damage.

Next on your inspection list is the speaker line. It is absolutely amazing how many people will pay a hundred or more dollars for a fine speaker, and then sacrifice seventy-five dollars worth by connecting forty or fifty feet of ordinary par-

Fig. 3—Actual scope trace seen behind the reference waveform found at amplifier input.



allel extension cord between it and the output transformer, often with folds of coils in reserve and in the circuit, "in case they want to change the position of the speaker some day."

Keep the line to the speaker as short as possible; the distributed capacity present in the extra length will chop off the highs in direct proportion to the length of the line. Also, the dc resistance can greatly weaken the low frequencies, depending on the quality of the wire used. (See *Adding Extra Speaker*, p. 23, March TECHNICIAN.) All this adds up to extra impedance in a circuit which is of such low impedance that a few ohms are most important. When the speaker is to be more than twenty feet from the amplifier, a safe practice is to install line-matching transformers.

As for the speaker itself, the extreme case of defectiveness is the open voice coil, in which case the

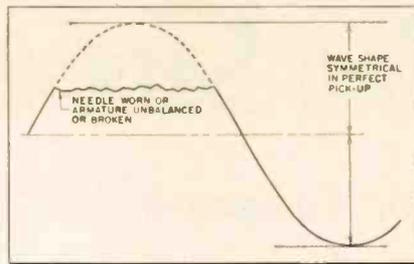


Fig. 4—Distortion due to defective pickup.

speaker is dead and the trouble is easily spotted with an ohmmeter. The more common defect is the off-center cone and voice coil, where the coil form touches the pole-piece during travel, causing noise and distortion. Gently depressing and releasing the speaker cone with fingers spread apart to prevent uneven pressure, will reveal this condition. A rasping, scraping sound indicates an off-center voice coil. The latter may even tend to bind in spots.

Some speakers are adjustable; others must be taken apart by dis-

solving the cement around the edge of the cone and the centering diaphragm; still others will have to be reconed. In all cases, snug fitting speaker shims are inserted all around the pole piece under the voice coil to assure perfect centering before resetting or cementing the cone and diaphragm permanently.

To make good speaker shims, photographic film of the various sizes and thickness may be used. If cut to the proper length, a one-piece cylindrical shim can be inserted to assure a centered fit.

None of the information given here is intended to tell you how to make a silk purse out of a sow's ear. Nevertheless, within the limits of performance capability in the audiophile's system, you can do your job. This together with recommendations on how your customer can improve his system beyond present limits, entitles you to your fee plus parts. •

## Checking Unmarked Capacitors

Requirements: One Ammeter, One Known Condenser, Five Minutes

JAY ROBIN GNESSIN & BEN CRISSES

• Often a capacitor on hand has no identification, or is marked with an unfamiliar code. While an ohmmeter will show that the unit is not shorted or leaking, a problem often remains: How is one to determine capacitance if a special checker is not available? With the simple technique described here, you should be able to measure capacitance quickly. This enables you to use the condenser immediately, or to mark it and stock it.

Lay out your equipment as shown in the illustration. With normal shop current of about 120 volts ac, an ammeter that can read up to 2 amperes (such as may be found in appliance testers), and one or two known accurate capacitors, you're in business! While not necessary, the switch is an added refinement to make things easier.

With the known capacitor switched into the circuit, the current reading is taken and noted. The unknown condenser is then switched into the circuit, and the new current reading is also recorded. That ends the test. Now a simple calculation provides the needed answer. The current recorded through the unknown capacitor is multiplied by the known

capacitance. This product is then divided by the current through the known capacitor. The answer is the value of the unknown condenser. Make sure to use similar units throughout; that is, amperes (or ma) and farads (or microfarads).

For the curious, here is the theoretical derivation of the formula:  $I = E/X_c$ , where  $I$  is current through the capacitor,  $E$  is the applied voltage and  $X_c$  is the capacitive reactance. Since  $E$  is fixed at about 120 volts, current will vary inversely with capacitive reactance,  $X_c$ . In other words, the more reactance, the less current will be permitted to flow. We also know that  $X_c = 1/2\pi fC$ . According to the latter familiar formula, capacitive reactance varies inversely with capacitance.

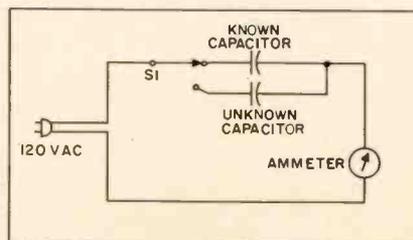
If current varies inversely with

reactance, and reactance varies inversely with capacitance, then current and capacitance are in direct proportion to each other. Simply stated, the larger the condenser (electrically), the greater is the current that it will permit to flow. For any two capacitors, then, the ratio of current through one to current through the other is the same as the ratio of the capacitance of one to the capacitance of the other:  $I_1/I_2 = C_1/C_2$ . If  $C_1$  is the unknown capacitor, the formula is easily transformed to  $C_1 = I_1 \times C_2 / I_2$ . This is a restatement of the arithmetic described in the third paragraph.

To take an actual case, let's say that a condenser known to have a value of 0.05 mfd gives a current reading of 2.2 ma. The unknown capacitor gives a reading of 22 ma, which is ten times as much. According to the formula, the unknown capacitor is found to be ten times as large electrically, or 0.5 mfd.

With a few handy comparison condensers, you can check values in practically any range. A word of caution: this method cannot be used with unidirectional condensers, like electrolytics, or those with very high leakage. The latter kind would present almost a dead short to ac. •

Simple hook-up for determining capacitance.



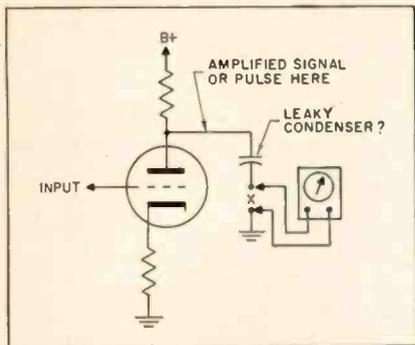
# Shop Hints to Speed Servicing

## Tips for Home and Bench Service Contributed by Readers

### False Leakage Indication

This suggestion was prompted by a technician of our acquaintance, who recently complained that he was finding plenty of leaky capacitors in various circuits in the course of troubleshooting, but that replacing them would not correct the complaint.

A few leading questions soon disclosed that the so-called leaky capacitors were not being tested with a condenser checker, but with the time-tested expedient used by many servicers and illustrated in the accompanying figure. In this method, the grounded (or more negative) end of the suspect capacitors is disconnected, the voltmeter is inserted at the point of this break (marked "X"), and the receiver power switch



Time-honored leakage test gives false reading.

is turned on. The presence or absence of a dc voltage reading will respectively indicate whether the condenser is or is not leaking. Since an amplified signal or pulse is present at the plate of the tube, and since this signal is ac, it will pass through the coupling condenser. Although it is ac, it may give a false dc meter reading, often indicating leakage where there is actually no leakage at all.

To eliminate confusion in conducting this test, proceed as usual but remove the tube associated with the condenser from its socket. This removes signal, but leaves B-plus on the plate side of the capacitor. Any reading on the dc ranges of the meter will then definitely indicate leakage rather than the presence of signal.—B. O. Riis, Miami, Florida.

### Tracing H-V Arcing

Many times arcing or corona cannot be easily located by sight. A convenient way to run down these elusive cases is to work with a length of spaghetti tubing, using it as a stethoscope. Cut a piece of tubing about 18 in. long. Use the largest diameter that will fit inside the ear. With one end of the tubing held to the ear, probe around the high-voltage supply until the one point is reached where the sound of arcing can be heard the loudest. Need it be suggested that the hand holding the tubing be kept away from dangerous points of contact?—Robert Seymour, Elgin, Illinois.

### Meter Checks Fuse Blowout

A 300-ma meter, which can be conveniently and compactly carried on service calls, may be used for determining the cause of fuse blowing in the high-voltage section. First clip the meter leads to either end of the fuse holder, with no fuse in the circuit, and turn the set on *with one hand on the power cord*. If the meter needle starts to swing up fast, a direct short is indicated, and the plug must be pulled out of the wall socket immediately.

In most cases, the set lights up and works with the meter being used instead of the fuse. Normal current will be about 75 to 100 ma. Next the damper tube is tapped. If this procedure results in a kick of the meter needle, the indication is that the damper tube is intermittently shorting and should be replaced. In other cases, the filament wiring of the damper may be shorting to chassis due to insulation breakdown, especially where the damper cathode is tied to the filament. This will show up when the set is jarred. By using the meter as a temporary replacement for the fuse, a considerable amount of assurance is provided that there will not be repeat blowouts, since the cause of fuse failure can

### SHOP HINTS WANTED

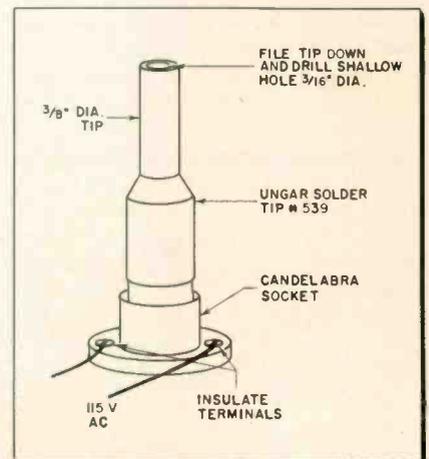
TECHNICIAN will pay \$5 for acceptable shop hints. Unacceptable items will be returned. Send your hints to "Shop Hints" Editor, TECHNICIAN, Caldwell-Clements, Inc., 480 Lexington Ave., N. Y. 17, N. Y.

usually be found and corrected.

Another use for the meter, while it is connected exactly as already described, derives from the fact that it is in series with the boosted B-plus line. Other circuits that receive B-plus from the same point may also be checked. For example, if the horizontal oscillator is getting B-plus from the damper, it is easy to determine whether the oscillator is functioning. If the oscillator tube is pulled out of its socket, there should be an increase of current (about 5 to 10 ma). This change will occur if the oscillator is functioning. If the oscillator is not working, no change in current will be noted, as there is no change in the amount of current being drawn by the output tube.—J. E. Hobbs, Atlanta, Georgia.

### Home-Made Soldering Pot

For tinning small parts, a convenient soldering pot can be constructed quickly in the following way: An Ungar soldering tip (No. 539) was used in this particular case. The tip is filed slightly to remove the point, and then a hole with a  $\frac{3}{16}$ -in. diameter is drilled to a depth of about  $\frac{1}{8}$



This pot facilitates fine work on small parts.

in. at the filed end. The entire tip is then screwed into a standard candleabra socket, to which the 115-volt line is easily connected. Exposed contacts on the socket should be insulated to avoid the possibility of shock.—A. Molinara, Hatboro, Pennsylvania.

# "Tough Dog" Corner

## Difficult Service Jobs Described by Readers

### Hi-Voltage or No H-V?

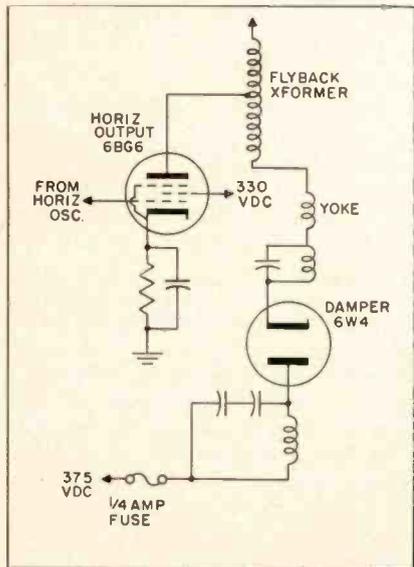
The ability to draw an arc from a second anode lead is *not* conclusive evidence that rectified dc is present. One chassis was pulled and brought to the shop before this fallacy was determined. The second anode lead developed a full 3/4-in. arc—but the high-voltage probe, connected to the meter, indicated absolutely no dc.

A shorted high-voltage rectifier tube had placed a pulse of about 5,000 volts ac, peak-to-peak, on the cathode of the rectifier. This produced a healthy arc. One can easily be misled into spending wasted time checking picture tubes and other circuits if it has not first been determined, with a meter and probe, that the arc is actually being produced by dc. Since it is not practical to carry cumbersome test equipment on service calls, it is a good idea to replace the h-v rectifiers in all cases where no raster can be noted even though an arc may be drawn.—*Pat E. McGee, Monmouth, Illinois.*

### Set "Re-fused" to Work

High voltage was absent, the fuse in the horizontal output stage kept blowing, and sound, which was present, was very low in level. As a preliminary check, all tubes in the

Damper heater lead dress kept blowing fuses.



horizontal and high-voltage sections were replaced, a new fuse was installed and the cap of the 1B3 high-voltage rectifier was lifted. The set was turned on to check the cap of the 6BG6 for an arc, and the fuse again blew. The plate cap of the 6BG6 and the fuse were both removed to take B-plus off the plate and screen grid respectively. An oscilloscope check showed the horizontal pulse was present at the control grid and appeared to be normal.

The fuse was then put back into the circuit. This restored a normal B-plus to the screen grid. However, as soon as the plate cap was repositioned, the fuse blew again.

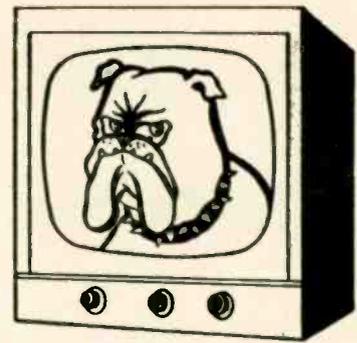
After the flyback and yoke were checked and determined to be okay, the 6W4 damper was removed and a new fuse was put in. When the set was turned on, the fuse held. As soon as the 6W4 was returned to its socket, the fuse blew again. Conduction of the damper was obviously doing the damage, but where and how? Taking the tube out of its socket again and measuring its filament voltage showed a normal reading.

Only one thing was left to do. That was to jump the fuse momentarily. Sure enough, as soon as this was done, the trouble showed up. The filament *winding* of the 6W4 was arcing to the chassis in the vicinity of the low-voltage transformer, but *only* on conduction of the damper itself since, under those conditions, the filament contained the boosted B-plus.

The remedy was simple. A length of spaghetti around the arcing wire did the trick. The low audio output that was also a symptom turned out to be another matter. Replacing the audio output tube cleared it up.—*Barone & Marschner, Irvington, New Jersey.*

### Shielding Out Buzz

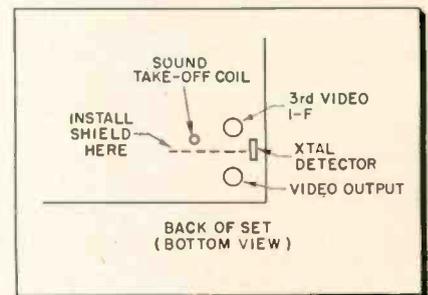
When my employer purchased a large number of Muntz receivers, mostly of models 321, 324, and 327 sets, we were almost immediately confronted with a sync buzz problem. The buzz was noticeable to some extent on most of the sets when the contrast control was set at a normal adjustment. On some of



### \$10 For Your "Tough Dog Story"

Have you tangled with a difficult or obscure service problem recently? Write it up, telling us how you licked it, and send it to "Tough Dog" Editor, *TECHNICIAN*, Caldwell-Clements, Inc., 480 Lexington Ave., N. Y. 17, N. Y.

the sets, the buzz level was entirely too high. Although the condition could be improved or deteriorated by manipulation of the contrast control, the sound take-off was noted



Anti-buzz shielding for sound take-off coil.

to be *ahead* of the controlled stage. Careful re-alignment of video and sound stages helped, as did tube substitution, but customers still had to be careful about how they adjusted fine tuning and contrast.

Finally a particularly stubborn case came up, which I took home to work on in my spare time. The culprit turned out to be poor lead dress and the absence of a shield on the sound take-off coil. Peaking coils in the video output stage were radiating 4.5-mc signal back to the sound take-off coil in the detector circuit to introduce the trouble. In the set under examination, actual oscillation was present. Soldering a piece of tin can to the chassis, in the position shown in the illustration, was the cure. This shield, which goes between the video output stage and the sound take-off coil, has been effective on all the other sets where the problem was serious.—*Horace D. Lasher, Cleveland, Ohio.*

### Hi-Fidelity Speaker

Specifications begin on p. 32

# Tooling-Up For Hi-Fi

## Recommended Test Equipment for Hi-Fi Servicing

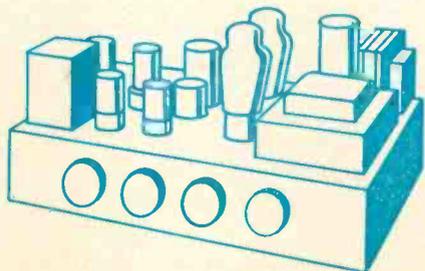
FRED KAMIEL  
THE AUDIO EXCHANGE

• With the industry's attention riveted on the skyrocketing sales of hi-fi equipment, little thought is being given to the other, equally important side of the picture—namely, who is available to service this equipment when it breaks down? And, perhaps more to the point, if a qualified technician is interested in the market, what equipment does he need to get started? This latter aspect—the basic test instruments for hi-fi audio servicing—will be covered in this article.

The technician who is thinking in terms of hi-fi servicing should be aware of the problems involved. The hi-fi enthusiast tends to be extra sensitive and extra demanding. He has paid a good deal of money for his equipment, and therefore he will be hypercritical about minor hums, hisses and distortions which would go unnoticed in the garden variety radio receiver.

Since the hi-fi unit has been built to exacting standards, the repair job, too, will have to measure up to high standards. The ear may truly be a remarkable organ—and it will, of course, be the final judge of the unit's operation—but it is highly unreliable as a trouble shooting tool. The technician needs instruments which will tell him *visually* what troubles he is faced with, and for this reason test equipment is all-important on the audio servicing bench.

This is the minimum a testbench should have to handle electronic hi-fi service problems satisfactorily: 1. AM-FM signal generator with microvolt calibration; 2. sweep generator; 3. oscilloscope; 4. Audio meter—flat from 20 to 50,000 cps;



5. Audio generator with sine and square wave output and calibrated attenuator; 6. Calibrated ballast resistors up to 16 ohms; 7. vtm; 8. Intermodulation tester; 9. VU meter in the speaker line; 10. AC ammeter in the ac supply line; 11. Good quality phonograph, amplifier, and loudspeaker with proper speaker baffle.

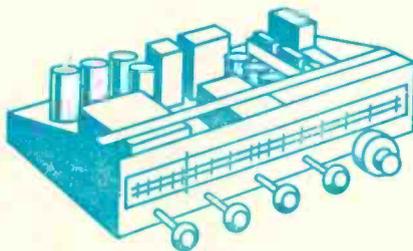
### Functions

Only the main functions of each instrument will be outlined here since each test instrument is actually quite versatile and more and more uses will be found as the technician's acquaintance with the instrument grows.

1. The AM-FM signal generator is used primarily for aligning AM and FM tuners; also, for testing the sensitivity of these tuners; and, too, as a marker generator for visible alignment.

2. The sweep generator is used for visible alignment on AM and FM tuners.

3. The oscilloscope is probably the most versatile of all test instruments. Its uses include visible alignment of AM and FM tuners and observations



of waveforms on amplifiers, pre-amplifiers, equalizers, etc. The "scope" is the most popular detective in audio work.

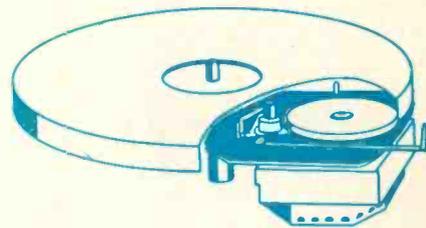
4. The audio meter is used to calculate the power output and gain in amplifiers and preamplifiers.

5. The audio generator provides the signal which is fed into the equipment under test, such as amplifier, pre-amplifier, tape recorder, loudspeaker, etc. Comparison of the input and output signal furnishes the clues about the condition of the equipment.

6. Calibrated ballast resistors are used only for calculating the power output delivered by the power amplifiers.

7. Vacuum-tube voltmeters measure circuit components and conditions without unduly disturbing the circuit being measured.

8. An intermodulation tester feeds a high and a low frequency simultaneously into an amplifier. Both the high and low fundamental frequencies are filtered out and the residual frequencies, which are the sums and differences of the fundamental frequencies, are measured as percent-



ages of the original frequencies. The intermodulation test is a sensitive index of the overall quality of an amplifier.

9. A VU meter in the speaker line indicates oscillations which may not be audible because of equipment or human limitations. Very high or low frequency oscillations might go undetected without this meter. The VU meter also is a valuable tool in aligning the heads of tape recorders.

10. The ac meter in the power supply line gives clues concerning defects in the power supply and B+ sections of equipment. It is always wise to compare the actual power consumption of the unit under test with the rated value. The ac meter is particularly valuable in checking on possible shorts in motors such as are used in tape recorders.

11. The amplifier, phonograph, and speaker are used to check upon the repairs that have been made. The importance of this check cannot be overemphasized. An amplifier that tests out OK but sounds bad—is bad. Your customer is extremely sensitive and critical, and will not be satisfied to be told that the equipment checks out all right. He is right, of course!

The serviceman will not be in a position to make an adequate aural check unless his own equipment is of excellent quality. It is very im-

(Continued on page 42)

# New Service Aids

## Test Equipment; Antennas; Rectifiers; Stabilizer

### Crest VOLTAGE STABILIZER

Line voltage stabilizer, model LVS-153, automatically maintains output line voltage at  $115\text{ v} \pm 3\%$  over an input voltage range of 95 to 125 v. One model, which automatically turns on and off with the TV set or appliance, covers a wattage range of from 100 to 300 watts.



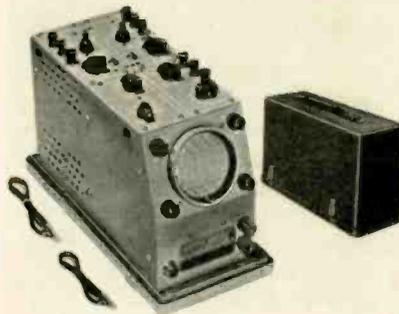
Output voltage is free from wave shape distortion and dependency of variations of output with frequency. Microtran Co. Div., Crest Laboratories, Inc. 84-11 Rockaway Blvd., Rockaway Beach, New York—TECHNICIAN (Ask for No. 6-40)

### Dynamic INDOOR ANTENNA

"Twin Ogyro" indoor antenna uses twin dipoles of "Ceroc," claimed to be a specially processed wire of unusual characteristics and gain. Each dipole is wound on a rubber moulded combination spool and suction cup, slightly less than 1 in. high and wide. Both dipole spoils take up no more room than two thimbles. Dipoles attach by suction to baseboard moulding, window pane or sill. \$1.00. Tentenna, Inc., 122 E. 42nd St., New York 17, N. Y.—TECHNICIAN (Ask for No. 6-41)

### Hickok OSCILLOSCOPE

Lightweight, portable 3 in. scope, Model 385, features a new 6-section unitized circuit construction for minimum interaction between amplifiers and sweeps and easy servicing. Direct-



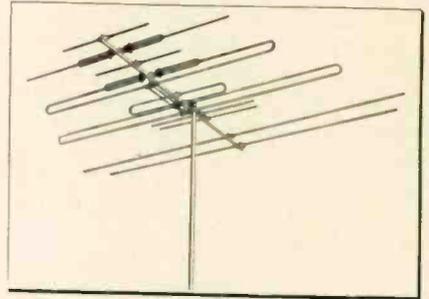
coupled amplifiers in both vertical and horizontal circuits. Fully compensated horizontal and vertical attenuators. Vertical bandpass—dc to 4 mc; horizontal—dc to 500 kc. Input impedance to vertical amplifiers is 2.2 megohms—25  $\mu\text{f}$ . Hickok Electrical Instr. Co., 10523 Dupont Ave., Cleveland.—TECHNICIAN (Ask for No. 6-42)

### Snyder AUTO ANTENNAS

Two new rear mount communications antennas are announced for AM automobile radio, automobile telephone or short wave communications. Features include cadmium plated and stainless steel masts and adjustable swivel ball joint genuine molded bakelite insulator mounting plates. In two models: HR-1 and HR-2. Both feature polyethylene extra-length low-loss cable, and guaranteed shock and vibration resistance. Snyder Mfg. Co., 22nd & Ontario Sts., Phila., Pa.—TECHNICIAN (Ask for No. 6-43)

### Welco TV ANTENNAS

New line of "Zee-Beam" TV antennas features the "Zee-X" element. One Zee-X element functions with full efficiency on both the high and low TV bands. Three models: Model 110 is the



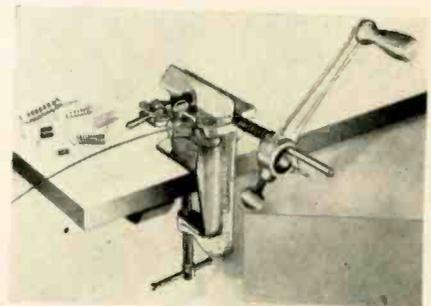
economy all channel VHF fringe antenna; Model 220, an all channel VHF antenna and the Super "Zee-Beam," an all channel VHF antenna design featuring exclusive Zee-X elements. Welco Mfg. Co., 225 S. 3rd St., Burlington, Iowa—TECHNICIAN (Ask for No. 6-44)

### RR RECTIFIER

New snap-in type rectifier, the "Quicklip," features a unique clip arrangement which does not require tools for assembly. It does not require special sockets for mounting; only needing, according to the mfr., two round holes to be snapped into place. In addition, solderless connectors are available for making electrical contact to the rectifier. Radio Receptor Co., Inc., 240 Wythe Ave., Brooklyn, N. Y.—TECHNICIAN (Ask for No. 6-45)

### G-C SPRING WINDER

On the "Speedex Spring Winder," any type of spring of any number of coils and of any pitch desired, can be turned out. Uses any size wire and forms any



diameter spring; both compression and extension springs are possible. The winder fastens to any bench, and a simple screw adjustment varies the pitch instantly. \$14.95. General Cement Mfg. Co., 919 Taylor Ave., Rockford, Ill.—TECHNICIAN (Ask for No. 6-46)

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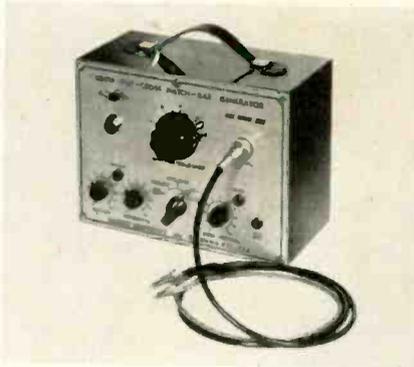


ALLEN B. DU MONT LABORATORIES, INC., CLIFTON, N. J. Replacement Sales, Cathode-ray Tube Division

# New Test Equipment

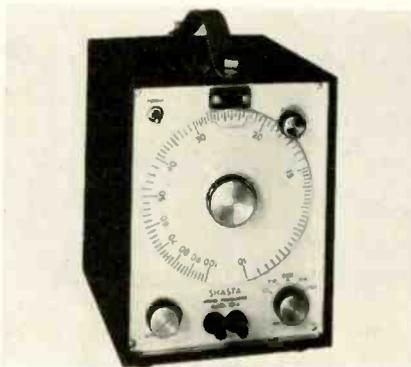
## EMC SIGNAL GENERATOR →

Multi-function white dot-cross hatch-bar generator, Model 800, is designed for both color and monochrome servicing. It produces white dots on the TV screens of any monochrome or color TV receiver for the adjustment of color convergence; also produces a cross hatch pattern, and a variable number of bars for adjustment of height and width controls. Useful in localizing and identifying general TV troubles. \$39.90. Electronic Measurements Corp., 280 Lafayette St., N.Y. 12. TECHNICIAN (Ask for No. 6-4)



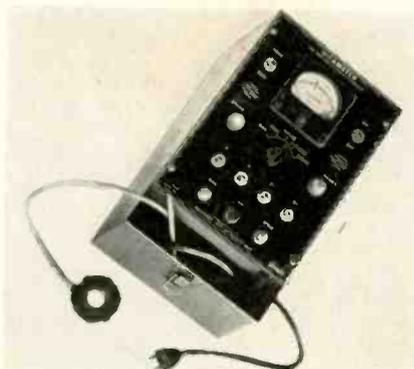
## Shasta AUDIO OSCILLATOR →

Model 301A oscillator is a compact rugged instrument designed to fill the need for a wide range general purpose laboratory audio oscillator. It covers the range from 10 cps to 1.0 mc in 5 steps. Output level is  $\pm 1$  db over the complete range. Power output is 160 mv/10 v. open circuit, with hum level less than 0.1% of rated output. Minimum load impedance—600 ohms. 9 5/32 x 7 5/32 x 8 11/16. \$140.00. Shasta Div., Beckman Instruments Inc., P.O. Box 296, Station A, Richmond, Calif. TECHNICIAN (Ask for No. 6-2)



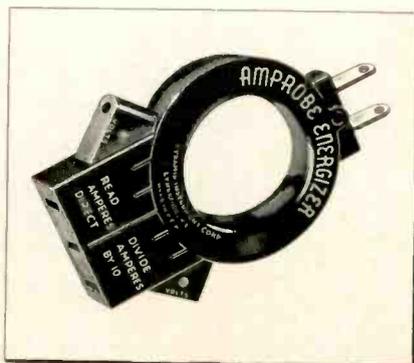
## ETI CRT TESTER-REJUV. →

"Vitamer" tests TV cathode-ray tubes for shorts, continuity, beam current and gas content. Also repairs open filaments, open cathodes, and shorts; vitalizes cathode tube. Reactivates cathode by dynamic sweep between cathode and grid, removing gas ions and stale emitting material. Added feature, the "life test function," gives information on approximate life expectancy of tube. 11 1/2 x 7 x 7. Metal case. \$69.95. Electronic Test Instr. Corp., 13224 Livernois Ave., Detroit, Mich. TECHNICIAN (Ask for No. 6-3)



## Pyramid Test Unit →

Amprobe Energizer Model A-40 makes possible instant current and voltage readings at the wall outlet, when used in conjunction with a snap-around volt-ammeter. Receptacles in the unit permit checking the line voltage while appliances are connected to the line, giving indication of voltage under actual load conditions. Two ranges; direct-reading, and 10x sensitivity, for readings on small appliances and motors. \$3.75. Pyramid Instr. Corp., 630 Merrick Rd., Lynbrook, N.Y. —TECHNICIAN (Ask for No. 6-1)



## Budelman RF WATTMETER

Compact, versatile r-f wattmeter-bridge Type 28A, fills three functions: wattmeter, impedance bridge and probe. It finds wide application in determining the r-f characteristics of transmission lines, wave traps, resonant impedances, and antennas. It also functions as a field strength indicator and AM detector. Three ranges—1, 10 and 100 watts. It presents a resistive load of 50 ohms ( $\pm 1$  ohm) for frequencies up to 180 mc. When used as probe, full scale sensitivity is 100 mv. Budelman Radio Corp., 375 Fairfield Ave., Stamford, Conn. TECHNICIAN (Ask for No. 6-5)

## Philco TESTER

Portable appliance tester, Model 5100, is designed for multi-purpose servicing of refrigerators, freezers, air conditioners, ranges, radios and TV receivers, as well as checking other household appliances. Power, voltage and current are indicated on a reliable electro-dynamometer type instrument. Precision 4-in micro-ammeter measures temperature and resistance. Unique temperature calibration circuit increases accuracy by permitting check against built-in thermometer. Philco Corp., Phila., Pa.—TECHNICIAN (Ask for No. 6-6)

## RCP TUBE CHECKER

Portable tube tester, Model 327, is claimed by the manufacturer to be the only tester on the market specifically designed to test the new series tubes. A special power transformer and switch have been added to insure correct testing conditions for series-designed tubes. The tester will, in addition, check all crt's, both black-and-white and color, and all other tubes in current radio and TV receivers; also hearing aid tubes, ballast and tuning indicator types. Radio City Products Co., Inc. Centre & Glendale Sts., Easton, Pa.—TECHNICIAN (Ask for No. 6-7)

## Time SCREW DRIVERS

"Roto-Top" screw driver features a unique top which remains fixed in the heel of the hand as the screwdriver is turned to minimize fatigue and soreness. Made of fine alloy steel, hardened to its full length. Fluted handles are of shock-proof, unbreakable tenite in transparent amber, with a red top. Write Time Mfg. Co., Dept. 299, Westminister, Mass.—TECHNICIAN (Ask for No. 6-25)

For more technical information on New Products, use inquiry card on page 26



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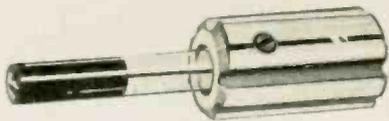
## New Products

### Alpha FLUXES

General purpose soft soldering Flux Kit contains a complete set of the most useful fluxes, including printed circuit, electronic and general purpose fluxes. It enables a rapid determination of the proper flux for a soldering job and saves the trouble and time involved in acquiring samples. Sixteen quality controlled fluxes in all, each flux in appropriately labeled glass bottles. \$6.50 per kit. Alpha Metals, Inc., 56 Water St., Jersey City 4, N. J.—TECHNICIAN (Ask for No. 6-22)

### G-C ALIGNMENT TOOL

Special purpose TV alignment tool, the "Adjustable Shorty," is adjustable in length via a handle set screw from



1¼ in. to 2 in., making it ideal for getting into extremely tight chassis locations. \$0.70. General Cement Mfg. Co., 919 Taylor Ave., Rockford, Ill.—TECHNICIAN (Ask for No. 6-35)

### Bell TAPE RECORDER

All-new 3-speed tape recorder, Model RT-75, features full push-button control with straight-line slot threading. A positive-action lever permits selecting of the three tape speeds, 7½ ips, 3¾ ips or 1⅞ ips. Frequency response at the 7½ ips speed is 30 to 12,000 cps and



4,500 cps maximum response is provided at the 3¾ ips and 1⅞ ips speeds, respectively. Equalization to compensate for the speed variations is accomplished automatically in changing speeds. Exceptionally fast forward and rewind speeds; a standard 1200-ft. spool of tape may be rewound in 70 sec. 6 in x 9 in. oval speaker. Outputs include 3.2 ohm jack for external speaker and Hi-Z jack for feeding an external amplifier. Bell Sound Systems, Inc., 555 Marion Road, Columbus 7, O.—TECHNICIAN (Ask for No. 6-65)

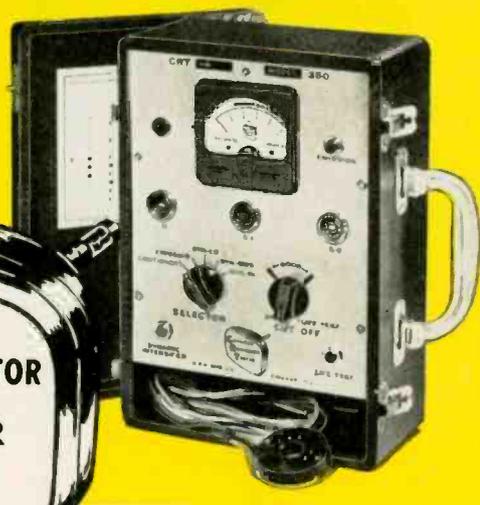
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cept the keys and controls. Features the use of 130 printed circuits. Kits for the separate components, such as each of the 12 tone generators, or preamplifiers, stop filters, and so on, may be purchased separately to make budgeting easy. The Schober Organ Corp., 35 Dail St., New Hyde Park, New York.—TECHNICIAN (Ask for No. 6-66)

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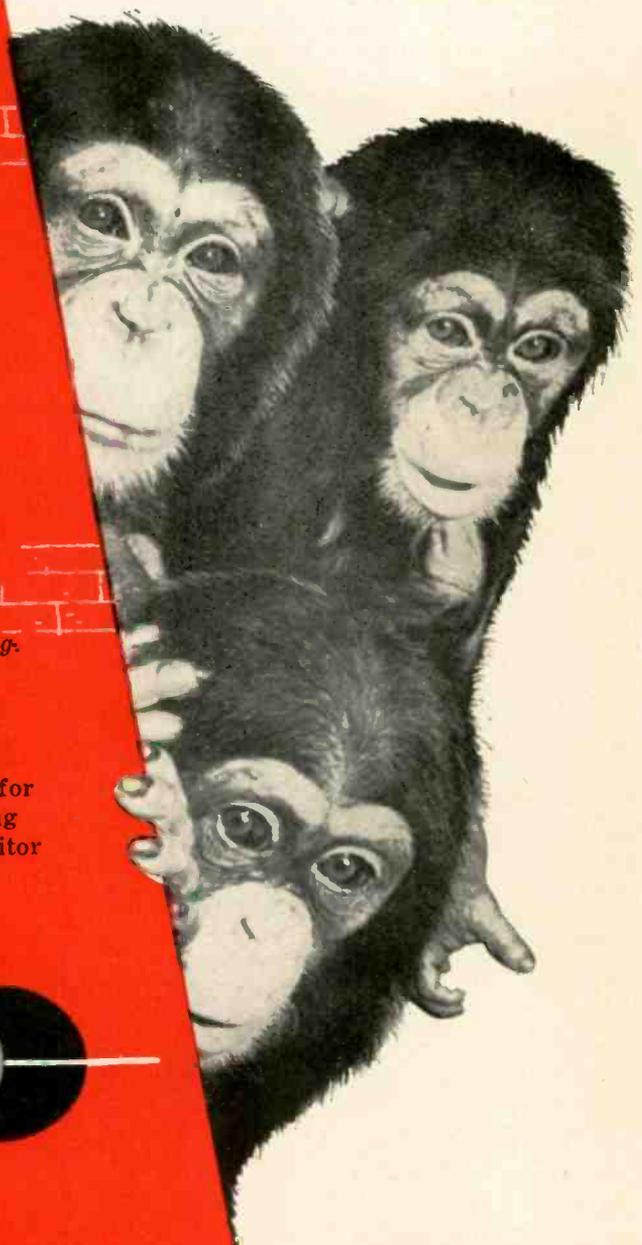
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255 GRANT AVENUE, E. NEWARK, N. J.



Export Division: Radio Shack International Corp., 131 East 40th St., N. Y., N. Y. In Canada: Charles W. Pointon, 6 Alcona Ave., Toronto 10, Ontario

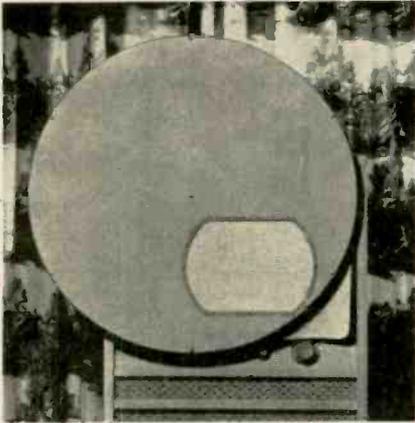
# HI-FIDELITY SPEAKER SPECIFICATIONS

KEY: AL—Acoustical Labyrinth (trade-mark); BI—Built-In; BLFH—back loaded (folded horn); BR—bass reflex; CDHLT—compression driver, horn loaded tweeter; CH—corner horn; CR—corner reflex; DLBR—duct loaded bass reflex; DR—direct radiator; DRT—direct radiator tweeter; DC—electrical crossover; FH—folded horn; FR—full range; FRHL—front and rear horn loaded; H—horn; HL—horn loaded; IB—infinite baffle; MC—mechanical crossover; MR—mid-range; R—reflex; RHL—rear horn loaded; T—tweeter; W—woofer. Prices quoted are net to consumer unless otherwise stated. Information was obtained directly from the manufacturers.

MODEL NO./NAME	PRICE	DIA. (in.)	V.C. IMPEDANCE (ohms)	POWER RATING (continuous; peak)	TYPE	RESPONSE (cps; ± db)	CONE RESONANCE	MAGNET WGT. lbs.-oz.	CROSSOVER FREQ. (kc.)	RECOMMENDED ENC. TYPE	REC. ASSOCIATED COMPONENTS	NOTES
<b>ACOUSTIC RESEARCH, INC., 23 Mt. Auburn St., Cambridge 38, Mass.</b>												
AR-1	\$185.00	12-8	4	30c, 60p	FR 2-way	30-13000 ± 5	43	3-5	BI	w/enc.	30-watt amp.	25 x 14 x 11-3/8 in.
AR-1W	145.00	12	4	30c, 60p	W	30-3500 ± 5	43	3-5	0.8 to 3.5	w/enc.	30-watt amp.	25 x 14 x 11-3/8 in.
<b>ALTEC LANSING CORP., 9356 Santa Monica Blvd., Beverly Hills, California</b>												
400B	\$ 21.60	8	8	12c	FR	100-10000	75	0-10				2-section cone
600B	42.00	12	8	20c	FR	35-8000	55	1-12				2-section cone
603B	66.00	15	8	30c	FR	30-8000	50	2-6				2-section cone
601A	99.00	12	8	20c, 30p	FR-Coax	30-22000	55	1-12	3.0 BI			
602A	114.00	15	8	25c, 35p	FR-Coax	30-22000	42	2-6	3.0 BI			
604C	156.00	15	16	35c, 50p	FR-Coax	30-22000	40	4-6	1.6 BI			
802C	57.00		16	30c	T	700-22000		1-3	0.8			
803A	60.00	15	16	30c	W	30-1600	45	2-6	1.6 or below			
3000A	40.00		8	20c	T	2500-22000		0-2.25	3.0			Must be used with N-3000A Network
700A	99.00	10	8	20c, 30p	FR-2 Way	70-22000	45	L F 5-11	3.0			
A-7	260.00	15	16	30c	FR-2 Way	30-22000	45	L F 2-4	0.8		Complete System	
B-200C	525.00	2-15	16	30c	FR-2 Way	30-22000	45	L F 2-4	0.8		Complete System	Corner - Has 2 L.F. Woofers
<b>BELL SOUND SYSTEMS, 555 Marion Road, Columbus 7, Ohio</b>												
HF2240	\$ 29.70	12	8	30p	FR Coax	38-13,600 ± 6	50	1-0	MC-2.4		BLH	
<b>THE R. T. BOZAK COMPANY, P. O. Box 766, Darien, Connecticut</b>												
B-199A	\$ 49.50	12	8	15c, 25p	W	30-4500 ± 5	40 or less	1-8	0.4, 0.8, 2.5		IB	B-200X, B209, N101*
B-209	48.00	6 1/2	8/16	15c, 25p	MR	200-3500 ± 4	Nil	1-8	0.4, 2.5		IB	B199A, B-200X, N101*
B-200X	30.00	2 1/2	8	6c, 12p	T	2-20KC	Nil	1-0	2.5			Made only as a dual unit
B-200XA	132.00	2 1/2	8	25c, 50p	T	2-20KC	Nil	4-0	2.5			Cluster of 8 Tweeters
* Crossover Network												
<b>BRITISH INDUSTRIES CORP. (Wharfedale Speakers), 164 Duane St., New York 13, New York</b>												
Super 5	\$ 21.50	5	10	30	T	3000-20000						
8 in. Bronze	15.05	8	15	5	FR	60-13000						
Super 8/CS/AL	21.50	8	10	4	FR	50-15000	67/70					
W 10/CSB	40.00	10	15	8	FR	30-18000	50/60					
Super 12/CS/AL	76.15	12	15	12	FR	30-18000	35/45					
W 12/CS	42.75	12	15	10	W	30-6000	40/50					
W 15/CS	76.15	15	15	20	W	25-6000	25/30					
<b>BROCINER ELECTRONICS LAB., 344 E. 32nd St., New York 16, N. Y.</b>												
4	\$396.00	8	16	30p	FR-2 Way	40-20000			BI		Complete System	Twin Cone Speaker
250	597.00	8 & 15	16	50p	FR-2 Way	30-20,000			0.25		Complete System	
* 20,000 Gauss Field Strength												
<b>DUOTONE COMPANY, INC., Locust St., Keyport, New Jersey</b>												
9762M	\$ 59.97	12	8	20	FR-Coax	22-20,000	45		BI		BR	Ticonal magnet
9762	56.97	12	8	20	FR	30-20,000	45				BR	Ticonal magnet
9758	29.97	10	8	10	FR	40-17,000	50				BR	Ticonal magnet
9750M	22.17	8	8	6	FR-Coax	35-20,000	60		BI		BR	Ticonal magnet
9770M	9.90	8	4	6	FR-Coax	50-20,000	85		BI		BR	Ticonal magnet
9760M	32.97	12	8	20	FR-Coax	30-20,000	45		BI		BR	Ticonal magnet
<b>ELECTRO-VOICE, INC., Buchanon, Michigan</b>												
SP8B	\$ 28.50	8	16	20	FR-Coax	35-13000 ± 6	65	1-0	MC 6.0		Baronet	T35B
SP12B	29.70	12	16	20	FR-Coax	30-13000 ± 6	45	1-0	MC 4.5		Aristocrat	T10A, 8HD, T35B
SP12	57.00	12	16	25	FR-Coax	30-13000 ± 5	43	3-0	MC 4.0		Aristocrat	T25A, 8HD, T35
SP15B	39.00	15	16	20	FR-Coax	30-13000 ± 6	38	1-0	MC 3.5		Regency, Empire	T10A, 8HD, T35B
SP15	78.00	15	16	30	FR-Coax	30-13000 ± 5	38	5-4	MC 3.0		Regency, Empire	T25A, 8HD, T35
12TRXB	59.70	12	16	20	FR-Triax	30-15000 ± 6	50	1-0	2.0, 3.5 BI		Aristocrat	
12TRX	114.00	12	16	25	FR-Triax	30-15000 ± 5	40	3-0	2.0, 3.5 BI		Aristocrat	With T35B
15TRXB	78.00	15	16	20	FR-Triax	30-15000 ± 6	38	1-0	2.0, 3.5 BI		Regency, Empire	With T35
15TRX	135.00	15	16	30	FR-Triax	30-15000 ± 5	38	5-4	2.0, 3.5 BI		Regency, Empire	With T35B
12B	29.70	12	16	20	W	to 1200	47	1-0	0.8		Aristocrat	With T35
12W	57.00	12	16	30	W	to 1200	40	3-0	0.8		Aristocrat	
12WK	57.00	12	16	30	W	to 1200	40	3-0	0.8		Aristocrat	
15B	39.00	15	16	20	W	to 1200	38	1-0	0.8		Regency, Empire	For Klipsch Enclosure
15BWK	39.00	15	16	20	W	to 1200	38	1-0	0.6		Regency, Empire	For Klipsch Enclosure, Centurion
15W	78.00	15	16	30	W	to 1200	30	5-4	0.8		Regency, Empire	For Klipsch Enclosure, Centurion 1, Georgian
15WK	78.00	15	16	30	W	to 1200	32	5-4	0.6, 0.3		Regency, Empire	For Klipsch Enclosure, Centurion 1, Georgian
18W	90.00	18	16	40	W	to 1200	27	0.8			Theater Bin	
18WK	90.00	18	16	40	W	to 1200	22	5-4	0.6, 0.2		Theater Bin	
T10A	40.50	16	20	MR		400-13000 ± 5	720	0-8	above 0.4			For Klipsch Enclosure, Patricia IV
T25A	57.00	16	30	MR		400-13000 ± 5	720	1-0	above 0.4			Use 6HD-8HD Horn
T35	33.00	16	40	T		3500-16000 ± 5	5000	0-6.8	above 3.5			Use 6HD-8HD Horn
T35B	21.00	16	25	T		3500-16000 ± 5	5000	0-3.16	above 3.5			Integral Horn
848HF	48.00	16	25	MR-Coax		300-10000 ± 5	540	0-8	0.3			Integral Horn
<b>GENERAL ELECTRIC CO., Syracuse, New York</b>												
850	\$ 9.95	8	8	15	FR	70-12,000	90	0-6.8				
1201A	20.37	12	8	25	FR	50-13,000	70	0-14.5				Use GE-406B Cabinet
1203A	14.22	12	8	25	FR	50-13,000	70	0-9.0				"
A1400	41.95	12	8	25	FR-Coax	40-15,000	55	0-14.5	1.8 BI			"

## COLOR CONVERTER

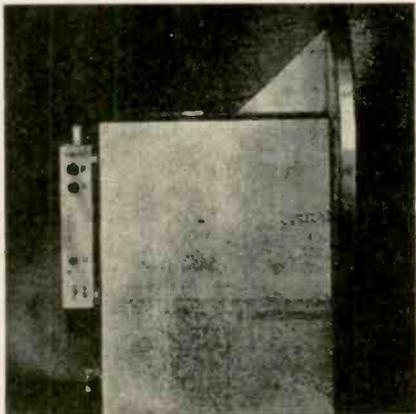
A field-tested color converter for large-screen black-white sets produces a 14-in. color picture whose fidelity is said to be limited only by the quality of its associated receiver. Col-R-Tel, manufactured by Color Converter, Inc., Columbia City, Ind., uses an adaptation



Color wheel produces 14-in. picture.

of the color wheel idea. It sells for \$149.95.

The 7-tube converter unit attaches out of sight at the back of the set. A connection to the pix-tube circuit permits pick-off of the color signal. A removable color wheel in front of the

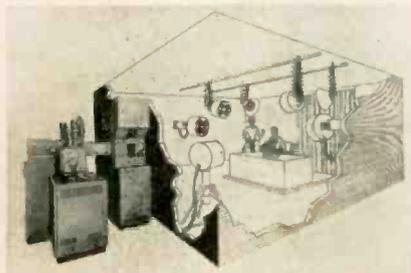


Converter unit is at rear.

set rotates at 600 rpm and is controlled by the converter sub-chassis.

Of 3 controls used, 2 are set by the technician at the time of installation. The 3rd, an adjustment for color brightness, is consumer operated.

## DU MONT COLOR SCANNER



New setup uses beam from crt to scan scene, with reflected light being picked up by multiplier phototubes, eliminating iconoscope.

*Used the World Over!*

## THE SHURE "UNIDYNES"

are the only small size, all-purpose moving-coil Dynamic Microphones that reduce the pickup of random noise energy by 67%!

The Unidynes, 55s and 556s, simplify P.A. installation . . . enhance your reputation . . . insure customer satisfaction by eliminating or reducing callbacks due to critical gain control settings—often necessary when conventional microphones have been installed.

*No wonder the Unidynes are used the World over—  
more than any other microphone  
of any make, size, or cost!*

**SHURE**

**SHURE BROTHERS, Inc.**

Microphones and Acoustic Devices

225 W. Huron St., Chicago 10, Illinois

Cable Address: SHUREMICRO

MODEL NO./NAME	PRICE	DIA. (in.)	V.C. IMPEDANCE (ohms)	POWER RATING (continuous; peak)	TYPE	RESPONSE (cps; db)	CONE RESONANCE	MAGNET WGT. lbs.-oz.	CROSSOVER FREQ. (kc.)	RECOMMENDED ENC. TYPE	REC. ASSOCIATED COMPONENTS	NOTES
<b>GOODMANS INDUSTRIES, 215 E. 37 St., New York 16, N. Y.</b>												
Axiom 22	\$ 72.95	12	15	20*	FR	30-15,000 ± 3	35	18-0		CR		Twin Cone Free Suspension Hi Compliance - low res.
Axiom 150MKII	53.50	12	15	15*	FR	30-15,000 ± 3	35	12-0		CR		
Axiom 80	68.50	10	15	4-6*	FR	20-20,000 ± 3	20	9-0		CR		
Axiette	23.20	8	15	5*	FR-T	40-15,000	65	3-0	0.8	CR	Audiom 60	
Audiom 60	44.50	12	15	15*	W	35-8,000	35**	12-0	0.8-1.0	CR	Aziette Tweeter	
Audiom 70	69.40	12	8/15	20*	W	35-8,000	35**	18-0	0.8-1.0	CR	Aziette Tweeter	
Audiom 80	95.50	15	15	25*	W	40-5,000	40**	25-0	0.8-1.0	CR	Aziette Tweeter	
Audiom 90	118.80	18	6	50*	W	40-5,000	35**	29-0	0.8-1.0	CR	Aziette Tweeter	

\* \* \* These power ratings are sinusoidal A. C. power ratings. The speakers will handle considerably more program power than these ratings indicate.  
 \*\* \* \* These speakers are available with higher frequency cone resonances, but are not stocked on this basis.

<b>H. A. HARTLEY CO., INC., 521 East 162nd Street, New York 51, New York</b>												
215	\$ 65.00	10	4	2c, 20p	FR-Coax	1-18000 ± 5	Nil	5	MC	non-resonant		

<b>INTERNATIONAL ELECTRONICS CORP., 159 Howell Street, Dallas, Texas</b>												
FMB-58	\$157.50		8	15c, 25p	FR	80-12,000 ± 5			0.8		Complete System	
Twin 70	285.00		8	25c, 40p	FR	50-12,000 ± 5			0.8		Complete System	
FM6-80	97.50		8	15c, 25p	FR	80-12,000 ± 5			2.0		Complete System	
Twin 90C	297.00		8	35c, 50p	FR	30-15,000 ± 5			0.6, 4.0		Complete System	

<b>JENSEN MFG. CO., 6601 S. Laramie Ave., Chicago 38, Ill.</b>												
PR-100	\$525.00		16	35c	FR-3-way					BI	Complete system	BLFH, 2-CDHLT. 54-1/4x32-5/8x24-5/8 in. BLFH, 2-CDHLT. 52-5/8x33x25-1/2 in. DLBR, 2-CDHLT. 38-5/8x25-7/8x19-3/8 in. DLBR, CDHLT. 30-1/2x22-5/8x17-1/8 in. CDHLT. 17-1/4 x 24 x 22 in. DRT, 17-1/4 x 24 x 22 in. CDHLT. 11-1/2 x 23-1/4 x 10 in. CDHLT. 11 x 24-1/2 x 10 in. Fabrikoid finish, CDHLT. 11 x 23-1/4 x 10 in. 2-CDHLT. HF Control. CDHLT HF Control. CDHLT HF Control. CDHLT HF Control. DRT Coaxial DRT. Use with RP-201 & RP-302 for 3-way; RP-102 for 2-way. Use with RP-201 & RP-302 for 3-way; RP-102 for 2-way. Use with P15-LL or P12-NL 4-3/4 x 11-1/2 x 14 in. CDHLT 2-3/4 dia x 3-3/4 depth. CDHLT 4 x 7-7/8 x 9-1/4 in. CDHLT
RS-100	468.00		16	35c	FR-3-way					BI	Complete system	
TP-200	312.70		16	35c	FR-3-way					BI	Complete system	
CT-100	164.50		16	25c	FR-2-way					BI	Complete system	
DU-500	85.50		4	20c	FR-2-way					BI	Complete system	
DU-400	49.50		4	15c	FR-2-way					BI	Complete system	
DU-300	76.50		4 & 8	20c	FR-2-way					BI	Complete system	
DU-202	77.50		4 & 8	20c	FR-2-way					BI	Complete system	
DU-201	62.50		4 & 8	20c	FR-2-way					BI	Complete system	
G-610	252.75	15-3/8	16	35c	FR-Triax					BI	DLBR, BR; BLFH	
H-530	129.50	15-1/8	16	30c	FR-Coax					BI	DLBR, BR; BLFH	
H-520	79.50	15-1/8	16	25c	FR-Coax					BI	DLBR, BR	
H-222	54.50	12-1/8	16	25c	FR-Coax					BI	DLBR, BR	
K-310A	37.60	15-1/8	16	16c	FR-Coax					BI	DLBR, BR	
K-210-	24.85	12-1/8	8	12c	FR-Coax					BI	DLBR, BR	
P15-LL	56.80	15-1/8	16	35c	W	2000 or 600 down			0.6, 2.0	BLFH, DLBR; BR	A-61 (3-way) A-204 (2-way) A-61 (3-way) A-204 (2-way) A-402 network	
P12-NL	36.50	12-1/8	16	25c	W	2000 or 600 down			0.6, 2.0	DLBR, BR		
RP-201	42.60		16	35c	MR	600-4000			0.6, 4.0	panel mt.		
RP-302	33.60		16	35c	T	4000-up			4.0	panel mt.	A-402 network	
RP-102	28.35		16	35c	T	2000-up			2.0	panel mt.	A-204 network	
P15NX	46.05	15-1/8	6-8	18c	Extended range re- placement					BR, DLBR		
P12NX	35.25	12-1/16	6-8	16c	improvement					BR, DLBR		
P12-RX	12.40	12-1/8	6-8	11c	speakers.					BR, DLBR		
P12-SX	11.35	12-1/8	6-8	9c	Heavier models useful					BR, DLBR		
P10-SX	10.54	10-1/8	6-8	8c	for high fidelity PA.					BR		
P8-RX	8.50	8-1/8	6-8	8c						BR		
P8-SX	7.48	8-1/8	6-8	7c						BR		
P6-TX	5.05	6-11/16	3-4	5c						BR		
P5TX	4.90	5	3-4	4c						BR		

\* \* \* Figures for frequency ranges and coverage angles are not published because of absence of standards and differences in rating methods among different manufacturers.  
 † \* \* Effective resonance in enclosure is determined by enclosure characteristics. Values in each case are suitable for recommended enclosures.

<b>KINGDOM PRODUCTS, LTD., 23 Park Place, New York 7, N. Y.</b>												
LP-65	\$ 8.50	2 1/2	5.5	2	T	3000-16500 ± 2.5	1600	0-12	4.0			Horn Construction
LP-215	11.50	9 1/4	4	12	FR-W	35-13500 ± 2.5	70	0-2.25		crossover HP-1 LP-65 Tweeter		

<b>JAMES B. LANSING SOUND, INC., 2439 Fletcher Drive, Los Angeles 39, California</b>												
D208	\$ 25.92	8	8	12c, 20p	FR	50-12,000	55	1-8			II-R	Shallow - 3-5/8 in. deep over all
D123	54.50	12	16	20c, 30p	FR	40-14,000	35	2-0			II-R & IB	
D130	76.00	15	16	25c, 40p	FR	30-17,000	38	4-0			II-R	
130A	72.75	15	16	25c, 40p	W	30-2000	38	4-0	0.5 & up		II-R	
130B	72.75	15	32	25c, 40p	W	30-2000	38	4-0	0.5 & up		II-R	
150-4C	114.00	15	16	30c, 50p	W	30-1000	36	5-0	0.3-1.0		II-R	
175DLH	118.50		16	25c, 40p	T	1000-23,000		3-0	1.2			
375	186.00		16	60c, 100p	T	200-15,000		8-0	0.3 & up			
											130 & N1200*	
											537-509 Horn Lens	

\* Crossover Network

<b>LERU LABORATORIES, INC., Box 490 Black Oak Ridge Rd., (Waynetship), Paterson 2, New Jersey</b>												
Siemens 19C	\$ 20.80	Oval 8 1/2 x 14	8	8	FR-W	50-12000	80	9000 G				
*Siemens 3-295	2.90	Rectangular 4-7/8 x 3 1/2			T	8000-15000			10.0			

\* Electrostatic -- requires about 300 v polarizing voltage, and simple C, L, R low frequency suppression network and D. C. Coupler

<b>OXFORD ELECTRIC CORP., 3911 South Michigan Ave., Chicago 15, Illinois</b>												
F8J408	\$ 20.00	8	8	15c, 20p	FR	70-12,000 ± 4	85	0-6.8			BR	Tweeter - 3 in. dia. 1.47 oz. Al V Magnet
F12J408	27.50	12	8	15c, 20p	FR	60-12,000 ± 4	75	0-6.8			BR	
F12L608	35.00	12	8	25c, 30p	FR	50-12,000 ± 4	70	0-14.5			BR	
C012J408	37.50	12	8	15c, 20p	FR Coax	60-15,000 ± 4	70	0-6.8			BR	
T3C208	6.50	3	8		T	1400-15000 ± 4	1800	0-1.47				
T5C208	7.35	5	8		T	1200-15000 ± 4	1500	0-1.47				

<b>PERNOFLUX CORP., 2835 N. Kedzie Ave., Chicago 18, Ill.</b>												
15X81	\$ 64.80	15	8	20c	W	30-11000	40	0-14.5	2.0, 4.0, 6.0		IB-H	Slotted Cone Slotted Cone Slotted Cone Slotted Cone Slotted Cone Slotted Cone Slotted Cone Slotted Cone Slotted Cone Cone Type Tweeter Front & Back Loaded Kit for Coaxial Mtg. on 12 in. Woofer
12X81	43.50	12	8	15c	FR	35-14000	55	0-14.5	1.0-12.0		IB-H	
12UP-B-1	21.00	12	8	12c	FR-W	45-12000	62	0-6.8	1.0-10.0		IB-H	
BWB1	29.85	8	8	15c	FR-MR	45-14000	65	0-10.3	3.0-12		IB-H	
BUP-B-1	18.00	8	8	7c	FR-MR	50-12000	70	0-6.8	3.0-10.0		IB-H or Resonator	
BT-B-1	13.50	8	8	6c	FR-MR	50-12000	70	0-4.6	3.0-10.0		IB-H or Resonator	
6L-1	8.10	6	4	6c	FR-MR	60-8500	80	0-2.15	2.0-6.0		IB-H or Resonator	
32KTR	9.45	3 1/2	16	2c	T	1500-16000	1800	0-2.15	2.0-8.0			
32KTR-C	12.60	3 1/2	16	2c	T	1500-16000	1800	0-2.15	2.0-8.0			

# HOW TO MAKE MONEY IN HIGH FIDELITY WITH Jensen *Authentic* HIGH FIDELITY LOUDSPEAKERS



G-610 *Triaxial*



H-530 coaxial



H-520 coaxial



H-222 coaxial



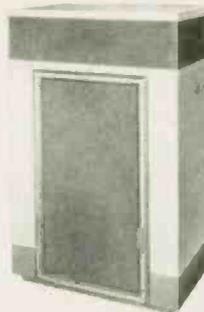
K-310A coaxial



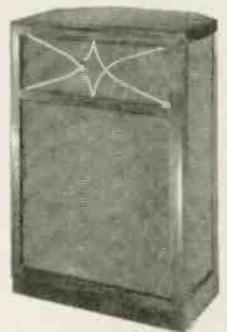
K-210 coaxial



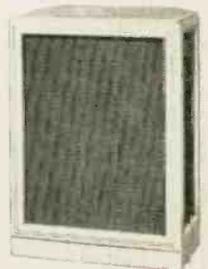
PR-100 *Imperial*



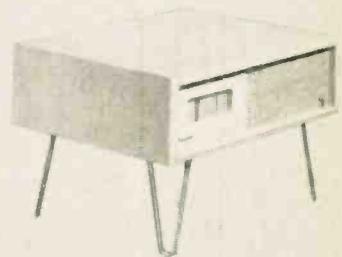
RS-100  
Laboratory Standard



TP-200 *Tri-Plex*



CT-100 *Concerto*



DU-500 TV *Double*



DU-300 *Double*  
*Treasure Chest*

Have you been wondering how to **get in the High Fidelity business**—but find you can't compete under the established distribution and pricing system?

Now you *can* compete—at a Profit! If you are an established dealer, you can buy Jensen Authentic High Fidelity loudspeakers—the complete line—sell at prevailing prices and make a normal profit. You buy out of stocks in your area from a Jensen High Fidelity Wholesaler, selected for his experience and ability to help you with promotional material and sales counsel.

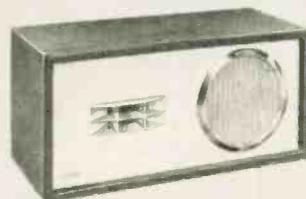
Why not **get the story now**—and be ready to get *your* share of the big high fidelity market? Just ask for "How To Make Money in High Fidelity"—on your letterhead, please.

*Louis W. Selsor*

Louis W. Selsor  
Distributor Sales Manager



DU-202  
*Double* Portable



DU-201 *Double*

**Jensen**

MANUFACTURING COMPANY 6601 S. Laramie, Chicago 38, Ill.

Division of The Muter Company • In Canada: Copper Wire Products, Ltd., Licensee

WORLD'S QUALITY STANDARD FOR MORE THAN A QUARTER CENTURY

MODEL NO./NAME	PRICE	DIA. (in.)	V.C. IMPEDANCE (ohms)	POWER RATING (continuous; peak)	TYPE	RESPONSE (cps; db)	CONE RESONANCE	MAGNET WGT. (lb.-oz.)	CROSSOVER FREQ. (tc.)	RECOMMENDED ENC. TYPE	REC. ASSOCIATED COMPONENTS	NOTES
<b>QUAM NICHOLS CO., 234 East Marquette Road, Chicago 28, Ill.</b>												
8A 10X	\$ 18.60	8	8		FR	65-12,000	80	0-10		BR		
10A 10X	24.00	10	8		FR	60-12,000	70	0-10		BR		
12A 10X	26.00	12	8		FR	50-12,000	60	0-10		BR		
12A6CO	30.00	12	8		FR-Coax	50-15,000	60	0-6.8	BI 2.0	BR		
15A 10CO	47.50	15	8		FR-Coax	25-15,000	50	0-10	BI 2.0	BR		
3A15T	5.75	3½	14		T	2000-15,000		0-1.47	2.0			
5A15T	6.50	5	14		T	2000-15,000		0-1.47	2.0			
<b>RCA VICTOR, RADIO CORP. OF AMERICA, Camden, New Jersey</b>												
SL-8	\$ 18.95	8	8	10	FR	65-10,000		0-6.8		BR		
SL-12	24.95	12	8	10	FR	50-16,000		0-14.5		BR		
LC-1A	189.95	17	16	20	FR	40-16,000		2-8		BR		
<b>SIGHTMASTER CORP., 111 Cedar St., New Rochelle, New York</b>												
X-100	\$ 99.50	15	8	30c, 40p	FR-W	30-30,000 †	30	5-0	1.0	BR		
† db is a function of the enclosure as well as room conditions**												
<b>SONOTONE CORP., Elmsford, New York</b>												
CA-15	\$ 96.00	15	15	25c, 40p	FR-Coax	20-17,000 ± 5 db	30	2-12		HR		
W-15	78.00	15	15	25c, 40p	W	20-7000 ± 5 db	30	2-12	0.8-2.0	HR	T-64	Cloth suspension, cone tweeter
T-64	10.00	6 x 4			T	800-17,000 ± 5 db			6.8-2.0		W-15	Cloth suspension Elliptical cone
<b>STEPHENS MFG. CORP., 8538 Warner Dr., Culver City, Calif.</b>												
120LX	\$ 29.25	12	16	20c*	W	30-5000	45	1-8	Below 5.0	FRHL	214, 5000X, 122AX, 1200X	
105LX	55.50	15	8, 16, 32	20c	W	30-3000	35	2-8	Below 3.0	FRHL	216, 800X P-30, 600X	
103LX	67.50	15	8, 16, 32	25c	W	20-3000	35	4-4	Below 3.0	FRHL	216, 800X, P-30, 400x, 600X	
103LX-2	67.50	15	4, 8, 16, 32	25c	W		35	4-4			For Klipschorn	
112FR	31.50	12	16	20c	FR	35-13000	60	1-8		HL-R	214, 5000X	Concentric Exponential Horns
101FR	58.50	15	16	20c	FR	30-13000	51	2-8		HL-R	214, 5000X	
102FR	70.50	15	16	25c	FR	30-14000	51	4-4		HL-R	214, 5000X	
122AX	54.00	12	16	20c	FR-Coax	35-18000	60	1-8	5.0 BI	HL/DR	214, 5000X, 120LX, 1200X	Dual Exponential Horns
152AZ	88.50	15	16	20c	FR-Coax	30-18000	48	2-8	5.0 BI	HL/DR	214, 5000X, 120LX, 1200X	
206AXA	133.50	15	16	25c	FR-Coax	20-18000	35	7-8	1.2 BI	HL/DR		Uses Multicellular Horns of 2 x 4 cluster
214	33.00		16	20c	T	5000-22000			5.0			Uses Multicellular Horns of 2 x 4 cluster†
216	63.00		16	20c	T	800-18000		1-8	above 0.8			
P-30	88.50		16	30c	T	400-16,000		2-8	above 0.4			
P-35	97.50		16	35c	T	400-16000		4-8	above 0.4			
* Peak power is about 50% higher and is a function of the enclosure also.†												
<b>STROMBERG-CARLSON CO., 1225 Clifford Ave., Rochester 21, New York</b>												
RF-475	\$ 179.95	15	16	40	FR-Coax	30-20,000	38	10-8		EC-BI		AL
RF-465	99.95	15	16	35	FR-Coax	30-20,000	40	2-4		MC-BI		AL
RF-471	49.95	12	8	32	FR-Coax	30-14,000	50	1-4		BI		
RF-460	20.00	8	8	12	FR	50-13,000	75	0-6.8		BI		
<b>TANNOY LTD., 36 Wellington St., E., Toronto, Ontario, Canada</b>												
Dual Concentric	\$ 159.00	15	15	25c	FR	35-20,000 ± 3	40	6-0	1.0 BI	IB-BR		
Dual Concentric	130.00	12	18	15c	FR	35-20,000 ± 3	35	3-8	1.7 BI	IB-BR		
Direct Radiator	57.50	12	20	15c	FR	50-12,000 ± 4	40	3-8		BR		
<b>UNIVERSITY LOUDSPEAKERS, INC., 80 S. Kensico Ave., White Plains, New York</b>												
315	\$ 132.00	15½	8	50	FR-Triax	30-20000	*		MC 1.0, EC 5.0-BI	HL BR		
312	57.60	12-1/8	8	25	FR-Triax	40-20000	*		MC 1.0, EC 5.0-BI	HL BR		
308	36.00	8-7/32	8	25	FR-Triax	50-15000	*		MC 1.0, EC 5.0-BI	HL BR		
6201	45.00	12-1/8	8	25	Dual-Range Coaxial	45-15000	*			HL BR		
Diffusicon 12	27.00	12-1/8	8	30	FR-Coax	45-13000	*		MC 1.0	HL BR		
Diffusicon 8	21.00	8-7/32	8	25	FR-Coax	70-13000	*		MC 1.0	HL BR		
6200	21.00	12-1/8	8	30	FR	45-10000	*			HL BR		
C15W	75.00	15½	4-8	50	W	30-3000	*		to 2.5	Classic, Dean, EN-15		
C12W	33.00	12-1/8	8	30	W	40-6000	*		0.7, 2.0, 5.0	HL BR		
CBW	13.50	8-7/32	8	25	W	50-5000	*		to 5.0	HL BR		
Cobrellex 2/T30	37.50	9¼ x 18½	8	50	MR-T	250-15000	*		above 0.35			
HF-206	27.00	3¼ x 6	8	50	T	3500-20000	*		above 3.5			
4401	15.00	3¼ x 6	8	25	T	2000-15000	*		above 2.0			
4402	24.00	2-5/8 x 10-20	4-8	50	T	2000-15000	*		above 2.0			
4408	18.00	5-13/16 x 7-3/8	8	20	MR-T	600-15000	*		above 0.6			
4409	24.00	5-13/16 x 7-3/8	8	40	MR-T	600-15000	*		above 0.6			
* Mfrs. note: Speaker design extends low end response below cone resonance.												
<b>UTAH RADIO PRODUCTS CO., INC., 1123 E. Franklin St., Huntington, Indiana</b>												
HFD12M	\$ 97.50	12	8	20	FR-Dual Coax	30-17500	55	0-14.7		R		
HFC12J	65.00	12	8	10	FR-Coax	35-17500	57	0-6.8		R		
HFC15P	120.00	15	8	25	FR-Coax	30-19500	45	1-5.5		CH		
HFT35C	12.50	3½	8	10	T	3000-17500		0-14.7	3.5-4.5			
HFT5F	19.50	5	8	25	T	2500-19500		0-3.16	2.5-3.5			
HFE8J	30.00	8	8	10	FR	50-14000	70	0-6.8		R		
HFE12M	58.00	12	8	20	MR	40-8000	55	0-14.7	1.0-5.0	R-CH		1 or more HFT35C HFT5F or HFT5F
HFW12P	87.50	12	8	25	W	35-5000	45	1-5.5	0.6-5.0	CH		
HFW15R	102.00	15	8	35	W	20-5500	38	1-15.6	0.6-5.0	CH		

Note: See University PSE Chart - form 78N32 - sent free upon request

# PSE\*



## 12 Plans For Service Profit in High Fidelity

Now—you, as a serviceman, can step into the high fidelity profit picture in the guise of a design engineer. You can coordinate a speaker system to meet the listening tastes and budget of any consumer, and the interior requirements of any home. You can sell more than installation—You can sell *know-how*.

All of this is made possible by the use of 12 University pictorial assembly plan booklets, called Technigrams, which cover every one of the 36 different speaker systems featured in the original University Progressive Speaker Expansion chart. These Technigrams contain all of the essential information, in words and pictures, required to assemble and install the speaker system your customer selects. Even baffle board layout diagrams are included.

All you do is decide on the best combination of speakers for any particular installation . . . refer to the Technigram in which that combination appears . . . and assemble and install it, following the simple illustrated wiring and assemblage instructions in the Technigrams.

This is a sure-fire sales tool, which will not only increase the amount of audio equipment you can sell, but also add to the extent and quality of the service you can offer.

See your University distributor today—and ask him for the complete PSE story. If you haven't seen the original University descriptive folder on the PSE plan, mail this coupon today for your copy.

### \* Progressive Speaker Expansion

—the plan that makes it possible to buy a speaker today in terms of the system you want tomorrow.



**University Loudspeakers**

80 South Kensico Ave., White Plains, New York

University Loudspeakers, Inc., Desk 80  
80 South Kensico Avenue, White Plains, N. Y.

Please send me my free copy of "Progressive Speaker Expansion."

Name .....

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City ..... State .....

78N32

the  
complete  
line!



**Cornell-Dubilier  
Communication  
Vibrators**

Based on  
Rigid U.S. Government  
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NOW... Cornell-Dubilier makes available to commercial users of communications equipment a new line of vibrators based upon the experience of producing over two million similar units to the exacting requirements of U.S. Signal Corps specifications.

These Eight Types Offer Complete Replacement for ORIGINAL Communications Equipment:

old	new
5515	<b>5715</b>
5518	<b>5718</b>
-	<b>5721</b>
-	<b>5722</b>
5605	<b>5805</b>
5620	<b>5820</b>
5621	<b>5821</b>
5622	<b>5822</b>



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**SPRAY TV TUNERS WITH HUSH**  
Wonderful Contact Restorer Reg. U.S. Pat. Off.



6 ounce Spray Can  
**\$2.25** NET  
2 ounce and 8 ounce bottles available

For efficient economic results, spray direct to any tuner in the easiest possible manner, even while set is in operation. Will not affect inductance, capacitance or resistance. Does not react to cold, oil, heat or corrosive solution; leaving a film which will not arc or build up dirt layers after application. HUSH is not recommended for Potentiometers, ("volume controls").

**Choice Territories Available**  
**CHEMICAL ELECTRONIC ENGINEERING, INC.**

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**Executone INTERCOM**

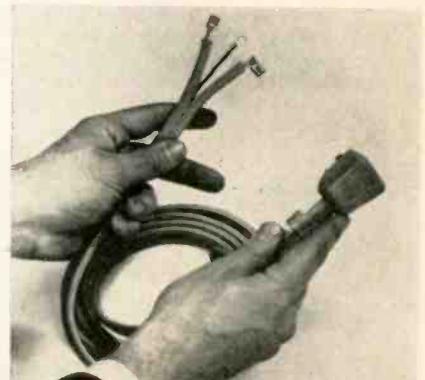
Wall-mounted master stations and economical "single amplifier" operation are among the outstanding features of the new "6000" electronic intercom system. Master stations in this system are available in attractive cabinets for desk or table, and in special wall-mounted housings. Economi-



cal central amplifier, rated at 30 watts is the only unit in the system that requires an electrical power outlet. Stations may be installed and full communication provided between as many as six master stations in this new "single conversation" system. In addition to two-way intercom, the system provides complete facilities for paging. Executone, Inc., 415 Lexington Ave., New York 17, N. Y.—TECHNICIAN (Ask for No. 6-27)

**GE CORD SET**

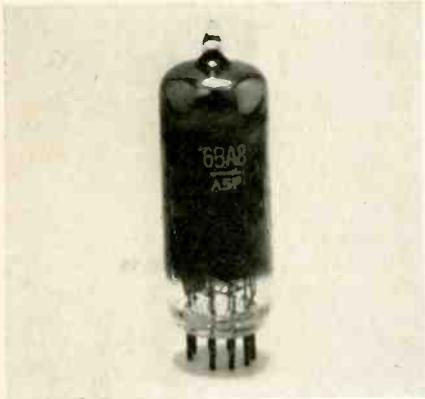
Attractive, flexible cord set for room air conditioners made of thermoplastic insulating material, similar in appearance to the popular rip-cord type but differs in that the green grounding conductor is nested between the other two conductors. When the cord is ripped, the green conductor becomes exposed. This cord is also available in a two-



conductor model for non-grounding application. Because of its flexibility the new cord set will allow sharper bending than has heretofore been possible with heavy, jacketed cords. Its smooth surface makes for easier cleaning and the cord will be available in a large range of colors. Available in the 14 AWG and 16 AWG. Accessory Equipment Department, General Electric Co., Bridgeport, Conn.—TECHNICIAN (Ask for No. 6-37)

### Sylvania TUBE

The 6BA8 is a miniature, 9-pin, medium-mu triode and sharp cutoff pentode intended for service in television receivers employing a series heater string. The pentode section of the 6BA8 has a plate dissipation rate of 3.25 watts and is designed to serve as



a video amplifier. The triode section has a mu of 18 and is suitable for applications where a low-mu triode is desirable, such as sync amplifiers, etc. Sylvania Electric Products, Inc., 1740 Broadway, New York 19, N. Y.—TECHNICIAN (Ask for No. 6-75)

### Clarostat ROTARY SWITCH

The Series BH miniaturized rotary selector switch is available in single-pole (up to 12 positions), 2-pole (6 positions), 3-pole (4 positions) and 4-pole (3 positions). Shorting or non-shorting, as required. Enclosed construction—constructed to military or commercial usages. Mounting is the same as that for the usual volume control, with standard 3/8-in. bushing and 1/4-in. shaft. Clarostat Mfg Co., Inc., Dover, N. H.—TECHNICIAN (Ask for No. 6-90)

### Barjay CAPACITOR TESTER

"Capacitest" will show open, shorted or intermittent capacitors and leaky electrolytics. Also shows circuit continuity and ac and dc voltages, and will indicate leakage of over 300 megohms.

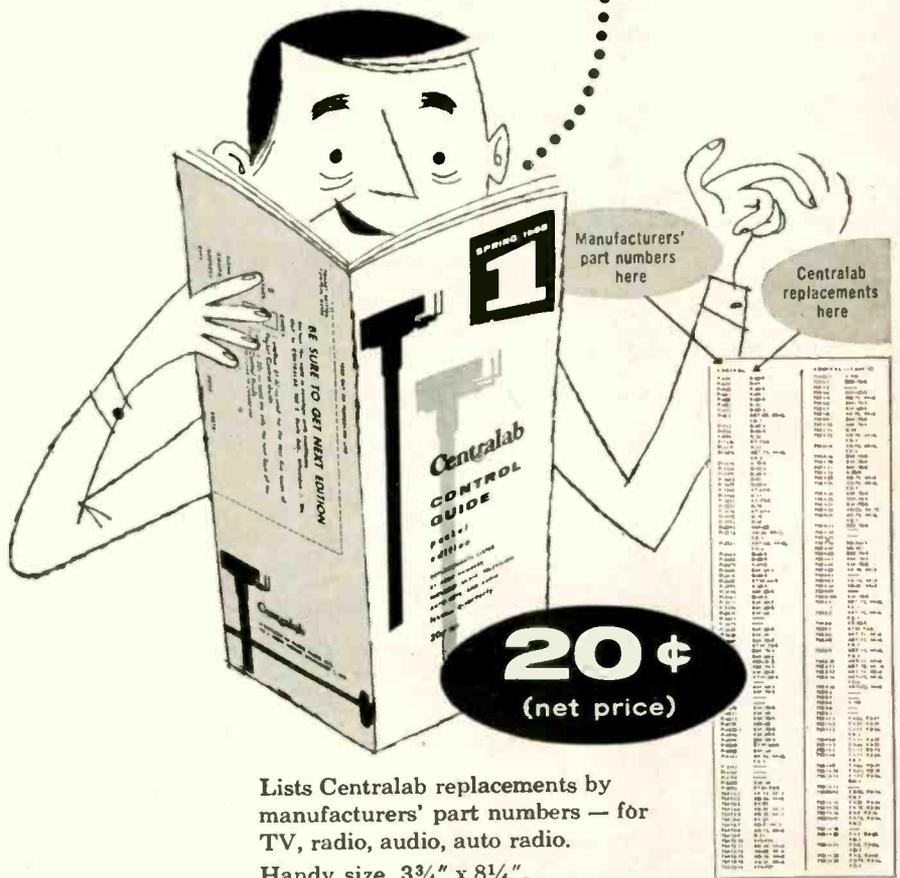


Unique, according to mfr., in that it will check condensers at 150 v, the usual working voltage. Measures 4 x 4 x 2 in. \$9.95. The Barjay Co., 145 W. 40 St., N. Y. 18, N. Y.—TECHNICIAN (Ask for No. 6-76)

# New!

## Centralab Pocket-Edition Control Guide No. 1

Here's the quickest way yet to find the right control replacement!



**EVERY  
SERVICEMAN  
NEEDS THIS  
VOLTAGE  
ADJUSTOR**



T-8394M MANUAL VOLTAGE ADJUSTOR

Where low voltage is affecting TV reception, the service man can detect the condition at once with a T-8394M Acme Electric Voltage Adjustor. And by a simple demonstration he can sell a Voltage Adjustor to the TV set owner. Sales are easy to make because demonstration while servicing a set quickly convinces its owner that the voltage regulation is essential to good TV reception.

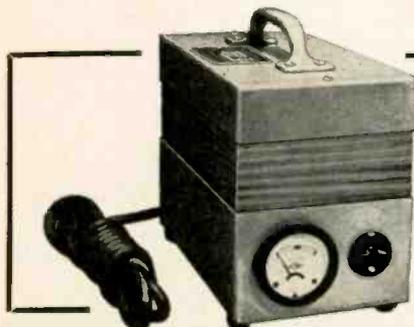
#### How To Use The T-8394M VOLTAGE ADJUSTOR on Service Calls

With the tap switch set at 115 volts, the meter reading will show incoming line voltage. Thus it can be instantly determined if line voltage is lower than normal required for good TV set performance.

The T-8394M Voltage Adjustor can also be used to reproduce the operating condition about which the customer complains by turning tap switch to the voltage which simulates such condition. For example, customer complains that evening program pictures flicker and shrink. When service man calls next day all operation appears normal — voltage tests out properly. But, by adjusting voltage to 97 volts the condition about which the complaint was made is reproduced. This indicates low voltage condition during evening that can be corrected with a T-8394M Voltage Adjustor.

#### Not A Gadget — A High Quality Unit You'll Be Proud To Use

The T-8394M Voltage Adjustor can be installed instantly, no tools needed. Just plug into most convenient outlet. Then plug television cord into secondary receptacle on Voltage Adjustor.



#### FOR COMPLETELY AUTOMATIC VOLTAGE CONTROL

Regardless of line voltage supply, the Automatic Voltrol corrects voltage fluctuation over a range from 95 to 130 volts. The voltmeter supplied indicates secondary voltage while unit is in operation. A built-in relay automatically disconnects circuit when set is turned off.

**Acme Electric**  
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**\$4.95**

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or C.O.D.  
+ Chgs.



## THE NEW TV DYNATRACER

- TRACES TV SIGNALS AND VOLTAGES
  - LOCATES DEFECTIVE COMPONENTS
  - REQUIRES NO ADDITIONAL EQUIPMENT
- Ideal for trouble-shooting television sets in home or shop. Outperforms more expensive testers and pays for itself on first repair.  
**A "MUST" FOR EVERY TV TECHNICIAN**

The "DYNATRACER" is a self-powered quality test instrument that traces TV signals through any Video, Sound, Sync, AFC, Horizontal or Vertical Sweep Circuit—isolates trouble to a stage or component.

Traces voltages (50/600 V. AC/DC). Also locates open, shorted, intermittent or leaky (up to 20 MEGOHMS) condensers, resistors, coils, XFormers, etc.

Complete with Instruction Manual and Repair Guide  
**10 DAY MONEY-BACK GUARANTEE**

**FREE** With each new order we'll include a unique "TV High Voltage Indicator" useful in your testing work.  
Cut out advertisement . . . attach name and address with \$5.00 bill, check or money order and mail to

**Century ELECTRONICS CO.** 111 Roosevelt Ave., Dept. 503  
Mineola, L.I., N.Y.

## Troubleshooting Tuners

(Continued from page 15)

plate resistances of the tubes, being in series, form a voltage divider so that approximately half the voltage (or 135 v.) is available at the plate of the 1st triode. See Fig. 2. As is evident, there exists a potential of up to 150 v. on the cathode of the second stage, with respect to ground. This is one invitation to trouble, as the insulation within the tube itself between heater and cathode must of necessity, be very thin. When a cathode-to-heater short occurs, tube #2 then has its grid 150 v. positive with respect to the cathode (now grounded). This, of course, makes the tube conduct very hard. The little ½-watt 1000 ohm resistor (R<sub>1</sub>) in series with the plate has to pass a great deal of current. Result: it either burns itself "open," or goes down in value to a few ohms. In either case, replacing the tube will not fix the trouble (snowy pix). The resistor must, of course, be replaced. The same condition has been known to happen if a tube becomes "gassy," and its plate current "runs away." •

(Part 2 of this article will appear in a forthcoming issue of TECHNICIAN.)

#### TV FOR DEFENSE

In case of war television will play a vital role in running the country. An experimental closed circuit TV network connecting the secret White House dispersal headquarters and important agencies has been set up in Washington, D.C., and 35 secret places outside of the capital. These emergency facilities would be tied into the commercial networks to enable the President to broadcast to the nation if necessary. This secret TV system is part of the Government's dispersal program directed by the Office of Defense Mobilization. Head of ODM has stated that this plan would seem "to insure against widespread confusion in governmental operations." Another phase of the dispersal program includes specially-trained full-time staffs maintaining the secret bases, ready to carry on Government business even if no department head survived an atomic attack on Washington. This month, a major test of the dispersal program with its closed circuit TV system is slated for a three-day period, with the President and other officials moving from Washington to emergency locations.

# TECHNICIAN VOTED FIRST BY SERVICEMEN

In its second calendar year, **TECHNICIAN** magazine overtakes six others in the field and sets trade paper publishing record

**B**urton browne advertising

619 NORTH MICHIGAN AVENUE  
CHICAGO 11, ILLINOIS

Superior 7-7700

May 5, 1955

562 FIFTH AVENUE NEW YORK 17, N. Y. JUDSON 2-1110

Mr. M. Clements  
Caldwell-Clements, Inc.  
480 Lexington Avenue  
New York 17, New York

Dear Clem:

Some weeks ago, I mentioned to you that, in view of the many conflicting claims of various service magazines in the electronic field, we were going to make our own readership survey. We have completed this survey and I think you will be very much interested in the results.

We mailed out 2000 double post cards to servicemen in twelve major trading areas recommended by our clients. The number in each trading area was proportionate to the relative number of servicemen in that area. Our source of names, which we used in order to be completely impartial, was the classified telephone directory from each area.

The post card stated the following:

1. What radio-TV publication do you prefer for technical servicing information? (Please name one or more.) 1st choice \_\_\_\_\_ 2nd choice \_\_\_\_\_ 3rd choice \_\_\_\_\_.
2. Name the feature or features you prefer.

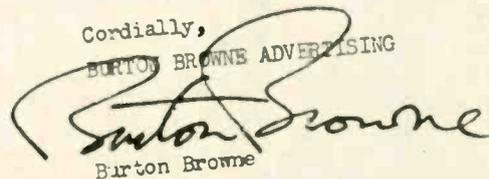
The results are as follows (given as percentages of the total listings of magazines by the servicemen):

Technician	26.0%
Magazine B	21.3%
" C	18.0%
" D	11.3%
" E	9.9%
" F	9.2%
" G	4.3%

The answers that we received to the question of the features they preferred would indicate that your Circuit Digest is an extremely valid and very popular addition to your book and, to a great extent, may account for your outstanding position in the survey.

Cordially,

BURTON BROWNE ADVERTISING

  
Burton Browne

jn

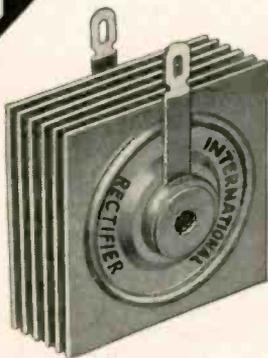
**Thank you Dr. Browne...**  
**and the thousands of servicemen who prefer TECHNICIAN magazine.**  
**The Publishers.**

**CALDWELL-CLEMENTS, INC., 480 Lexington Avenue, New York 17, N. Y.**

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# Selenium



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World's Largest Supplier of  
Quality Industrial Rectifiers

## Electrolytic Condensers

(Continued from page 17)

should not be exceeded. Where the input filter condenser's capacitance is too large, the impedance in series with the rectifier may be too low when the condenser is uncharged, as it is when the set is first turned on. The resultant peak current will be excessive, and the rectifier's life short.

Servicemen who use larger than called-for values of capacitance at the input filter, in an attempt to boost supply voltages, should realize that this practice is not a safe one, unless a resistor (of app. 50 ohms) is used in series with the rectifier plate, to limit the peak current to a safe value.

**Peak Voltage Considerations.** The peak voltage an electrolytic capacitor is exposed to is equal to the dc voltage *plus* the ac ripple voltage developed across it. This peak voltage is present under continuous operating conditions, and should not be confused with the *surge voltage*, which is, in effect, the maximum voltage the condenser can withstand for a short period of time.

The peak voltage should not exceed the dc voltage at which the dielectric film was originally formed. For a 150 v condenser, this formation voltage is app. 200 v. Under ordinary circumstances, there isn't much danger of the peak voltage approaching the formation voltage referred to. When receivers are to be operated on 25-cycle power supplies, however, such a danger does exist (since the higher capacitative reactance present causes a larger-amplitude ripple voltage to be developed across the input filter condenser). Condensers with a higher voltage rating should be used in such applications.

**Shelf Life.** The shelf life of an electrolytic capacitor refers to the length of time it can remain out of service, without deteriorating in any respect. A well-constructed capacitor may be idle for as long as two years, without suffering damage. Units with a poor shelf life characteristic are, however, apt to be permanently impaired during a long idle period. It pays to buy or use the best possible condenser, in applications where the electrolytic condenser will, for some reason, be subjected to long periods of disuse.

Leakage current is considerably larger than normal when an elec-

trolytic condenser that has not been used for some time is put back into harness (see Fig. 4). The current will, however, drop back to normal after some time, unless the unit is defective. •

## "X-RAY" CABINETS



Magnavox has a new selling tool in the Lucite cabinets for demonstrating better sight and better sound features. Also enables dealer to show how convenient "top tuning" works.

## Tooling Up for Hi-Fi

(Continued from page 25)

portant, therefore, that a speaker be used which is capable of good low frequency response, and that it be housed in a good baffle. Many complaints concern hum and low frequency oscillation. A poor amplifier and speaker simply will not reveal these defects. The serviceman will want to devise some convenient switching arrangement so that any unit under test can quickly be brought into the circuit for aural testing.

In time the serviceman will find himself acquiring less essential, yet very worthwhile instruments such as frequency analyzers, harmonic distortion analyzers, FM standard visual generators, a calibrated microphone, and other rather expensive pieces of equipment which are useful in high-quality service work.

The technician must always remember that the customer is willing to pay for and therefore is entitled to high quality service on his high quality equipment. On a simple radio in which the speaker has a very limited frequency range, it is of no consequence if the hum content of the audio section is a little high. But in a critical system in which the speaker system may reproduce from 30 to 15,000 cps., even a slight hum, or slight intermodulation distortion will be noted by the critical ears of the hi-fi fan.

Future articles will cover some common problems which arise in tuner alignment, amplifier checking and improvement, and similar hi-fi service problems. •

## Service Ass'n Reports

### RTGLI Analyzes Licensing Bills, Polices Distribs

In the April issue of the *Guild News*, the Radio Television Guild of Long Island, Box 87, Bethpage, N. Y., presents a comparative analysis of four licensing bills for technicians, one now in effect, the other three proposed. The actual state law in Wisconsin, proposed state bills for Utah and Louisiana, as well as the proposed N. Y. C. bill, are included.

The Guild continues its monthly practice of sending out shoppers to distributors in the area to check on who's doing indiscriminate over-the-counter selling—and also continues to publicize the results. Shopped in April were 35 middlemen in the N. Y. C.-Long Island area. Of these, 14 sold with no questions asked. The figure is reported to show a decline as compared to the situation before the shopping program was inaugurated.

Murray Barlowe, Guild prexy, would like to hear from other associations that are conducting similar check-up programs, in order to compare notes for mutual benefit and possibly organize an appeal to manufacturers. He also tells us there's hot news up the Guild's sleeve which we hope to break in next month's issue. It involves a lawsuit against a distributor now pursuing a 2-way sales policy, with sound legal basis for the action.

### Transistors in Transition

Prominent manufacturer of transistors sent us a release telling how these devices have "been heralded as electronic marbles of the future." Comes the question: Where were the marbles—in the mouth of the publicity man or in the head of his stenographer?

### "FRIENDS OF SERVICE"



The Buffalo RTSA group was host to the sixth Annual Spring Convention of NATESA. Left to right: Andrew Ferguson, Sprague; Walter Bieda, Sylvania; Frank J. Moch, NATESA; A. C. W. Saunders, RTSA; Ferdinand J. Lynn, RTSA; H. H. Rainier, Sylvania; and Dan Creato, RCA Service.

# KESTER

Absolutely non-corrosive and non-conductive, KESTER "RESIN-FIVE" CORE SOLDER contains an activated type of resin that gives you that fast, positive action on all your jobs . . . including the most difficult.

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Newark 5, New Jersey • Brantford, Canada

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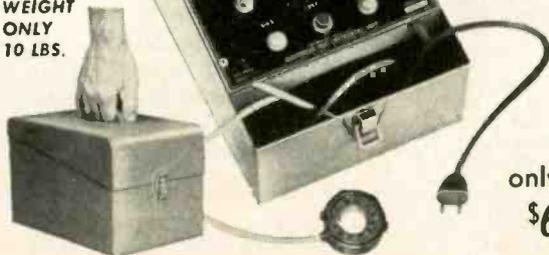
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AN INSTRUMENT DESIGNED TO MAINTAIN, IMPROVE and VITALIZE OPERATION OF CATHODE RAY TUBES

Unique reactivator function is accomplished by dynamic sweep between cathode and grid . . . removing gas ions and stale emitting material from surface of cathode tube.

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- repairs open elements
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- estimates tube life expectancy

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## CARTRIDGE Interchangeability GUIDE

Get it NOW



A turn of the wheel shows at a glance the exact E-V model to replace any popular crystal or ceramic phonograph cartridge.

This handy, up-to-date Interchangeability Guide is small and easy to use (only 6½ in. diameter). Get it FREE from your E-V Distributor or write to Electro-Voice.



All E-V phono-cartridges now come in new individual sealed-in-plastic Blister-Paks with full model identification and instructions. This exclusive E-V advanced packaging makes it easier for you to stock, sell and service phono-cartridge replacements. Remember E-V Basic 6 Preferred Types make over 92% of all replacements in the \$70,000,000 cartridge replacement market.

No Finer Choice than

# Electro-Voice

ELECTRO-VOICE, INC. • BUCHANAN, MICH.

## Let's Look at Circuits

(Continued from page 18)

low resistance ( $R_p$ ) of the tube.

With this strangling bias now disposed of, the liberated V2 swings into conduction. The increasing current passes through R3 and the voltage drop across this load resistor increases. Less voltage is available at the plate of V2. The reduced voltage at the plate is coupled back to the grid of V1 through C2, at which point it also represents a reduction in voltage. With the V1 grid voltage thus lowered, this latter tube tends to conduct less than . . . Does this begin to sound familiar? It should! It's just the same situation described before with one important change: V2 is now building up to heavy conduction, while V1 is being driven to cut off. The triodes have switched roles.

As long as voltage continues to be applied, this see-saw action continues in a regularly timed sequence. We have, in short, an oscillator. The period of oscillation can be established by controlling the time it takes for the grids to charge to the cutoff point. Since this time is established by the grid's R-C time constant (C2 and R2, or C1 and R4), the frequency of oscillation can be selected by using appropriate values of these resistors and condensers. For a finer adjustment that also permits some range of variation, one of these resistors—R4, for example—can be made variable. It becomes a frequency or "hold" control.

One of the nice things about our see-saw is that it lends itself to pin-point control; that is, it may be locked in step by another oscillation or pulse of approximately the same frequency. The controlling pulse or voltage is applied to one of the grids, generally the one that shows an input connection in broken lines on our schematic.

How the control is achieved and how the output is used, however, are matters aside from the basic operation of the circuit. They well may be left for a follow-up discussion. •

## Catalogs & Bulletins

**PANEL METERS:** Engineering data sheet describes and gives complete performance information on a new series of large side indicator panel meters. For free copy, write to International Instruments Inc., P. O. Box 2954, New Haven 15, Conn. (Ask for No. B6-10)

**TWIST PRONG CAPACITOR INDEX:** A comprehensive twist prong type capacitor cross-index and price list of recommended replacements for four leading brands. Over 1000 different twist prong capacitor types listed with stock numbers and approximate price of C-D equivalent. Copies of Form UPX155 available without charge from Cornell-Dubilier Elec. Corp., S. Plainfield, N. J. (Ask for No. B6-1)

**CARTRIDGE REPLACEMENT CHART:** New master cross-index replacement chart of phono cartridges lists current Astatic replacement numbers. In booklet form with a three-hole punch for insertion into any standard loose-leaf binder. Free copies may be obtained by writing to The Astatic Corp., Dept. RC, Conneaut, Ohio. (Ask for No. B6-2)

**PRINTED CIRCUITRY:** New 8-page booklet describes the application, uses, and advantages of printed circuits in various electrical products and equipment, and provides technical information to aid in design or planning of printed circuitry. For copies, write to Printed Wiring Div., Cornell-Dubilier Elec. Corp., S. Plainfield, N. J. (Ask for No. B6-3)

**TV ANTENNA HARDWARE & ACCESSORIES:** New 32-page catalog covering everything in TV accessory line, including indoor and outdoor antennas, antenna kits, chimney repair kits, TV detents, safety cords, and aerosol spray paints. Free copies may be obtained by ordering catalog No. 17 from iE Mfg., 324 N. Hoynes Ave., Chicago, Ill. (Ask for No. B6-4)

**AUDIO-VISUAL EQUIPMENT:** New catalog illustrates and details complete line of audio-visual equipment, ranging from a small portable inexpensive 3-speed phono to a powerful PA combination machine. Available without charge from Audio-Master Corp., 17 E. 45 St., New York, N. Y. (Ask for No. B6-5)

**GUIDE FOR PICTURE TUBES:** New TV Picture Tube Guide lists all magnetically deflected picture tubes to date, monochrome or color, including those made by other manufacturers as well as CBS-Hytron. Basing diagrams and pertinent data for 242 tubes are presented in easy-to-read, easy-to-use format. Available free from CBS-Hytron distributors. (Ask for No. B6-13)

**PRINTED CIRCUIT REPAIR KIT:** 6-page service manual for the service and repair of printed circuits. Compiled in booklet form with three-hole punch for easy insertion into standard loose-leaf binder. Available from General Cement Mfg. Co., Rockford, Ill. (Ask for No. B6-14)

### OBTAIN THE BULLETINS

described here by writing on company letter-head to Bulletins Editor, TECHNICIAN, 480 Lexington Ave., New York 17, N. Y., listing numbers given at end of each item of interest. Please mention title of position held. Use coupon on page 26.

## New Books

**PICTURE BOOK OF TV TROUBLES, VOL. 2: VERTICAL SWEEP & DEFLECTION CIRCUITS.** By John F. Rider Laboratories Staff. Published by John F. Rider Publisher, Inc., 480 Canal Street, New York 13, N. Y. 96 pp. Paper cover. \$1.80.

Like the first in the series, this is an organized presentation of specific faults that have occurred in one particular section of a number of receivers. Distinctive feature of the series lies in this direction: while there is much known data on what may be expected in properly functioning circuits, no other attempt comes to mind wherein the characteristics of abnormal operation have been so carefully observed and recorded, then compared with normal voltages, resistance readings, waveforms, crt patterns, etc.

Commonly used circuits with typical variations are treated. If every possible fault has not been anticipated—human frailty being what it is—the least one can say is that the treatment is exhaustive. Additional chapters cover troubleshooting techniques.

A helpful feature is a bound-in fold-out insert at the back of the book featuring all circuits discussed, together with normal waveforms. When pulled out, it permits simultaneous inspection of the circuit and the specific complaints being studied without the nuisance of turning pages back and forth.

**TELEVISION SIMPLIFIED, 5TH EDITION.** By Milton S. Kiver. Published by D. Van Nostrand Co., Inc., 250 Fourth Avenue, New York 3, N. Y. 541 pp. Hard cover. \$6.75.

This revised and enlarged edition contains all of the added material put into the 4th edition on UHF, cascade tuners, 40-mc i-f systems and other recent developments, together with a new and up-to-date chapter on color television. Fold-out schematics of typical receivers include one of a current color model. The book, in keeping up with the field, has grown impressively in size as compared to the 1st edition nine years ago.

**TV FIELD SERVICE MANUAL, VOL. 4.** Edited by Harold Alsberg. Published by John F. Rider Publisher, Inc., 480 Canal Street, New York 13, N. Y. 160 pp. Paper cover. \$2.40.

Latest in this series, which is running through the alphabet of TV manufacturers, covers sets made by GE, Hallcrafters and Hoffman. Featured are tube and chassis layout diagrams, locations of adjustments and controls, lists of commonly occurring symptoms together with probable adjustments or tube substitutions to be attempted, along with other more general hints as to what can be done in the home by technician to avoid the need for bringing the set into the shop. For series-string sets, filament wiring diagrams are also included.

The new  
Model TV-50

# GENOMETER

A versatile all-inclusive GENERATOR which provides ALL the outputs for servicing:  
A.M. Radio • F.M. Radio • Amplifiers • Black and White TV • Color TV  
**7 Signal Generators in One!**



**BAR GENERATOR:** Projects on actual Bar Pattern on any TV Receiver Screen. Pattern will consist of 4 to 16 horizontal bars or 7 to 20 vertical bars.

**CROSS HATCH GENERATOR:** Projects a crosshatch pattern on any TV picture tube. Pattern consists of non-shifting, horizontal and vertical lines, interlaced.

**DOT PATTERN GENERATOR (FOR COLOR TV):** The Dot Pattern projected on any color TV Receiver tube by the Model TV-50 will enable you to adjust for proper color convergence.

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- ✓ Audio Frequency Generator
- ✓ Bar Generator
- ✓ Cross Hatch Generator
- ✓ Color Dot Pattern Generator
- ✓ Marker Generator

**R. F. SIGNAL GENERATOR:** Generates Radio Frequencies from 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics.

**VARIABLE AUDIO FREQUENCY GENERATOR:** Provides a variable 300 cycle to 20,000 cycle peaked wave audio signal (also fixed 400 cycle sine wave).

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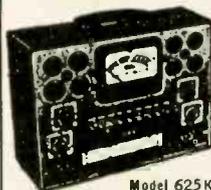
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## NEW STOCK OF FIRST QUALITY TELTRON TUBES

**GUARANTEED LOWEST PRICE EVER!**  
All tubes individually boxed  
and unconditionally guaranteed

**GIFT OFFER!** One 6BG6G Tube will be shipped FREE with any \$10.00 order accompanying this ad.

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  - New lever-action switches for individual testing of every element
  - Tests all conventional and TV tubes
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May be bought outright from Teltron for \$34.95.

TYPE	PRICE	TYPE	PRICE	TYPE	PRICE	TYPE	PRICE
1A7GT	.53	6AV5GT	.60	6K7	.40	12BA7	.56
1H5GT	.51	6AV6	.37	6L6	.78	12BE6	.46
1L4	.51	6AX4GT	.60	6Q7	.40	12BH7	.61
1L6	.51	6AX5GT	.60	6S8GT	.65	12BY7	.65
1LC6	.49	6BA6	.58	6SA7	.45	12C7	.63
1N5GT	.51	6BA7	.58	6SK7GT	.45	12SL7GT	.60
1R5	.51	6BD5	.48	6SL7GT	.60	12SN7GT	.56
1T5	.51	6BF5	.48	6S7	.40	19T8	.71
1X2	.65	6BG6G	1.18	6T8	.71	25B06GT	.82
2A3	.35	6BH6	.51	6B8	.76	25C06	1.09
2A7	.35	6BJ6	.51	6V3	.80	25L6GT	.41
3Q4	.53	6BK5	.75	6V6GT	.48	25Z5	.55
3Q5GT	.61	6BK7	.78	6W6GT	.53	25Z6GT	.36
3S4	.48	6BN6	.90	6X4	.37	35B5	.48
3V4	.48	6BL7GT	.78	6X5GT	.38	35C5	.48
5V4G	.49	6BQ7	.85	6X8	.80	35W4	.33
5Y3GT	.30	6BY5G	.60	7F8	.49	35Y4	.35
5Y4G	.40	6BZ7	.95	7N7	.52	3Z5GT	.33
6A8	.40	6C4	.41	12AL5	.43	50A5	.48
6AC7	.65	6CB6	.51	12AT6	.37	50B5	.48
6AF4	1.02	6C06	.95	12AU6	.43	50C5	.48
6AH4GT	.65	6F6	.42	12AV7	.73	117L7GT	1.20
6AK5	.96	6F5GT	.44	12AX4GT	.60	117Z3	.33
6AL5	.43	6H6	.50	12AX7	.61	117Z6GT	.65
6AQ5	.48	6J5GT	.49	12A27	.65	80	.40
6AR5	.48	6J6	.61	12B4	.72	1629	.39
6AU5GT	.60	6K6GT	.39	12BA6	.46		

**SPECIALS! thru July 1st**

183GT	.55	6SN7GT	.52
1U4	.38	6W4GT	.38
1U5	.38	12AT7	.65
5U4G	.39	12AU7	.49
6AC5	.48	12SA7	.39
6AU6	.37	12SK7	.39
6BE6	.39	12SQ7	.35
6B06GT	.74	35L6GT	.38
6CD6G	.74	50L6GT	.45
6S4	.38		

**SAME DAY SERVICE**

48 Hour Postal Delivery To West Coast

**TERMS:** Save all freight and postage charges. All orders accompanied by full remittance will be shipped POSTAGE PAID anywhere in the continental U.S.A. 25% deposit required on C. O. D. \$1.00 handling charge on orders under \$10.00. Open accounts to rated firms only.

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## NEW TRIAD CATALOGS



**GENERAL CATALOG TR-55**  
listing 84 new items



**TV-GUIDE TV-155**  
giving latest recommendations  
on correct television replacements



## News of the Industry

**H. C. BONFIG**, formerly of ZENITH RADIO CORP. has been appointed president of CBS-COLUMBIA.

**LLOYD DOPKINS** has been appointed vice-pres. in charge of sales for GRANCO PRODUCTS INC., Long Island City, N. Y.

**HAROLD J. SCHULMAN** has been named asst. to the pres. for CBS-COLUMBIA, in charge of coordinating all company plans and activities.

**WENDELL TIETSWORTH**, formerly head of Eastern Commercial Engineering of General Electric's Tube Department, has joined Sonotone Corporation as asst. sales administrator of the Tube Division.

**PETER L. STONE** has been elected president of Allen D. Cardwell Electronics Productions Corp.

**MISS NORMA L. TESTARDI** is the new advertising manager at International Resistance Company, Phila.

**ROBERT RAYNOR** has been named sales promotion mgr. to head the new merchandising dept. for CLEAR BEAM ANTENNA CORP. and TEMPO TV.

**EUGENE F. GRANT** has been named director of engineering for the NATIONAL CO., INC., Malden and Melrose, Mass.

**EDWARD P. ROBINSON**, formerly sales mgr. for ESPEY MFG. CO., has been named factory representative in the metropolitan N. Y. area for SIGHT-MASTER hi-fidelity speaker system and line of equipment.

**EDWARD F. SHAVER** has been appointed sales promotion mgr. for JENSEN MFG. CO., Chicago.

### 26-TUBE COLOR RECEIVER



RCA has fond hopes that the "Seville" will break the color TV market wide open. Set incorporates a 21-in. color tube and a 26-tube simplified chassis. Price tag of \$795.00 makes it the industry's lowest priced 21-in. set.

### BRONZE TRIBUTE



One of the foremost physicists, the late Dr. Robert Millikan, is paid tribute with the presentation of a bronze bust to Dr. Lee DuBridge, pres. of Calif. Institute of Technology. Occasion was the 45th anniversary of Cornell-Dubilier. Left to right: Dr. A. O. Beckman, Wm. Dubilier, Octave Blake and Dr. DuBridge.

**TACO ENGINEERS.** Continuing a program designed to further the importance of antennas to the communication industry, **KENDRICK K. LIPPITT** and **ROBERT T. LEITNER**, TACO engineers, addressed meetings of the Institute of Radio Engineers and the American Institute of Electrical Engineers.

Complete show-time broadcasting from special studios at the 1955 **HIGH FIDELITY SHOW** at the Palmer House, Chicago, Sept. 30-Oct. 2, over FM station WFMT, Chicago, will be a feature of this Fall's event.

**OLSON RADIO WAREHOUSE, INC.**, Akron, Ohio, has opened a new store in Milwaukee, Wisc., making a total of five warehouses and stores in Chicago, Cleveland, Pittsburgh, Akron and Milwaukee.

**WALTER L. SCHOTT**, Pres., **WALSCO ELECTRONICS**, Los Angeles, announced that WALSCO has become an associated division of **TELAUTOGRAPH CORP.** The new affiliation will not affect the present managerial arrangement at WALSCO.

**RADIO RECEPTOR CO., INC.**, Brooklyn, New York has taken a 5-yr. lease on a newly completed \$750,000 factory building at 80 N. 5 St., Brooklyn. The company is currently operating two other plants in Brooklyn.

**RAYTHEON MFG CO.** has announced plans to double the size of its factory service training program in color TV. 200 servicemen have already completed the course since it was inaugurated last September.

A new idea in phonograph cartridge packaging has been introduced by **ELECTRO-VOICE, INC.** Each E-V replacement phono-cartridge is now sealed-in-plastic in a unique "Blister-Pak" for greater protection. Full model identification chart and instructions are printed right on the package for greater convenience in stocking, selling and servicing.

(News continued on page 48)

**QUIETROLE** the Original  
LUBRICANT CLEANER for  
noisy controls  
and switches

"Known  
Worldwide"

for  
★ QUALITY  
★ MERIT  
★ RELIABILITY

Available  
in 3 sizes:  
2 oz., 4 oz., 8 oz.

Even new controls last longer  
and operate quieter with  
QUIETROLE . . . the most reliable  
product of its kind.

"The CHOICE OF BETTER SERVICEMEN EVERYWHERE"

manufactured by  
**QUIETROLE  
COMPANY, INC.**  
Spartanburg, South Carolina



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JUNE 1955**

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While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.

**CIRCUIT DIGEST INDEX**

To continue our policy of providing extensive and timely coverage of the field, we have used the space normally devoted to the Circuit Digest Index for other editorial material this month. Accordingly, the index does not appear in this issue. Regular publication of this valuable aid to your use of Circuit Digests will be resumed with forthcoming issues.

**EICO® SAVE 50%—BUILD EICO KITS!**

Sig. Gen. \$19.95

5" Scope \$44.95

VTVM \$25.95

VOM \$12.90

Tube Tester \$34.95

See EICO's 38 Kits & 42 Wired Instruments in stock at your local jobber. Write for Catalog T-6.  
Prices 5% higher on West Coast.

**EICO** 84 WITHERS STREET, BROOKLYN 11, N. Y.



**CLOSING DATES FOR**

**TECHNICIAN  
& Circuit Digests**

- 1st of preceding month for all ads requiring proofs, composition, foundry work, key changes, etc.
- 10th of preceding month for complete plates only—no setting.
- 1st of month—Publication Date. Cancellations not accepted after 1st of preceding month.

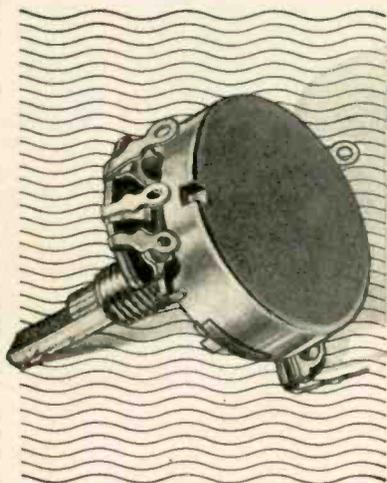
**CALDWELL-CLEMENTS, INC.**

480 Lexington Avenue, New York 17



"This bulb indicates gold.  
This one lights up for Uranium  
—and this one spots  
**JENSEN NEEDLES.**"

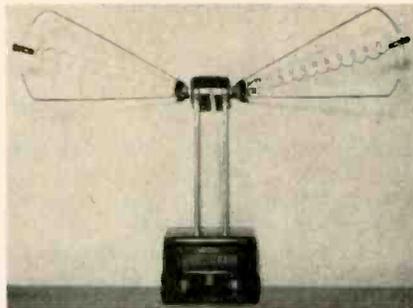
take  
**CONTROLS**  
for  
example



RCA Controls for RCA Victor TV receivers, radios, and phonographs are specifically designed to save you time and money by fitting right, installing fast. Controls are just one example of how every RCA Service Part is FACTORY-TAILORED to keep your servicing "on the go" profitably. Remember: RCA Service Parts are the only genuine replacement parts for RCA Victor TV receivers, radios, and phonographs.



**CONVERTENNA**



A gadget known as the Convertenna is creating a rash of sales in the South Florida TV trade. It consists of a Vidonalr Indoor UHF-VHF antenna mounted on a Mallory 88 UHF converter. Dealers are using it for home demonstrations to show owners of old VHF-only sets variety of entertainment available to them on Channels 17, 23.

**Reps & Distributors**

**CLEAR BEAM ANTENNA CORP.**, Canoga Park, Calif. announces the appointment of **RAY RIPLEY** to represent it in N. & S. Dakota, Minn. and Western Wisc.

**PYRAMID ELECTRIC CO.**, North Bergen, N. J., announces the appointments of two new representatives. **FRANK WEDEL CO.**, Seattle, Wash., will cover Oregon, Washington Northern Idaho, Western Mont., Alaska and British Columbia. **WILLIAM KELLY** Burlington, Iowa, will serve Iowa and Neb.

**ELCO CORP.**, Phila., Penna., announces the appointment of **HOVING SALES CO.**, Fort Wayne, Ind. as its representative for Ind. and Ky.

**LOWRY-DIETRICH**, Pittsburgh, Penna., will cover Western Penna. and West Va., and **D. DOLAN SALES**, Chicago, will handle the Chicago area.

**INTERNATIONAL RECTIFIER CORPORATION**, El Segundo, Calif., announces the appointment of **E. W. McGRADE CO.**, Kansas City, Mo., as sales representative in Kan., Mo. and Southern Ill.

**RICHARD KAISER** has joined **ART CERF & CO.**, Newark, N. J., and will represent them in Eastern Penna., exclusive of Phila.

**ROGERS ELECTRONIC CORP.**, New York, N. Y., appointed **DELZELL-MAYNARD SALES CO.**, Dallas, Texas, to represent it in Texas, Okla., Ark. and La. The Southeastern area will be served by **JOHN B. PEPPER ASSOC.**, Atlanta, Ga.

**STEPHENS MFG. CORP.**, Culver City, Calif., announces the appointment of **BILL KOLANS & CO.**, S. San Francisco, to represent it in the Northern Calif. area.

**NEDA** has moved to 4704 W. Irving Park Rd., Chicago 41, Ill.

**CARTER MOTOR CO.**, Chicago, announces the appointment of following distributors: **HUGHES-PETERS, INC.**, Columbus, Ohio; **P. I. BURKS CO.**, Louisville, Ky.; **SREPCO, INC.**, Dayton, Ohio; **ELECTRONIC SALES**, Los Angeles, Calif.; **VARAH LTD.**, Vancouver, B. C. and **HUDSON RADIO & TV CORP.**, New York City.

**HYNES & WALLER**, Wash., D. C., have been named to handle the full line of **BENDIX TV** and radio products in that metropolitan area. **HURON ELECTRIC SUPPLY CO., INC.**, Buffalo, will handle the full line in that city.

**McKESSON & ROBBINS, INC.**, Buffalo, have been appointed distributors for **SYLVANIA** radios and Hi-Fi phonographs.

**KEY TO RAYTHEON TUBE CADDY**



The key to one of Raytheon's first new tube caddies received by a distributor was presented to **M. Green** (center), owner of **Almo Radio Co.**, **E. I. Montague** (left) and **L. D. Lowery** of Raytheon make presentation.

**"WHAT IS IT?"** (from p. 13)

The wire structure is the grid of one of G.E.'s "Five-Star" Reliability tubes, and the two small bits clinging to the elements are pieces of lint carried unsuspectingly into the assembly room by employees. The very likely result of this, if allowed to occur, would be an intermittent short and a faulty tube.

G.E. engineers took this highly magnified photo to point out a common cause of tube malfunctioning and to focus attention on the program which they have instituted to ensure that such defects do not show up in G.E. tubes. Nicknamed "Operation Snow White," the program calls for all employees connected with tube manufacturing to wear lint-free clothes, and to take scrupulous pains to prevent dust or other foreign particles from accumulating in work areas.

All employees, male and female, wear white nylon or dacron uniforms. Understanding GE executives, —sensitive to female employees' morale,—gave the girls a choice of 12 different uniform styles.

# capacitor replacements

## FOR SETS OF THE MONTH

### CROSLLEY CHASSIS 466,467

Symbol No.	Rating $\mu\text{F}$ @VVDC	Crosley Part No.	Sprague Replacement
C132	140+5@350	159495-1	R-2030
C138	15@525	159319-1	TVA-1905
C139	200@200	158557-1	R-1646
*C140	140+5@350/200@200	159318-1	R-2031
**C140	140@350/5@300/200+30@200	159520-1	R-2032
C162	100@150	159316-1	TVA-1420
*C190	20@200	159519-1	TVA-1510

\*—Used in early production.  
\*\*—Used in late production.

### CRAFTSMEN "SOLITAIRE" MODEL

Symbol No.	Rating $\mu\text{F}$ @VVDC	Craftsmen Part No.	Sprague Replacement
C1	25@25	—	TVA-1205
C3	40@350/40@300/30@250	—	TVL-4622
C27	60+40@450/20@400	—	TVL-2770
			TVA-1709
C28	100@50	—	TVA-1310

### MOTOROLA MODELS 5M, 5M-12

Symbol No.	Rating $\mu\text{F}$ @VVDC	Motorola Part No.	Sprague Replacement
C17	15+10@350/20@25	23A485677	TVL-3630

### ANDREA CHASSIS VO21

Symbol No.	Rating $\mu\text{F}$ @VVDC	Andrea Part No.	Sprague Replacement
C23			
C25	20@525/40@450/20@350/	HCE-1339	R-1528
C62	100@25		
C66			
C26			
C28	4+4@500	HCE-1341	R-2033
C34	2@25	HCE-1302	TVA-1301
C59	10@25	HCE-1329	TVA-1204
C64			
C65	40@450/20@350	HCE-1340	R-1897
	Integrator Network	FM-5289	V-1

### PACKARD-BELL CHASSIS T-10

Symbol No.	Rating $\mu\text{F}$ @VVDC	Packard-Bell Part No.	Sprague Replacement
C4	5@50	24038	TVA-1303
C10	10@350/80@300/25@25	24083A	R-2034
C22	60@300/10@200	24084A	R-2035
C39	Integrator Network	23980	V-1

Sprague makes more capacitors . . . in more types . . . in more ratings . . . than any other capacitor manufacturer. Send 10¢ for the 65-page giant seventh edition TV Replacement Manual to Sprague Products Co., 65 Marshall St., North Adams, Mass., or get it FREE from your Sprague distributor.

### GENERAL ELECTRIC "K" LINE

Symbol No.	Rating $\mu\text{F}$ @VVDC	G.E. Part No.	Sprague Replacement
C236	20@450	RCE-093	TVA-1709
C308	5@50	RCE-174	TVA-1303
C400	80+60@350/40@300/20@150	N-RCE-206	R-2011



You'll never see your doctor advertise a special sale on appendectomies . . .

You'll never see your lawyer announce cut-rates for divorce cases . . .

You'll never see your dentist hold a "2-for-1" sale on extractions . . .

AND You'll never see the day when you can take your TV set in for a service "bargain" and be sure you're getting a square deal!

"Bargains" in home electronic service are as scarce as the proverbial hen's teeth! Here's why—

The expert service technician, just like other professional people, must undergo years of study and apprenticeship to learn the fundamentals of his skill. And a minimum investment of from \$3000 to \$6000 per shop technician is required for the necessary equipment to test today's highly complex sets. Finally, through manufacturer's training courses and his own technical journals, he must keep up with changes that are developing as fast as they ever did in medicine, law, or dentistry. Those best equipped to apply modern scientific methods are almost certain to be

most economical for you and definitely more satisfactory in the long run.

Unfortunately, as in any business, there will always be a few fly-by-night operators. But patients, clients, and TV set owners who recognize that you get only what you pay for, will never get gypped. "There just ARE no service bargains" . . . but there is GOOD SERVICE awaiting you at FAIR PRICES!

*Harry Nathan*  
PRESIDENT

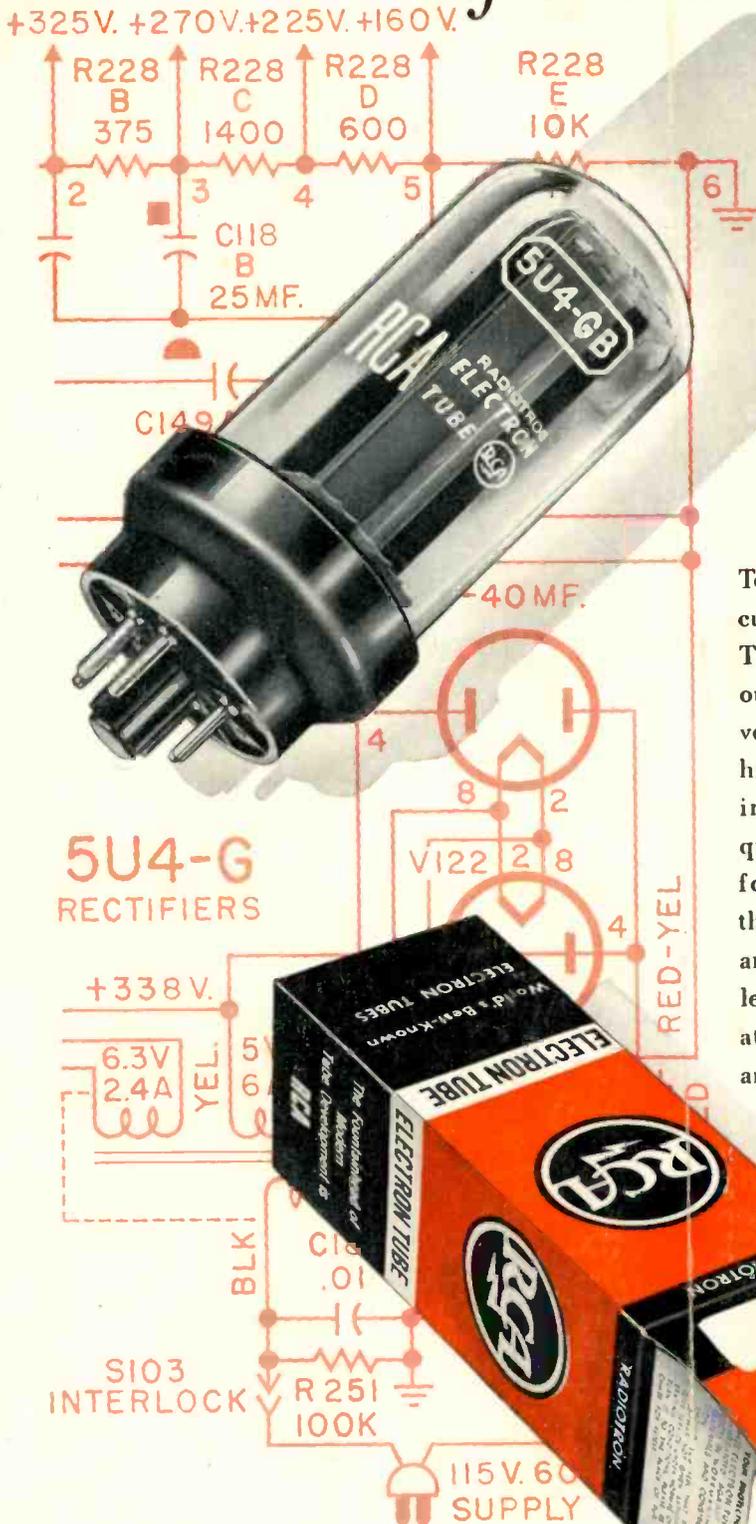
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North Adams, Mass.

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(Distributors' Div. of the Sprague Electric Co.)

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To meet the ever-increasing demand for higher currents in the low-voltage supplies of modern TV receivers, RCA is making available the new, outstanding 5U4-GB. This tube is a heavy-duty version of the top-quality RCA 5U4-G which is highly recommended for applications where the increased ratings of the 5U4-GB are not required. The 5U4-GB features more plate area for better heat conduction, increased plate thickness for more uniform heat dissipation—and new button stem construction to reduce leakage and electrolysis. Result—a reserve operating capability which assures you top performance in high-current TV power supplies.

*Here's another example of how  
RCA safeguards your servicing  
profits by "building-in" extra  
quality where you need it!*



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