

*Radio*

FEB 21 1949

# SERVICE DEALER



FEBRUARY, 1949

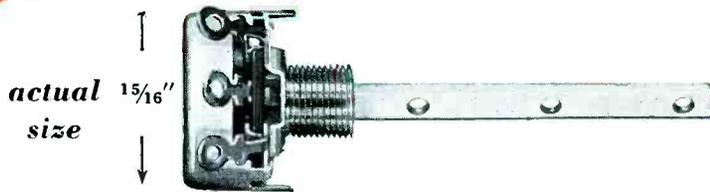
## TEST EQUIPMENT ISSUE

Cathode Ray Oscilloscopes  
Vacuum Tube Voltmeters  
Square Wave Generators  
Volt-Ohm-Milliameters  
Test Equipment Charts  
Income Tax—It's Easy

# AM-FM-TV-SOUND

*The Professional Radioman's Magazine*

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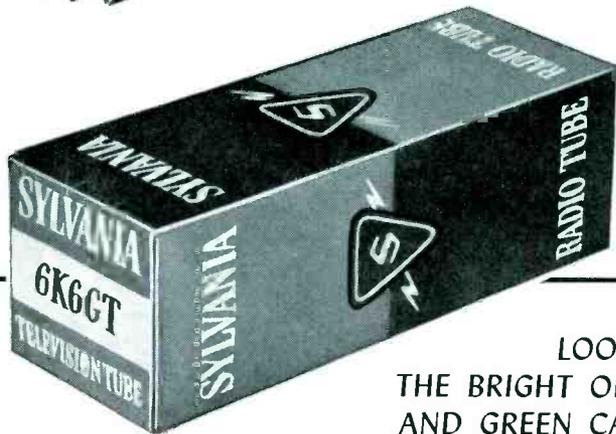


Each tube is identified by the special orange markings. This is your assurance of the higher quality demanded by television.

Now, when you replace worn-out receiving tubes in your customers' television sets, give them the finest in television reception with these new receiving tubes *specially processed* by Sylvania for the extra-tough requirements of television service.

These new Sylvania television tubes, in the new bright orange and green television cartons, actually undergo *three times more exacting tests* to insure they are unsurpassed! Their higher quality and superior performance more than justify their small additional cost.

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LOOK FOR  
THE BRIGHT ORANGE  
AND GREEN CARTON

Replace worn tubes with these specially processed Sylvania tubes made to pass television's rigid requirements.

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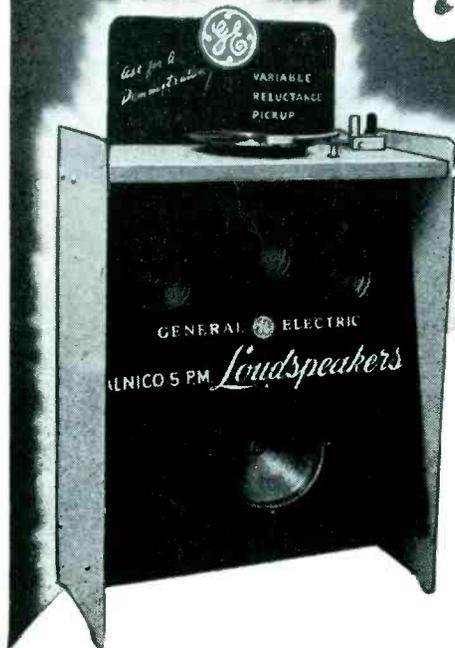
1B3GT	6J6	7F7
6AG5	6K6GT	7H7
6AL5	7B4	7N7
6BG6G	7B5	7Z4
	7C5	

# SYLVANIA ELECTRIC

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RADIO SERVICE DEALER ● FEBRUARY, 1949

# DEMONSTRATION ACROSS GENERAL ELECTRIC



**I**N city after city dealers and servicemen have witnessed amazing demonstrations proving the outstanding quality and superiority of G-E speakers. Many distributors have purchased these demonstration units to show dealers just what we mean when we say—General Electric Speakers are *quality* speakers.

If you have not seen these demonstrations—if you have not seen General Electric speakers operate under difficult conditions, be sure to contact your local distributor. There is a marvelous exhibition of speaker performance waiting for you.

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For complete information on General Electric speakers, write:  
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*You can put your confidence in—*

**GENERAL**  **ELECTRIC**

# THE NATION PROVED SPEAKER QUALITY!

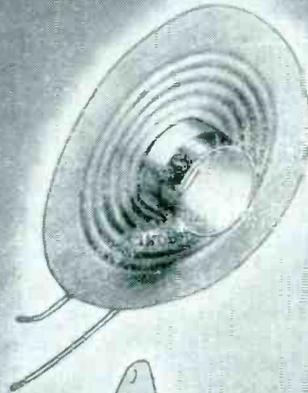
## THERE IS EVERY GOOD REASON TO STOCK G-E SPEAKERS

Every G-E speaker is performance-engineered at Electronics Park.

Every G-E speaker is equipped with the Aluminum Foil Base Voice Coil.

Every G-E speaker can handle plenty of power.

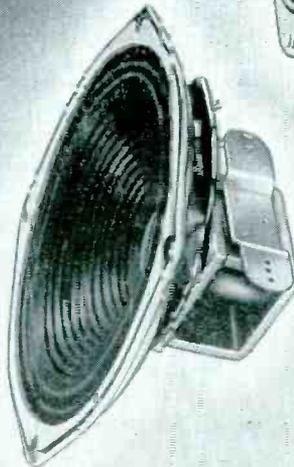
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The inside story of G-E speaker superiority—the Aluminum Foil Base Voice Coil.



4" and 5 1/2". For small set replacements, drive-in theaters, car radios, etc.



6" and 8". For larger set replacements, public address systems, car radios.



10" and 12". For public address systems, console radio replacement.

# EDITORIAL

## Test Equipment

This issue's text content is predominantly on test instruments required for servicing diverse types of AM, FM, TV and Sound equipment most efficiently and in a minimum of time. As outlined here last month, we found that too many radiomen have been using obsolete instruments, or have been reluctant to purchase needed new equipment simply because they did not know what to buy to meet present-day and future requirements in this fast-progressing business.

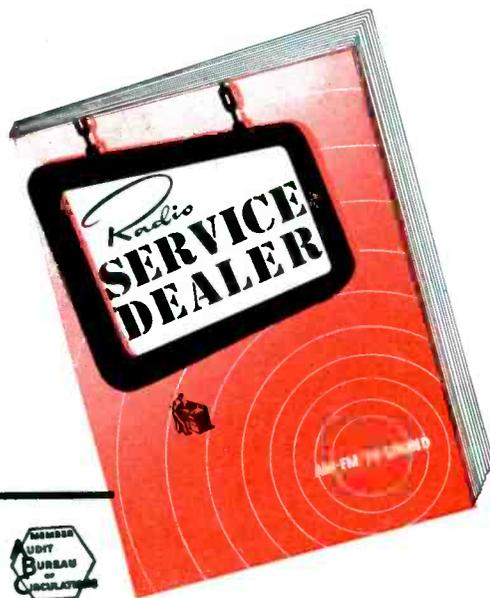
It was the original idea of our editorial staff to present the complete story about the "basic 11 instruments all servicemen should have" in this issue. However, after diligent research we found that there are 14 basic instruments needed by all well-equipped shops, and space limitations would not permit us to cover them all properly in a single issue.

Therefore, herein you will find for the first time in any radio trade publication catering to the radio servicing profession, complete and authentic data pertaining to 7 different types of instruments, to wit: CRO's; Markers; Electronic Analyzers; Square Wave Generators; TV Kilovolters; VOM's; and TV Sweep Generators. In our next issue we will cover: Tube Testers; TV Calibrators; Frequency Meters; Signal Generators; FM Sweep Generators; LC Checkers and Cross Hatch Generators.

For many years to come the contents of this and our next issue will have immeasurable reference value to all our readers. As buying guides in regards to test equipment nothing like this has been attempted by a publisher before. Then, having had all the facts about instruments placed before them, the industry's servicemen should immediately take stock of their own position and go about buying the equipments they need and should have. It pays to work with the right tools. An investment made in the proper kind of test equipment pays handsome dividends.

### Cleveland, We Apologize!

Last month our article titled "Field Findings" stated that the new East-West TV link opened on January 12th would benefit the industry because it would provide better TV programs to the West and stimulate set buying there. We inadvertently stated that the 1948 Baseball World Series games "played in Detroit" were not telecast to the East. That was an error—a *bad* error, for every radioman residing in Cleveland has, in no uncertain terms, called our attention to the fact that it was Cleveland and *not* Detroit that won the 1948 flag. All right—being a Dodger fan, a guy can make mistakes. Perhaps being a Dodger fan is the biggest mistake of all! Clevelanders, forgive me. Detroiters, perhaps the Dodgers will play your team this year. But, for now, let's forget the whole thing. *PLEASE!*



**Sanford R. Cowan**  
EDITOR & PUBLISHER

**Samuel L. Marshall**  
MANAGING EDITOR

**COWAN PUBLISHING Corp.**  
342 MADISON AVENUE  
NEW YORK 17, N. Y.

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National Advertising Sales Manager  
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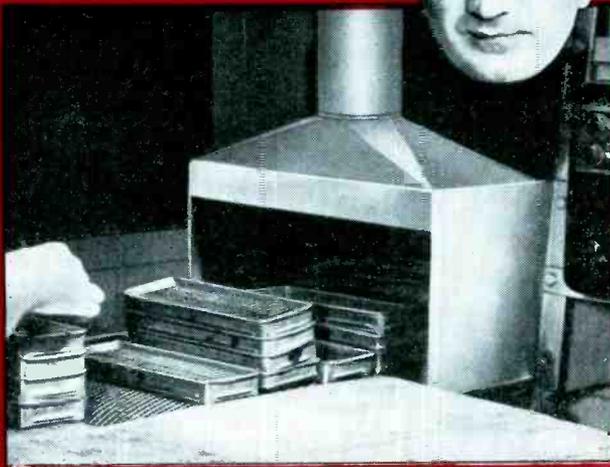
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# "KEN-RAD TUBES BRING REPEAT BUSINESS!"



HUGH WATSON, Foreman, Grid Section, where grids are shown below going into 700-degree (centigrade) G-E furnace to be de-gassed and de-oxidized. Every precaution is taken in making Ken-Rad tubes to assure top performance, long life.



Says C. F. PATTERSON, J & M Radio Service Shop, 838 North Rampart, New Orleans, La. Like thousands of reliable service men, Mr. Patterson insists on Ken-Rad tubes because he knows quality pays off.

"I started in business in 1933 and I've been using Ken-Rad tubes ever since!

"In all that time I've never had a complaint. Ken-Rad tubes perform. They last. No other tube I know does a better job for you or your customers.

"This is important, because you've got to satisfy customers if you're going to build repeat business.

"Ken-Rad tubes always satisfied my customers. And that satisfies me."

## "KEN-RAD TUBES ARE TESTED TUBES!"

"Ken-Rad tubes satisfy customers and build repeat business because they're tested tubes. Tops in quality, stamina, endurance.

"I know—because I've been supervising the making of Ken-Rad tubes for years.

"We make Ken-Rad tubes with the greatest of care. They're thoroughly tested for noise, microphonics, static, life, shorts, appearance, gas, air and hum.

"You can sell them with confidence. And you can rely on them to increase business, too!"

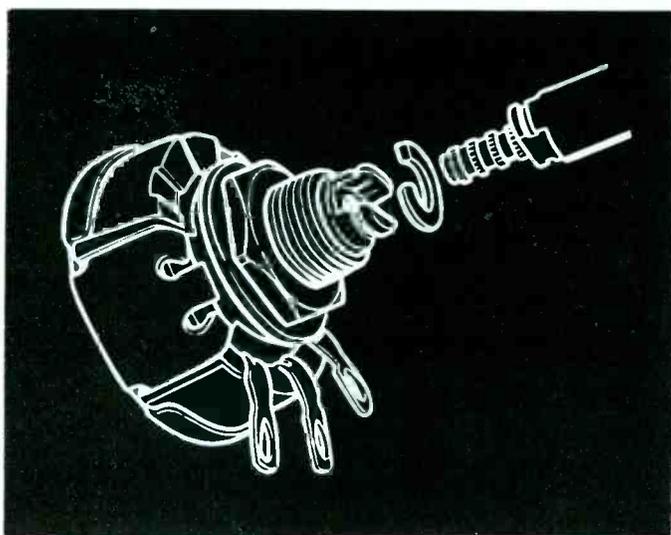
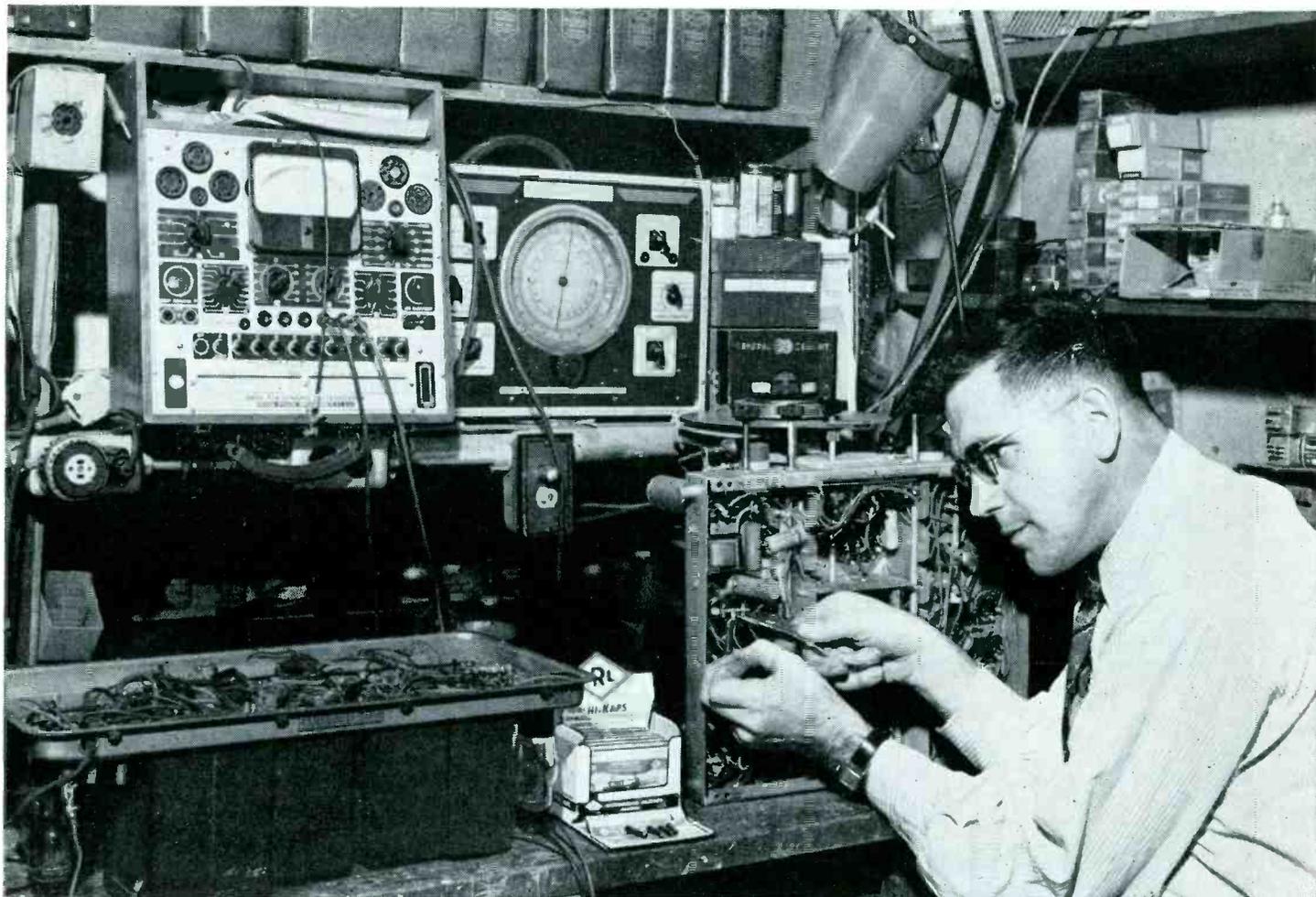


**The Serviceman's Tube**

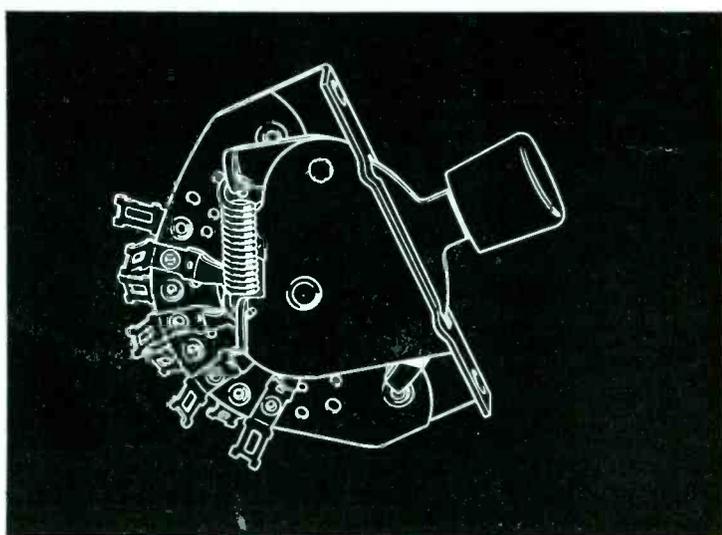
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**KEN-RAD** *Radio Tubes*  
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**Controls:** With CRL's improved *Adasraft* Radiohms you can carry a small stock of controls, yet be ready to handle almost any kind of control replacement problem. No wiggle, no wobble, no slip. Just insert shaft pilot in control stub shaft, and slip "C" washer into place. Available in all sizes for all model "M" volume control applications. Six types of shafts.

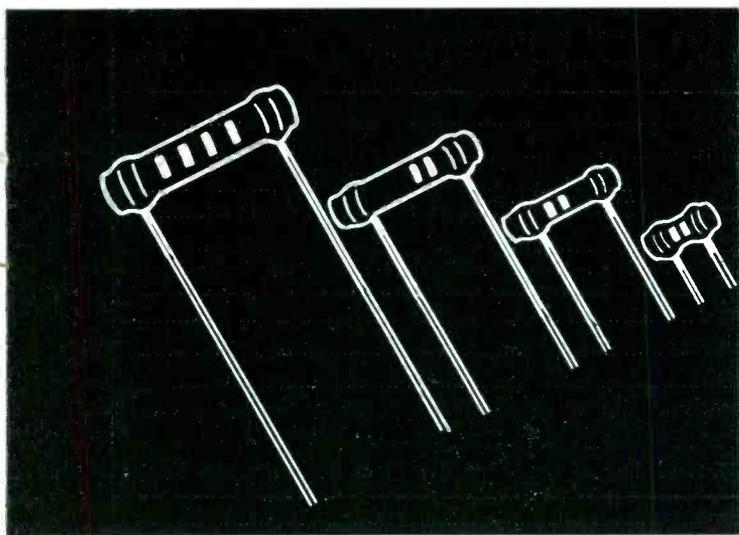


**Switches:** Centralab offers you a complete line of Tone, Rotary Selector, Lever Action and Medium Duty Power Switches, which features a wide variety in both laminated phenolic and steatite insulation. Available with shorting or non-shorting contacts. See your Centralab Distributor for further information, or write direct for new Catalog 26.

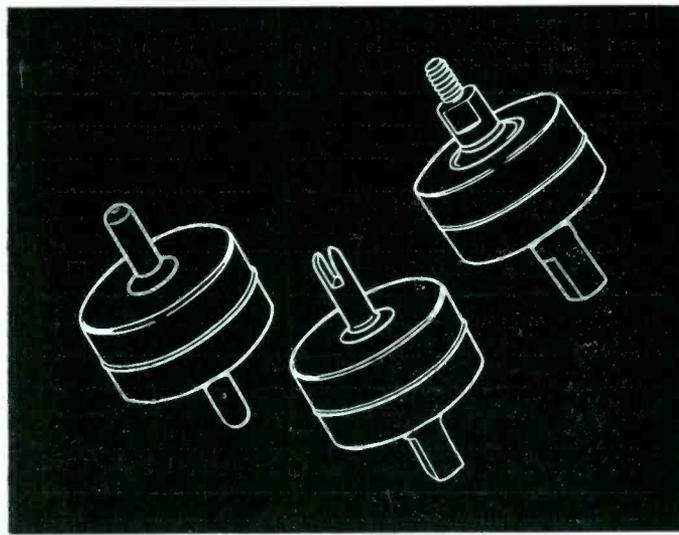
# Centralab packages!

*Yes — CRL containers bring you more than just replacement parts. They hold important extras that can help transform an ordinary repair shop into a really profitable service business. Consider performance. You'll find dependability that insures repeat orders. . . invites new customers. Consider repair time — and you'll see how easy-to-use CRL parts speed output by eliminating tricky bending or fitting operations. Consider handling — and prove to yourself how clearly-marked CRL parts provide quick, positive identification. Yes — consider all the advantages and you'll agree with successful servicemen everywhere that it pays to use quality Centralab parts. For the complete story on the CRL line, call your Centralab distributor.*

← —LaVerne C. Garman, owner of Garman Radio Service, West Allis, Wisconsin, says, "Centralab replacement parts help us turn out better work . . . quicker. And our experience proves this is the best combination for building customer goodwill."



**"Hi-Kaps":** CRL line of ceramic By-pass and Coupling Capacitors gives you ceramic dependability and permanence at a new low price! Packaged in a convenient envelope of five, *Hi-Kaps* are clean, easy to stock and handle. Wide range from .000050 to .010000 mfd. Rating — 600 WVDC. 1000 VDC. flash tested. Ask your Centralab Distributor for all the facts.



**"Hi-Vo-Kaps":** Just out! Centralab's new high voltage capacitors for television and high voltage applications. Made of Ceramic-X, *Hi-Vo-Kaps* combine high voltage and small size to give you convenient, dependable performance. 10,000 WVDC. flash tested. 20,000 VDC. Capacity — 500 mmf. See your CRL Distributor, or write direct.

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Radiart's superiority asserts itself once again! This Television and FM Antenna line has been enthusiastically received everywhere! One of the reasons for this remarkable preference is the 85 ATV HI-LO array. By means of its exclusive matching network . . . it assures minimum interaction between arrays thus offering results equal to two separate independent and costly installations! It features independent orientation with minimum interference from other arrays! RADIART SIMPLI-FLEX ANTENNAS GET THE PICTURE ALWAYS . . . even where others fail . . . for trouble free . . . speedy and less costly installations . . . order RADIART!



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MANUFACTURERS OF THE FAMOUS RED SEAL VIBRATORS

# TRADE FLASHES

A "press-time" digest of production, distribution & merchandising activities

## I.R.E. Convention

The 1949 Convention of The Institute of Radio Engineers, to be held from March 7 to 10 at the Hotel Commodore and Grand Central Palace in New York City, will feature a technical program including twenty-seven sessions on subjects embracing virtually the entire radio-electronic art, and six symposia, on nuclear science, network theory, electronic computers, radio aids to navigation, semiconductors, and marketing.

## RCA 45 RPM Records

An entirely new system for the reproduction of recorded music in the home resulting in a new type of phonograph and record were revealed recently by the RCA Victor Division of Radio Corporation of America.

The new phonograph and record operate at 45 revolutions per minute and provide excellent tone and a standard 7" record.

## Manson's Views on TV

Dr. Ray H. Manson, Stromberg-Carlson president, told the Rochester Engineering Society recently that only the limiting factors of picture-tube availability and the FCC freeze in issuing further television permits, pending a study of co-channel interference, had tempered the 1948 growth of television. Despite these governors, he said, television advanced more rapidly in the last 12 months than any other industry.

Dr. Manson pointed to the number of television receivers made and put in use since the close of World War II as an excellent index of video's expansion. In 1946 only 6,400 units were made. Last year there were 178,700, and it is estimated that this year's figures will reach 1,000,000. Nineteen forty-nine production will crowd two million.

Dr. Manson commented that the recent FCC freeze was a good thing for the industry. It checked the headlong rush of television expansion, permitting a thorough planning of telecasting and more time for perfecting receiver designs.



## October Hytron Winner

First prize in the October Hytron Servicemen's Contest was won by Charles A. Hurray, Jr., (right) of 529 Taylor Avenue, Avalon, Pittsburgh 2, Pennsylvania. One of Pittsburgh's most active radio servicemen, Mr. Hurray was delighted by his good fortune.

The presentation took place December 4, 1948 at the John Marshall Company of Pittsburgh . . . a leading Hytron jobber. On hand for the ceremony were Mr. Al Bauer, (center) manager of the John Marshall Company, and Mr. John P. Ludgate, (left) Hytron Representative, who awarded the prize. Mr. Hurray was presented with a Weston Model 769 High Frequency Electronic Analyzer.

## New Rider Publication

John F. Rider Publisher, Inc. inaugurates a new jobber house-organ the Profit Pyramid. The first issue has been forwarded to all jobbers, and will be issued regularly to jobbers and their personnel.

## Transvision Folder

In Folder No. P-1 Transvision gives detailed information about its complete line of Television Components. Plainly written and clearly illustrated with photographs and schematic diagrams, 19 television parts are analyzed according to: (a) function, (b) general use considerations, (c) rating, and (d) connections.

Copies of the Transvision "Television Components Folder No. P-1" can be obtained by writing: Transvision, Inc., 460 North Avenue, New Rochelle, N. Y.

## Clarostat Moves Plant

In order to increase its production facilities the Clarostat Mfg. Company is moving its manufacturing, warehousing and office facilities (presently divided among four locations in the New York area) to Dover, New Hampshire.

## Prexy Prognostication For 1949

Don G. Mitchell, Sylvania Elec. Prod. Inc.: "The latest estimated 1949 production is 2,000,000 sets . . . We are on the threshold of a multi-billion dollar business that soon will be among the largest of consumer markets . . . within a couple of years the replacement market will be greater than the entire output of viewing tubes in 1948 . . . Defense mobilization will pay a larger role in the radio and electronics market than it has since the war . . . it will be several months before commercial production of germanium triodes at competitive prices can be announced."

William Balderstan, Philco: "We expect to do a volume well over \$100,000,000 in TV alone in 1949 . . . the industry will produce and sell more than 2,000,000 sets . . . we expect to produce 600,000 sets . . . Many millions of people will not have TV service for a long time, so they will continue to depend on radios and radio-phonographs for a great deal of their entertainment."

Dr. W. R. G. Baker, G. E.: "Television receiver billings at the retail level will exceed \$650,000,000 in 1949. And industry forecasts still indicate a market for radio receivers of all types with a retail value of more than \$450,000,000 . . . Television sets are being made at the rate of 200,000 a year at General Electric's new Electronics Park plant here . . . The industry will sell between 1,600,000 and 2,000,000 television sets in 1949

[Continued on page 36]

# LOOK TO

# McMurdo SILVER

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Here — at prices you can afford — are five Laboratory Caliber Electronic Test Instruments that you need to insure efficient and profitable AM - FM - TV servicing.



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## MODEL 911 TV/FM SWEEP GENERATOR

2 thru 226 mc.; electronic sweep adjustable 0 to 10 mc.; high output adjustable 0 to 1/2 volt. Separate 1 mc. and 5 mc. precision crystal marker oscillators insure correct TV video i.f. curve shape and width; phasing control and 60 ~ sine-wave 'scope TV sweep voltage; 120 ~ saw-tooth FM 'scope sweep voltage. All this only \$78.50 net.

## MODEL 906 FM-AM SIGNAL GENERATOR

Choice of the big engineering laboratories plus thousands of service technicians, 906 stands out as maximum value 90 kc. thru 210 mc. in 8 ranges,  $\pm 1\%$  accuracy; less than 1/2 microvolt, including strays to over 1 volt metered output; multiple shielding; adjustable 0 to 100% amplitude modulation, adjustable 0 to 1,000 kc. FM sweep. Price only \$116.50 net.

## MODEL 905-A "SPARX"

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## 904 C/R BRIDGE

A condenser resistor tester of precision caliber 1/4 mfd./1000 mfd.; 1/4  $\Omega$ /1000 meg  $\Omega$ ; variable d.c. polarizing voltage leakage current; 0/50% power factor. Laboratory accuracy of  $\pm 3\%$ . Measures all condensers with 0/500 V. rated d.c. volts applied. Only \$49.90 Net

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The lowly a-c/d-c tubes must pack a heck of a lot of performance—at a price. Hytron tubes do. They offer the special advantage of being built to the strictest requirements of leaders in the small set field. GT or miniature—you, too, will find Hytron a-c/d-c tubes your best choice.



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# The CATHODE RAY Oscilloscope

by WALTER BUCHSBAUM

**A discussion of typical modern CRO's from a point of view  
of their applications and limitations in service work.**

UNTIL the popularity of FM and television receivers soared suddenly in 1947, oscilloscopes were rarely found on the average serviceman's bench. Until then the oscilloscope was regarded largely as a laboratory instrument and servicemen shied away from its use. But for aligning and troubleshooting TV and FM sets the cathode ray oscilloscope is almost as essential as the VTVM for any other kind of testing. Especially in television, where non-sinusoidal waves are used to deflect the electron beam, the 'scope, as it is usually called, is the only way of checking for linearity and proper operation of the sweep circuits. Since sweep frequency generators are now available to servicemen, the oscilloscope can be used together with them to allow the serviceman to observe the frequency response curve of the amplifier.

## New 'scope designs

Because of the wider use of 'scope by the service dealer, instrument manufacturers have designed new oscilloscopes, especially suited for television and FM service work. The main difference between these new instruments and those previously designed for laboratory use, is the easier operation and certain special features.

The photograph in *Fig. 1* shows a DuMont Model 164-E 'scope using a three inch diameter cathode ray tube. Only the most essential controls are available, and the adjustment and use of this unit permits very quick work. For accurate sawtooth wave analysis, a 'scope with greater frequency response of the input amplifier is required. In addition, timing and input amplitude control circuits of greater range are required for use in TV sets.

A special 'scope was designed by DuMont for TV sweep circuits which is the Type 224-A shown in *Fig. 2*. In addition to regular input terminals, this unit has a special high-frequency probe and, to give better control over

the input amplitude, an attenuator was added permitting attenuation up to 1:100 of the signal to be viewed. A special feature of this unit is the "Internal Modulation" terminal which permits checking the phase relations between synchronizing pulses and sawtooth waves. This instrument is



**Fig. 1—DuMont Model 164E**

much better suited for television work than the one in *Fig. 1*. For best alignment of r-f and i-f circuits, DuMont recommends their Type 208 B, shown in *Fig. 3*. Depending on whether a serviceman expects more alignment and installation or more trouble shooting work, a proper choice can be made of these or similar instruments.

## Function of 'scope

In the photograph of *Fig. 3* the controls necessary for adjustment of the 'scope are neatly divided into three groups. On top are the "Beam Controls", including focus and intensity, power switch and beam switch. The X and Y position controls are used to center the beam so that the observed signal is fully visible. Below the "Beam Controls" are the "Linear Time-Base Controls" which regulate the speed at which the electron beam is swept across the face of the tube.

At the left is a terminal for the injection of external synchronizing signals such as may be supplied by a sweep frequency generator in a visual alignment procedure. The Sync. Signal Selector can be set for either external or internal synchronizing action, or else the screen pattern can be synchronized to the 60 cycle a-c power line. Coarse and fine frequency adjustments are set to the frequency of the observed signal and the Sync. Signal Amplitude control adjusts the amount of synchronizing voltage necessary to hold the pattern steady. The terminal marked "Test Signal" is connected to the filament supply of the 'scope and furnishes a 6.3 volt (r.m.s.) sine wave which can be used for testing the operation of the 'scope or to calibrate it as shown in the next paragraph.

The lower section of the front panel of the DuMont Type 208 B oscilloscope contains the input terminals for the vertical and horizontal signal and means to control the amplitude of either. Ordinarily the signal to be observed is connected to the Y-axis, or vertical input terminals and the X-axis, or horizontal sweep is used only when a sweep frequency

generator is employed and supplies its own sweep voltage. The X-axis is also used when phase and frequency comparisons are made by means of Lissajous figures. Not all oscilloscopes have all the above mentioned controls, but the basic adjustments are always provided for. The Hickok Model 195 B shown in Fig. 4 has as an added feature a built in 120 cps sweep for use with a sweep frequency generator manufactured by the same firm.

Other oscilloscopes have special features like a modulation amplifier which makes it possible to put television images on the screen of the 'scope. Of first importance, however, is that the service man must be thoroughly familiar with the basic uses of the oscilloscope before he attempts the more difficult applications.

**Danger. High Voltage!**

The main use of the oscilloscope is to see the shape of a periodical elec-

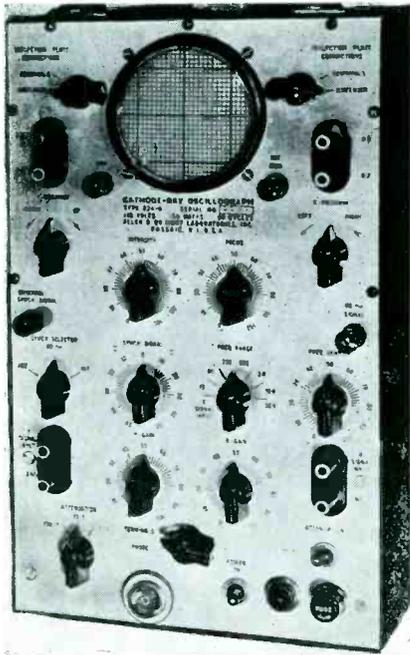


Fig. 2—DuMont Model 224-A  
trical change; in other words, voltage waves. Current waves themselves cannot be seen on the 'scope but, if the current flows through a linear resistance, voltage and current will be the same and the input of the oscilloscope connected across this resistance will result in a replica of the current wave appearing on the screen.

In order to observe the shape of a particular signal, the horizontal sweep of the 'scope must be synchronized with the signal under test. Only when it is completely synchronized will the observed wave shape appear to stand still. When the synchronizing voltage is too large, sync. control too far ad-



Fig. 3—DuMont Type 208-B

vanced, then the wave shape of the signal may be distorted.

An oscilloscope can be used as a VTVM reading true peak to peak voltages. First calibrate it by connecting the vertical input leads to a source of known voltage, as the "Test Signal" furnished by the 'scope, as in Fig. 1. This is 6.3 volts r.m.s., or about 18 volts peak to peak. Adjust the vertical size control until the amplitude of the test signal extends for 18 small squares on the raster over the screen. Now, when you want to measure the peak to peak voltage of an unknown signal, connect the vertical 'scope input leads to it and count the number of squares it covers vertically. That is the peak to peak voltage.

If the 'scope has a range switch allowing attenuation as in Fig. 2, voltages from 180 to 1.8 volts can be measured just by use of that switch. The greatest time saving function of

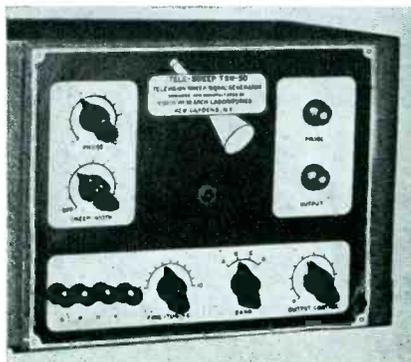


Fig. 5—Vision Telesweep TSW 50

the 'scope is its use in visual alignment of wide-band amplifiers. Here a signal generator whose frequency is varied over a wide range, enables us to see the actual frequency response curve on the screen of the 'scope. By observing the response curve the serviceman can make all alignments at once, without having to plot the curve graphically first. This is especially useful in the alignment of television i-f amplifiers and the adjustment of discriminator curves. A typical FM i-f response curve as obtained with the Vision Telesweep TSW 50 and the DuMont oscilloscope Model 208 B is shown in Fig. 5.

The use of the oscilloscope is not limited to FM and TV, but a large number of applications will be found in the PA and broadcast service field. In both these fields the main usefulness of the 'scope lies in the observation of an audio signal to check for distortion. Since the eye is more

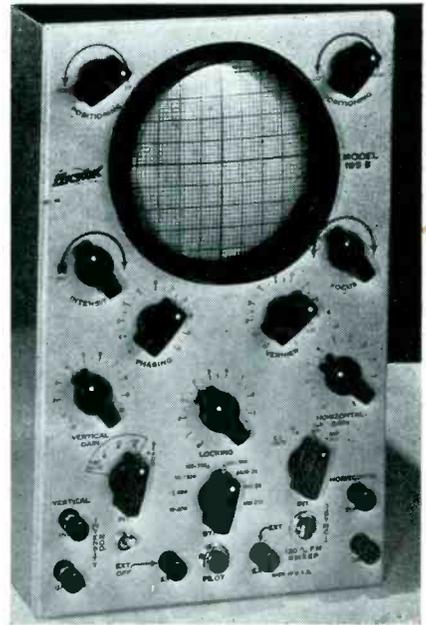


Fig. 4—Hickok Model 195-B

sensitive than the ear, even the slightest bit of distortion will show up on a good 'scope. When checking audio amplifiers for distortion, a regular AF signal generator is used. Any audio frequency may be applied and the 'scope synchronized to it. Don't forget to make sure the output of the generator is a good sinwave, before suspecting the amplifier.

The 'scope is especially valuable when measuring the maximum undistorted output power of a unit. The output of the signal generator is

[Continued on page 48]

# OSCILLOGRAPHS

Mfr.	Model	Tube Size (inches)	Input Impedances (meg-ohms)				Amplifier Response cps		Deflection Factor Rms. Volts/Inch Amp. Direct			Sweep Range (cycles)	Other Features	Wt. Lbs.	Size Inches
			Vert. Amp.	Hor. Amp.	Vert. Plates Direct	Hor. Plates Direct	Vert.	Hor.	V	H	V				
Du Mont	164 E	3	1-	.8-			5-100 K	5-100 K	.80	.65	30	30	20	11 1/2 x 7 3/8 x 14	
Du Mont	208 B	5	2-30	5-30			2-100 K	2-100 K	.01	.50	21	22	51	14 3/16 x 8 13/16 x 20 1/4	
Du Mont	224 A	3	2-30	2-30	10-20	10-20	10-2 M	10-100 K	0.1	0.7	25	28	50	14 3/4 x 8 3/8 x 15 1/8	
Du Mont	241	5	2-40	2-40	5-20	5-20	20-2 M	5-100 K	.70	.70	22	21	65	17 1/2 x 10 3/4 x 21	
Du Mont	274 A	5	1-40	1-40	4.7-50	4.7-60	20-200 K	20-200 K	.20	.25	16	18	35	14 x 8 3/8 x 19 3/8	
Eico	400	5	1-50	1-50	1-50	1-50	50-50 K	50-50 K	.65	.65			40	13 x 8 1/2 x 17	
Feller	TS-7	5	1-50	1-50	5-50	5-60	20-100 K	20-100 K	0.5	0.5	18	18	38	17 1/2 x 15 x 9 1/2	
G. E.	C.R.O.-3A														
Hickok	195-B	5	1-25	4-35	2.2-	2.2-	30-1 M	30-1 M	.03	.15	15	20	25	8 5/8 x 18 1/2 x 13	
Hickok	505-A	5	1-25	4-25	3-	3-	30-1 M	30-1 M	.03	0.2		15	35	14 x 11 1/2 x 9	
Philco	7019	2	.5-1						1		30			6 3/8 x 4 x 10	
Precision	ES-500	5	2-20	.5-20	3.3-	3.3-	10-1 M	10-500 K	.02	.5			36	8 1/4 x 14 1/2 x 18	
R. C. A.	WO-55A	3	.5-55		5.6-15		0-200 K	0-200 K	1.3	1.5	120	135	15	9 3/4 x 13 1/2 x 8 1/2	
R. C. A.	WO-58A	5	1-9.5		2-9.5		6-100 K	6-100 K	0.5				40	13 3/4 x 9 1/2 x 19 15/16	
Supreme	650	3					15-100 K						22	11 1/2 x 7 1/4 x 13 1/4	
Supreme	655	5					15-100 K						29	12 x 9 1/2 x 18	
Supreme	660	5	25	5-10	5-5		5-5 M	5-1.5	.1	.14	8.5	9	56	12 x 16 x 19	
Sylvania	131	3	1-30	1-50	.68-45	.68-60	10-100 K	10-100 K	.5	.5	17	17	18	10 3/8 x 7 3/4 x 13 3/8	
Sylvania	132	7	.5-26	.5-33	3.9-20	3.9-20	10-70 K	10-55 K	.21	.25	15	18	37	17 x 11 1/2 x 17 1/4	
Telmark	450-A	5	2-30	2-30	2-20	2-20	6-900 K	6-900 K	.15	.15	18	18	32	15 x 9 x 20	
Waterman	S-10-A	2	.5-10		.5-36		20-100 K		1	1	30	24	5 1/2	6 3/8 x 4 x 10	
Waterman	S-10-B	2	.5-36		3.3-36		20-150		1	1	30	30	5 1/2	6 3/8 x 4 x 10	
Waterman	S-11-A	3	.5-10		10-10		0-200 K		.1	.1	28	28	8 3/8	7 x 5 x 11	
Waterman	S-12-A	3	12.5-10		12-10		0-200 K		.05	.05	30	30	25 1/2	7 x 19 x 9	

# VACUUM TUBE

**T**HE electronic analyzer, or electronic volt-ohmmeter, has become almost indispensable in modern servicing, due to its versatility and fact that in certain operations, such as signal tracing, sensitivity measurements, and fidelity measurements, it is unexcelled. The electronic analyzer, of course, is a highly developed form of the vacuum tube voltmeter, but unlike its predecessor, it has all of the advantages and few, if any of the disadvantages of the original instrument.

## Principles of Operation

The operation of a vacuum tube voltmeter is based upon the change in plate current which occurs when the grid voltage of a tube is varied. This change is measured by a milliammeter in the plate circuit of the tube; this

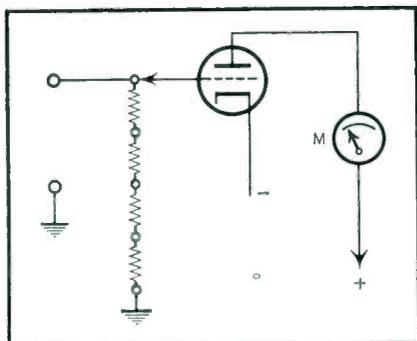


Fig. 1—Basic VTVM circuit.

milliammeter may be calibrated in terms of volts. Perhaps the most important feature of such a device is its high input impedance. A modern non-electronic analyzer, using a 200-microampere meter, offers a resistance of 5,000 ohms per volt, or, using a 10-volt range, a total resistance of 50,000 ohms. A 20,000 ohm per volt meter would have a total resistance of 200,000 ohms. Using the same meter in a vacuum tube voltmeter circuit, an input impedance as high as 10 megohms may be realized.

In spite of this tremendous advantage, the earlier vacuum tube voltmeter had several disadvantages. One of these was the fact that the normal, or no signal, plate current of the tube had to be taken into account. In the first types, this normal current was subtracted from the final reading

**A breakdown of the basic circuits employed in commercial instruments, simplifying its use in radio servicing.**

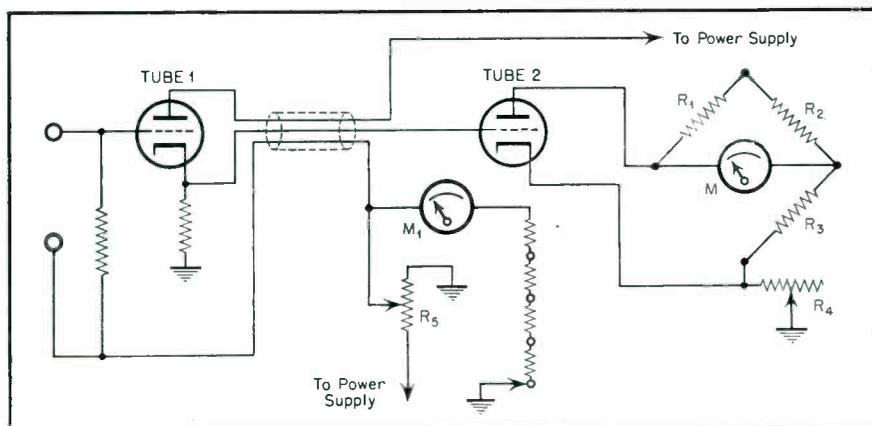


Fig. 2—Bridge-Type circuit employed in vacuum tube voltmeter.

of the meter in order to obtain the true value. Later on, several more or less satisfactory methods of cancelling the normal current were developed, and in the modern electronic analyzer we find some type of bridge circuit in use which includes a balancing potentiometer for bringing the meter reading to zero before making measurements. A second disadvantage of the early vacuum tube voltmeter was its susceptibility to changes in plate voltage which resulted from line voltage variations. Inaccuracies from such causes are prevented chiefly by the use of a voltage-regulated power supply.

Current models of electronic analyzers have a number of features which merit consideration. First of all, a very wide range of voltage and resistance measurements is possible. One model, for instance, is equipped with d-c voltage ranges of 3, 6, 12, 60, 300, 1200 and 6000; resistance ranges of 0-2000, —200,000, —2 megohms, —20 megohms, —200 megohms and —2000 megohms; and a-c voltage ranges corresponding to the d-c ranges listed.

It is fairly evident that if an electronic analyzer is to be useful in measuring r-f voltages (as, for instance, in signal tracing work) the ef-

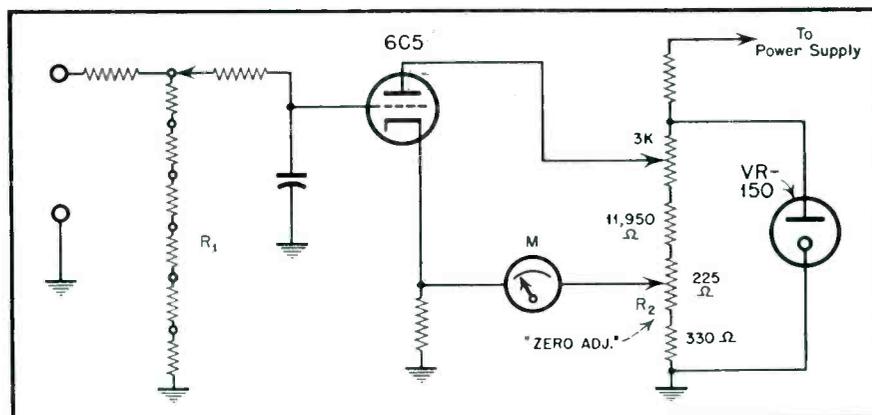


Fig. 3—Basic d-c voltage circuit used in Precision Model EV-10.

# VOLTMETERS

by WILLIAM R. WELLMAN

non-electronic instruments when desired.

It is not difficult to understand that because of its extreme sensitivity, the electronic volt-ohmmeter is admirably suited to the measurement of very high values of resistance, as for instance, in determining the leakage resistance of a condenser. While almost any electronic instrument may be used for this purpose, some types are especially designed and calibrated for the measurement of capacity of paper and mica condensers. Such calibration is based upon the fact that the insulation resistance of a condenser is inversely proportional to its capacitance in microfarads.

## Circuit Considerations

So much for a general discussion of the features found in currently available models. Suppose we now take up a more detailed consideration of circuits used.

In an electronic analyzer, as in any other electrical instrument used in radio work, the sensitivity of the meter is quite important. As might be expected, meter movements of high sensitivity are generally used. The sensitivity is usually between 100 and 400 microamperes for full scale deflection, depending upon the design of the instrument, with 200 microamperes about the average. Two hundred microamperes corresponds to an ohms-per-volt rating of 5,000 in a conventional instrument; but bear in mind that this sensitivity is further multiplied by the use of the vacuum tube circuit. To put it another way, an electronic analyzer using a 200-microampere movement affords far better sensitivity than is realized in a non-electronic instrument with a 50-microampere (20,000 ohms-per-volt) movement.

For the sake of continuity, the basic circuit of a vacuum tube voltmeter is shown in *Fig. 1*, although it is realized that this will be familiar to almost all servicemen. As previously mentioned, this circuit has the disadvantage that it registers not only the change in plate current due to the applied voltage, but the normal plate

[Continued on page 39]

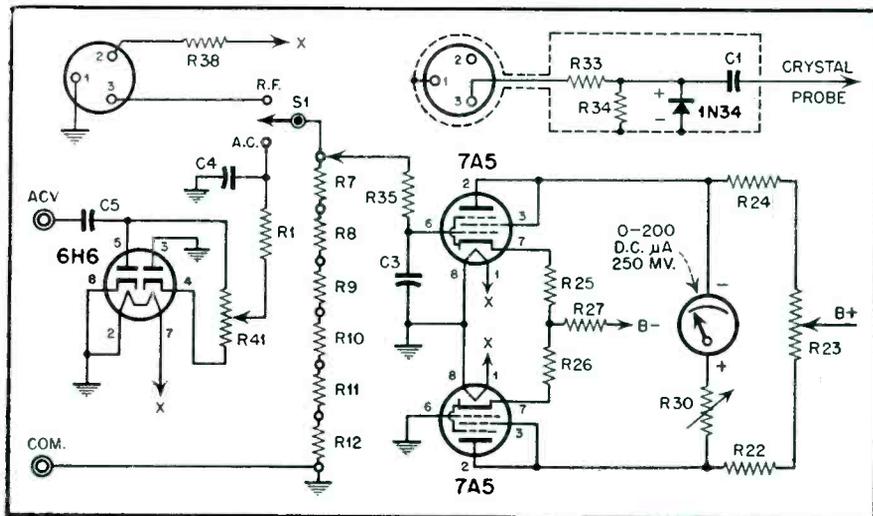


Fig. 4—Simplified a-c and r-f circuit used in Triplett Model 2451.

effects of capacitance must be eliminated, or at least kept to a minimum. For this reason, an ordinary pair of test leads cannot be used because the capacitance between leads would result in inaccurate readings. This is overcome by using a specially designed probe with a vacuum tube or a crystal located within the probe as close to the tip as possible. The length of leads between the probe and the analyzer is then relatively unimportant, for the leads then conduct only

d.c. It should be emphasized that such a tube or crystal probe is used in addition to the tube circuit in the analyzer proper; in other words, the r.f. is applied to the tube or crystal probe and the rectified output of the probe is applied to the input of the electronic analyzer circuit. With an arrangement of this kind, the analyzer becomes useful at frequencies as high as 400 megacycles. Some electronic analyzers are designed so that they may also be used as conventional,

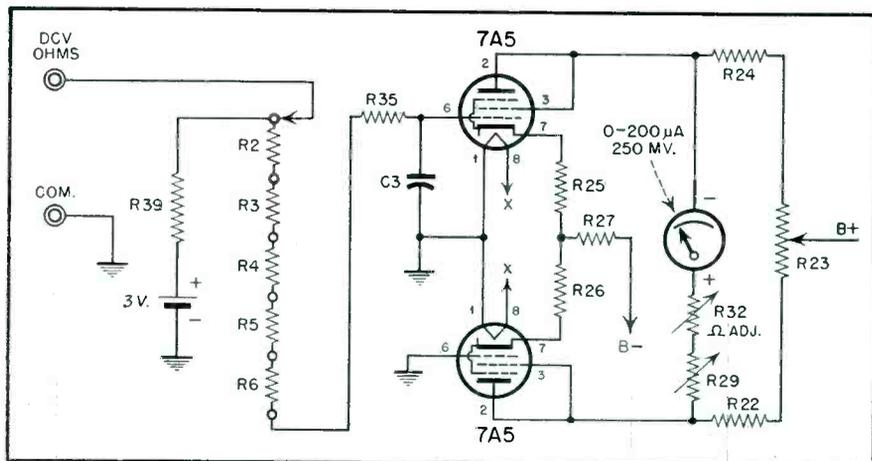


Fig. 5—Simplified ohmmeter circuit used in Triplett Model 2451.

# ELECTRONIC VOM

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Mfr.	Model	Input Res. Mes.	RANGES (full scale)						R. F. Probe	Input Cap. $\mu$ mf	Freq. Range (cycles)	Other Features	Wt. Lbs.	Size Inches
			D. C. Volts Lo-Hi		Ohms Lo-Hi		A. C. Volts Lo-Hi							
			No.	No.	No.	No.								
Elec. Inst. Co.	221-A	25	5-1000	5	1K-1000 M	5	5-1000	5	Yes					
	100	11	3-1000	6	1K-1000 M	6	10-1000	5	Yes	R-F Volt: 0-3-10-30-50	10½	9½ x 6 x 4¾		
Elec. Inst. Co.	210	26-2.5	5-5000	6	1K-1000 M	6	5-1000	6	Yes					
	400C	10					.001-300	12	No	20-2 M	-60 to +50 db	14	8 x 7½ x 9	
Hewlett Packard	404A	10					.003-300	11	No	2-50 K	-62 to +52 dbm	14	7½ x 10½ x 9	
	209	10	3-1200	6	.1-10000 M	8	3-1200	6	Yes	30-200 M	Cap. Test	13	14 x 16½ x 8	
McMurdo-Silver	900A		3-1200	6	2K-2000 M	6	3-1200	6	Yes	30-500 M	1.2 Ma-12 Amps.; -10+55 db	14	12½ x 7½ x 5½	
	EV-10	13.3	3-6000	8	2K-2000 M	6	3-6000	8	Yes	30-300 M	.6 Ma-12 Amps.; -26+70 db	19	10½ x 12 x 6	
Precision	451		2.5-1000	6	1K-1000 M	6	2.5-1000	6	Yes	30-700 M		20	10¾ x 9 x 8	
	456	16	6-6000	9	1K-1000 M	7	3-6000	10		10-500 M	1.5 Ma-30 Amps.; Cap. Test	41½	12½ x 16 x 14¾	
Radio City Products	665-A	16	6-6000	6	1K-1000 M	7	3-6000	7	No	10-.25 M	Cap. Test	17	13 x 9¼ x 6¾	
	668	16	6-6000	6	1K-1000 M	7	3-6000	7	No	10-.25 M	Cap. Test	11	9½ x 9¼ x 5½	
R.C.A.	WV-65A	11	3-1000	6	1K-1000 M	6	3-1000	6	Yes	30-100 M	3 Ma-10 Amps.	9	9½ x 6¼ x 5½	
	WV-75A	1.65	3-1000	6	1K-1000 M	6	3-1000	6	Yes	30-250 M		9	9½ x 6¾ x 6¾	
Simpson	WV-95A	11	5-1000	6	1K-1000 M	6	1-1000	7	Yes	30-250 M	10 Ma-10 Amps.; Cap. Test	15	10 x 13½ x 7½	
	195-A	10	5-1000	6	1K-1000 M	6	5-1000	6	No	30-100 K	-20+62 db	14	9½ x 6¾ x 6¾	
Supreme	226	50	1-5000	9	1K-1000 M	7	1-5000	9	Yes	30-130 M	1 Ma-10 Amps.	8	8½ x 9½ x 8	
	574	40 DC-10 AC	1-2500	6	1-1000 M	8	1-2500	6	Yes	60-100 M	R-F, db, Amp. Tests	16	5 x 9½ x 12	
Sylvania	134Z	16-2.7	3-1000	6	1K-1000 M	6	3-300	5	Yes	20-300 M	3 Ma-10 Amp.	12½	10½ x 7¼ x 6¼	
	2451	11	2.5-1000	6	1K-1000 M	6	2.5-1000	6	Yes	30-400 M	2.5 Ma-1 Amp.	13	10 x 10 x 5	
Weston	769	15	3-120	4	2K-2 M		3-120	4	No	50-300 M		13½	10 x 13 x 6¾	

# Fundamentals of SQUARE WAVE TESTING

by CHARLES CHILTON

**A**LTHOUGH no one test method may be considered as the best single analysis of the performance of an amplifier, it is probable that the square-wave test will give more information about an amplifier or a sound system than any other one test, and in much less time. This method consists of introducing a square wave at the input of the system to be measured, and observing the signal at the output on an oscilloscope. Besides giving a fair measure of frequency response, the square-wave test also indicates transient response and phase shift.

In order to understand why the square wave is so effective it is first necessary to understand the composition of the wave itself. A true square wave consists of the fundamental frequency combined with specific amounts of all the *odd* harmonics in a definite phase relationship. To produce a square wave on the screen of an oscilloscope, it is necessary that the odd harmonics up to at least the seventh must be transmitted without much attenuation, and the phase relations must be maintained. Thus, for example, an amplifier which

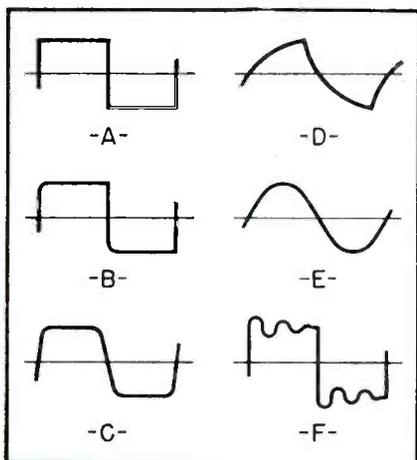


Fig. 1—Response curves obtained with h-f signal applied to input.

**Square wave testing is rapidly becoming more popular as a means of tracing distortion in amplifiers. This article tells how this form of analysis may be used advantageously.**

passes a 2,000-cps square wave perfectly may be considered as having good response up to 14,000 cps. Conversely, if the output of an amplifier under test is approximately a true sine wave when the 2,000-cps square wave is applied, it may be considered that there is practically no transmission at, or above, the frequency corresponding to the third harmonic of 2,000 cps, or 6,000 cps.

Any change in the response of an amplifier is accompanied by a phase shift which alters the shape of the output signal, and the changes are sufficiently reproducible to enable various conclusions about performance to be determined with accuracy.

demands that the transient character-

istics of an amplifier—or any component of an entire system—be such that no spurious frequencies are generated when sharp changes occur in the input signal voltage. The transient characteristic of an amplifier may be expressed in terms of its ability to transmit both high and low frequencies. When the square wave is applied to an amplifier the signal voltage rises abruptly to a maximum, remains at that maximum for one-half cycle, reverses in polarity in an extremely short time, and remains at the maximum value but at the opposite polarity for the next half cycle. The square wave, therefore, has two transients per cycle, with the instantaneous voltage shifting from maximum positive to maximum negative, and vice versa. If the output signal is identical with the input, the amplifier may be said to have good transient response, and to be "well damped."

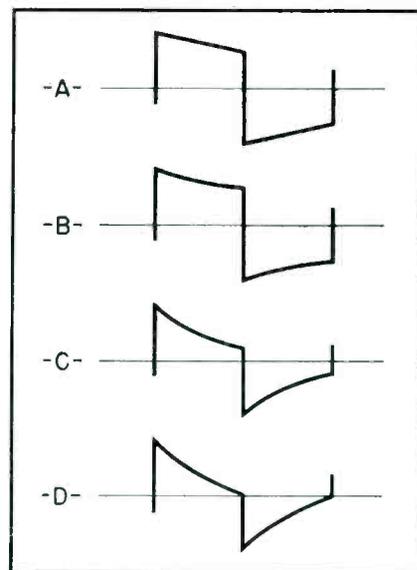


Fig. 2—Response curves obtained with l-f signal applied to input.

## Practical Uses

To be of value to the service technician, square-wave testing must be reduced to a delineation of the effects of various amplifier idiosyncrasies upon the square-wave passing through it. While these effects may be determined and analyzed mathematically, it is not practical for shop use. It is much simpler to consult a chart of typical waveforms which indicate the conditions existing in the equipment being tested. Figures 1 and 2 show a number of examples which may be expected from amplifiers having different characteristics. (A) is the input signal as viewed on the 'scope, and it goes without saying that the 'scope itself must be capable of reproducing the wave without distortion. All the

[Continued on page 46]

# TEST EQUIPMENT SYMPOSIUM

These charts and articles have been prepared according to the true definition of the word, *symposium*—"a collection of comments or opinions—brought together by different writers—on the same subject." The writers are authorities in their fields, and the charts have been prepared from the most recent technical specifications made available by the manufacturers. Where blank spaces occur such infor-

mation was not forthcoming from the manufacturer; or no information is obviously required.

The specifications breakdown is presented in the forms shown in order to make available the most useful information on these instruments, and to serve as a basis of comparison between apparatus of the same type.

Because of the large number of items received it has been found necessary to carry over this symposium into

the next issue and possibly the one after.

Reference to these tables and articles should clarify the basic principles and applications underlying all types of test equipment currently used or needed in servicing AM, FM, TV, and sound. We shall earnestly endeavor to continue this policy of clarification especially in view of the "state of flux" TV finds itself in at the present moment. —S.L.M.

## SQUARE WAVE GENERATORS

Copyright 1949 Cowan Publishing Corp.

Mfr.	Model	Freq. Range Cycles	Output Volts	Other Features	Wt. Lbs.	Size Inches
Measurements Corp.	71	5-100 K	0-75	<ul style="list-style-type: none"> <li>• R-F modulator</li> <li>• Multi-vibrator osc. for synch. frequency calibration, etc.</li> <li>• Video amp. test</li> </ul>	15	7 x 15 x 7½
Reiner	530	10-100 K	0-20	Facilities for locking frequency of oscillator with external standard	18	8 x 9 x 15

## MARKER GENERATORS

Mfr.	Model	Freq. Range Megacycles	Type of Osc.	Coil or Crystal Tuning	Output Volts	Other Features	Wt. Lbs.	Size Inches
Kay Electronics	Mega-Marker	2 Ranges 19-29 29-39	Osc. (pip)	Both	5 MV.	High accuracy	5	7 x 10 x 6
	Mega-Marker Sr.	Carrier Frequencies Channels 2-13	Osc. (pip)	Crystal	4 MV.	Facilities for aural alignment	15	8 x 16 x 8
	Mega-Pipper	Any 4 video i-f frequencies	Osc. (pip)	2 crystals 2 coils	1 V.	Automatically makes visible video and sound carriers, and adjacent channel sound carriers		8 x 16 x 8
Vision Research	TM 100	9.5-28	Absorption	 Coil		Special 10.7 MC point provided for FM receivers		

# TV-FM SWEEP GENERATORS

(See "Sweep Generators" by John F. Rider, RSD, Nov. 1948)

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Mfg.	Model No.	R-F OUTPUT			SWEEP			INTERNAL MARKER			Facilities for Marker Crystal on Panel	Other Comments or Features	Wt. Lbs.	Size Inches
		Mc	Modulation	Volts	Range Mc	Type	Types	Range Mc	Modulation	dip or pip				
Approved	A-300	2-227	FM CW	.5	.5-10	Elec.	None	—	—	None	No band-switching required.	20	8 x 10 x 12	
Coastwise Electronics (Ferret)	720	0-260	FM CW AM		.05-20	Electronic	Variable Crys. Osc.	19-40 Crys. Freq.	CW-AM CW-AM	both	The R-F OUTPUT contains facilities for optional AM, FM modulation, or CW.	14	10 1/4 x 10 1/4 x 5 1/2	
Heathkit	C-3	2-227	CW-FM		0-10	Elec.	None	—	—	None	No band-switching required.	6	8 x 10 x 12	
Hickok Elect. Inst.	610A	10-250	FM CW	.75	0-15	Mech.	Variable Crystal	20-40 Crys. Freq.	CW-AM CW-AM	both	Crystal controlled frequency available 5-216 mc.	30	14 x 16 1/2 x 8	
Kay Elec. Megasweep	11	0.05-500	CW FM	.1	.03-30	Elec.	None	—	—	None	Output measured by high precision wavemeter. Klystrons employed at 10,000 mc. No retrace.			
McMurdo Silver	911	2-230	CW FM		0-10	Elec.	Crystals	1 and 5	CW	pip	No band-switching required.			
Philco	7008	3.2-260	AM FM CW		0-15		Variable	3.2-250	CW AM		Contains complete CRO. Separate r-f probe. Crystal calibrator.		16 x 16 x 6 1/2	
Radio City Products	Tee Yee 90	4.5-40	CW FM		.05-6		None	—	—	External Socket	Contains complete CRO. Uses travelling detector type probe.	25	14 x 18 x 12 1/2	
RCA	WR 59A	0-10 5-15 20-30 25-90 10-11.5 20.25- 22.25 Chan. 1-13	FM CW	.1	0-10	Mechanical	None	—	—	None	Pre-set sweeps for each channel or desired r-f output. No tuning. Choice of balanced or single-ended output.	20	10 x 13 1/2 x 7 1/2	
Precision	E-400	2-240	FM CW		0-1 0-10	Elec.	None	—	—	External Socket	External deviation terminals. External modulation term. for r.f.	16	8 x 8 x 14	
Transvision	SG	0-227	FM CW		0-12	Mech.	Variable Crys. Osc.	20-30 Crys. Freq.	CW CW	pip	No band-switching required.	20	8 x 10 x 12	
U. S. Television	TVFM	.05-220	FM CW	.1	0-12	Elec.	Crystals	1 and 10	CW	pip	Marker frequencies are crystal controlled (internal).	16	8 x 8 x 14	
Vision	TSW 50	5-216		.1	.5-10	Mech.	None	—	—	External Terminal	Contains r-f probe.			

# MULTIMETERS

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Mfr.	Model	Sensitivity ohms/volt	D-C RANGES						A-C RANGES						Other Features, Comments	Wt. Lbs.	Size Inches	
			Volts		Milliamps.		Ohms		Volt		Milliamps.		Output					Db.
			Lo-Hi	No.	Lo-Hi	No.	Low	High	Lo-Hi	No.	Lo-Hi	No.	Lo-Hi	No.				
Bradshaw	10	1000 AC & DC	1-1000	5	1-1000	4	10 K	20 M	5	1-1000	5	150-15 K	3				5	5 1/4 x 6 3/4 x 2 1/2
	30	1000 AC & DC	5-1000	6	1-100	2	10 K	1 M	3	12.5-1250	5						5	5 1/4 x 6 3/4 x 2 1/4
	312	Low	25-250	4	50	1		100 K	1	3-300	4	50	1					1 7/8 x 2 3/4 x 3 3/8
	371	Low	3-300	4	25	1	10 K		1									1 7/8 x 2 1/4 x 3 3/8
	421	1000 AC & DC	7.5-1500	5	7.5-75	2	5 K	500 K	2	7.5-1500	5							5 1/16 x 3 9/16 x 3
	431	2000 DC-1000 AC	30-1500	3	150	1	3 K	300 K	2	15-150	2							5 5/16 x 2 15/16 x 2 1/2
	432	10,000 DC	3-600	4			2 K	2 M	4									5 7/16 x 3 9/16 x 3
	450	1000 DC	5-1000	5	1	1	30	3000	3	10-1000	5							3 3/16 x 2 7/8 x 2
	451A	1000 AC & DC	10-1000	5			500 K		1									3 3/16 x 2 7/8 x 2
	452	10,000 AC & DC	10-1000	5			2 K	2 M	4									3 3/16 x 2 7/8 x 2
Elec. Inst.	458	1000 DC	5-2000	6	1-100	3	1 K	2 M	3	12.5-1250	5	2.5-100	3					10 1/2 x 6 3/4 x 5 1/2
	511	1000 DC	5-2500	5	1-10 K	4	500	1 M	3	10-1000	4							8 1/4 x 6 x 4 1/4
Hickok	435	20,000 AC & DC	2.5-5000	6	.05-10 K	7	10	10 M	6	2.5-5000	6							9 1/2 x 6 1/4 x 3
	900	(Electrodyn.)								130-260	2	260-26 K	5					6 1/2
Precision (available in bakelite portable and panel mounting)	40	1000 AC & DC	3-6000	6	4-600	4	5000	5 M	3	3-6000	4							3 3/4 x 6 1/4 x 2 1/2
	80	1000 AC & DC	6-6000	6	.6-12 K	6	1000	10 M	4	6-6000	6							5 1/2 x 7 1/8 x 3
	85	20,000 DC-1000 AC	3-6000	6	.12-12 K	6	6000	60 M	4	3-6000	6							5 1/2 x 7 1/8 x 3
	847	1 K, 5 K-DC; 1 K-AC	3-6000	8	3-12 K	8	2000	20 M	5	3-6000	8							7 1/2 x 8 1/2 x 3
	858	1 K, 20 K-DC; 1 K-AC	3-6000	8	.06-12 K	8	6000	60 M	5	3-6000	8							9 x 10 x 4 1/2
	333-334	1000 AC & DC	.002-500	7	.02-500	7					5-500	6						
Radio City Products	447	1000 AC & DC	5-2500	5	1-10 K	5	500	1 M	3	10-1000	4							5 3/8 x 8 5/8 x 3 3/8
	449	5000 DC-1000 AC	5-1000	4	.5-1 K	4	2000	2 M	4	5-1000	4							6 x 3 x 2 1/4
	462	20,000 DC-5000 AC	2.5-5000	6	.1-500	4	200	20 M	3	2.5-5000	6							4 1/4 x 8 1/2 x 10 1/8
	488A	20,000 DC-1000 AC	3-6000	7	.06-12 K	7	3000	30 M	3	3-6000	7							11 5/8 x 9 3/4 x 6 1/8



## KILOVOLTERS

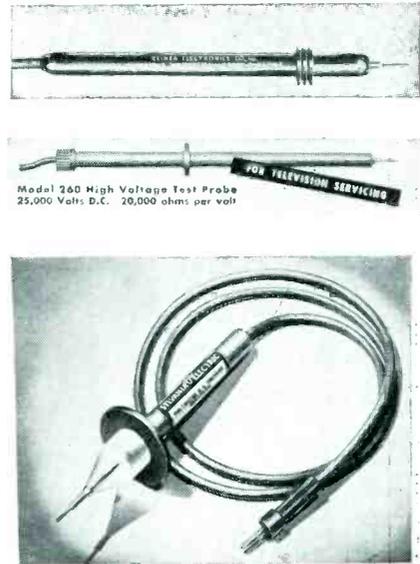
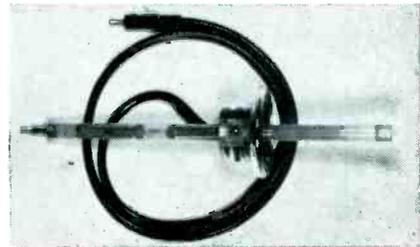
(100 $\mu$ A Sensitivities or Better)

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Mfr.	Model	Sens.-Ohms/Volt	Range (D.C.)	Other Features	Wt., Lbs.	Size, Inches
Beta Electronics	101	50 K	0-15 KV	10" Polystyrene Probe	9	11 x 5 x 7
	102	50 K	0-30 KV	Same as above	9	11 x 5 x 7
	103	50 K	0-50 KV	Same as above	9	11 x 5 x 7
	121	50 K low-25 K high	0-15 KV-30 KV	Same as above		11 x 5 x 7
	122	50 K low-25 K high	0-25 KV-50 KV	Same as above		13 x 6 x 9
Bradshaw	4000	50 K low-25 K high	0-25 KV-50 KV	Poly Probe-Rev. Switch		12 x 13 x 8 $\frac{1}{2}$
Elec. Designs	Kilovoltyst	50 K	0-10 KV-30 KV	Lower range d-c, r-f, a-c, ohms tests		12 x 6 x 9
Hickok	465	10 K	0-10-30	Portable bakelite case	5 $\frac{1}{2}$	6 $\frac{1}{8}$ x 7 $\frac{1}{8}$ x 4 $\frac{3}{4}$

## HIGH VOLTAGE PROBES

(See "HIGH VOLTAGE PROBES" by L. S. RICH, RSD October 1948)

Mfr.	Model	Voltage	Megohms	Ohms/Volt of Instrument Used With	Illustration
Richard Mattison	Hi-Volter	Multiply meter reading by 10	90	10 M VTVM	
Precision	TV 1	30 KV		VTVM	
	TV 2	30 KV	480	20,000 At 6000 V Terminals	
Reiner Electronics (Recommends connecting probe to low voltage terminals of instrument)	950-5 M	5 KV	25	5,000	
	950-20 M	5 KV	100	20,000	
	9100-5 M	10 KV	50	5,000	
	9100-20 M	10 KV	200	20,000	
	9120-5 M	12 KV	60	5,000	
	9120-20 M	12 KV	240	20,000	
	9150-5 M	15 KV	75	5,000	
	9150-20 M	15 KV	300	20,000	
	9250-20 M	25 KV	500	20,000	
Simpson (For use on their models 260 and 221 multimeters)	HV 260	25 KV	480	20,000 at 1000 V Terminals	
	HV 221	30 KV		20,000 at 300 V Terminals	
	HV 221	30 KV	594	20,000 at 300 V Terminals	
Sylvania (For use with (Polymeter))		10 KV		Multiplies range of Polymeter by 10	
Triplett					

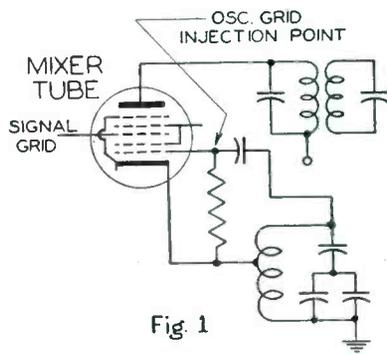
# Test Pointers

## ON SIGNAL INJECTION

Signal-injection is probably the fastest known method of locating the point of signal-disappearance in defective radio receivers. Signal injection is also an economical approach because only a test oscillator is required and such an oscillator should be a part of every technician's equipment for precise alignment work.

Here's how to trouble-shoot a dead AM receiver by signal injection:

1. Make sure that the filter input resistance is over 2000 ohms. Repair filter, if necessary.
2. Turn power on, and check filter output voltage.
3. Inspect all tubes to see that heaters are operating.
4. Adjust test oscillator for maximum audio output. Connect ground clip of af cable to the receiver chassis, and touch probe of af cable to plate terminal of the output tube. (Use a series capacitor in all tests, unless the probes or generator contain blocking capacitors.) A low audio tone will be heard from the speaker if the output transformer and speaker are operative.
5. Reduce generator output and proceed progressively toward front end of set; touch probe to grid of output tube, to plate of audio tube, to grid of audio tube, and finally to diode load resistor. If sound from speaker ceases at some point, use an electronic volt-ohmmeter to locate the faulty component.
6. Adjust test oscillator for modulated output at the intermediate frequency of the receiver. Touch probe in turn to the detector diode, next to the plate terminal of the last if tube, then to the grid terminal, and proceed progressively to the mixer signal grid. The generator output must be progressively reduced; this reduction serves as a rough indication of stage gain. If signal disappears at one of the check points, use the volt-ohmmeter to "close in" on the defective component.
7. Re-adjust test oscillator to some frequency near the high end of the broadcast band, and tune receiver to this frequency. Touch probe to mixer signal grid. If signal comes through, the trouble is in the rf section. If the test signal does not come through, the trouble is in the oscillator.
8. Check for presence of oscillator bias with an electronic voltmeter. A substitution check of oscillator performance can also be made: turn modulation off and tune test oscillator to a frequency which is the sum of the intermediate frequency and the frequency of a strong local broadcast station. (Every service shop should be equipped with a good outside antenna.) The test oscillator output is substituted for the local oscillator output as shown in Fig. 1.



9. If set is still dead, and oscillator is ok, turn on modulation and tune both test oscillator and receiver to the same rf frequency. Touch probe to plate of rf tube, and work back progressively to the antenna.

These signal-injection tests usually require less than five minutes to complete. As the technician gains experience, he will find many short cuts which are beyond the scope of this article. To summarize, signal-injection techniques are speedy and versatile, and no specialized test equipment is required other than the test oscillator which is also needed for receiver alignment.



# For speedy servicing...

## the RCA WR-67A Test Oscillator

• A better job at a modest price . . . with more features than you'll find in most signal generators . . . that's the RCA WR-67A . . . an instrument specifically designed to cut servicing time on AM sets, where speed counts the most.

Signal injection and alignment work are rapidly and accurately accomplished with the WR-67A. The range switch gives you the quick selection of three fixed frequencies of 1500, 600, and 455 kc . . . or smoothly variable fundamental frequencies from 100 kc to 30 Mc.

Other outstanding features include: a temperature-compensated oscillator . . . special signal injection probe . . . both step and vernier attenuators . . . double shielding . . . miniature tubes throughout . . . six-band drum dial with easy-to-read, four-foot scale spread . . . adjustable modulation level for internal and external modulation . . . power-line filter to minimize rf leakage . . . and 400-cycle signal source.

RCA WR-67A Test Oscillator combines speed, accuracy, convenience, and over-all dependability. Professional in appearance and professional in performance, it is one of eight *matched test units* engineered for modern AM, FM, and TV servicing. Get further details on the WR-67A from your RCA Test Equipment Distributor —or write RCA, Commercial Engineering, Section 55 BX, Harrison, N. J.

### SPECIFICATIONS OF WR-67A

Frequency Range	100 kc. to 30 Mc.
R-F Output	.5 $\mu$ V to 1 volt RMS (Output impedance varies from 10 to 1000 ohms as attenuator is varied from 1 to 4).
Modulation Frequency (internal)	400 cycles (approx.)
A-F Output	.25 RMS volts across 100,000 ohms at no load.
A-F Input	.2 RMS volts required for 30% modulation.
Power Supply	105-125 volts, 50-60 cycles, 30 watts.
Dimensions	w. 13 $\frac{1}{2}$ " ; h. 10" ; d. 7 $\frac{1}{2}$ "
Weight	15 lbs.

Always keep in touch with your RCA Distributor



**RADIO CORPORATION of AMERICA**  
TEST AND MEASURING EQUIPMENT  
HARRISON, N. J.

# INCOME TAX

## *It's Easy!*

by **BETTY LEE GOUGH**

**J**OE Jones is married, has three children, and is the owner of a small appliance store in the South. Last year, his firm did pretty well for a small outfit. In addition, he made money on the side in stocks and bonds and from other sources. For a concrete example in good income tax practices, let's look at the way Mr. Jones made out his income tax return. It shows how to handle almost any situation.

His total income was high, so Jones used the long form. From his company, Jones made \$7200.00. In addition, he delivered an address to a civic club in another city. For this, he received \$100.00. It cost him \$46.00 in hotel bill, railroad fare, etc. to get to the town, leaving him \$54.00 for his speech-making activity. Thus his direct business income was \$7254. This sum was entered on line two of the long form.

From stock in a dredging company, Jones received \$1500.00 dividends. His savings account at the bank paid \$50.00 interest during the year. On \$3000 worth of U.S. government bonds, he took in \$200.00 interest. So on line three, Jones entered the figure \$1750.00 for dividends and interest he had received.

He also owns a brick duplex. From it, Jones received \$1500.00 rent. But it cost him money to keep the rented apartments in shape. The painter put in a bill for \$50.00. The taxes came to \$120. Interest on the mortgage was \$400.00. Jones figured that the house depreciated in value another \$400.00. All of this was entered in Schedule B on page two of the long form. The depreciation was explained in Schedule F, taxes and the interest that Jones paid on his mortgage in Schedule G.

Mr. Jones also received \$5000.00 in royalties from an oil company,

**In this final installment on the best methods of filing income tax returns a practical illustration is given.**



"I think the repair man found out what the loud buzzing was in the radio"

representing lease remuneration from a patch of land on which oil had been discovered. (From this figure a certain amount of depletion can be deducted, in the same way as depreciation on fixtures. Jones took the optional flat figure of 27½% allowed by the Treasury Department. It amounted to \$1375.00.) The royalty figures were entered in Schedule B.

During the year, Jones had sold some corporation stock. He had bought it for \$4500.00, and got \$4750.00 for it. He incurred a broker's expense of \$50.00 in doing this.

He also sold the home in which he and his family lived for a \$2000.00 profit. (But since he had held the house for seven years, it was neces-

[Continued on page 43]

*Cash in - on the*  
**PHILCO**  
LP RECORD PLAYER



**TREMENDOUS NEW PROFIT OPPORTUNITY  
FOR RADIO SERVICEMEN**

Here's a brand new avenue to big profits for radio servicemen everywhere! Yes, every service customer is a prospect for the revolutionary new Philco M-15 record player that equips any radio or phonograph, old or new, to play the amazing 45 minute non-breakable Vinylite records.

Now... start at once making these big, extra profits on service calls...

1. Profits on sales of the Philco M-15.
2. Profits on installing jacks in customers' radios and phonographs. A simple, easily installed jack is all they need to plug in and play the Philco M-15.

Get the facts about this red hot, nationally advertised Philco product. Millions want it! See your Philco Distributor today!

# NEW PRODUCTS

## NEW G.E. TV METAL PICTURE TUBE

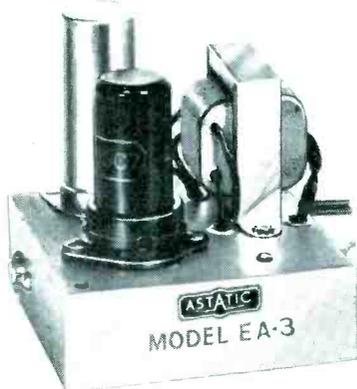
A new metal-type television picture tube which will give more viewing area in low-priced sets has been developed by General Electric Tube Division's engineers at Schenectady, N. Y. The new tube has a diameter of eight and one-half inches and will cost no more to build than seven-inch tubes now used for low-priced sets. It will offer, however, 50 per cent more picture to set owners using 7 inch tubes.



The new tube is a metal type and is the result of many months' research by engineers for such a tube. Though engineering details were not released, it was pointed out that picture quality offered by the new tube is comparable with that of the best tubes now in production. It employs magnetic focusing and deflection.

## NEW ASTATIC AUDIO ACCESSORIES

A new Equalizer-Amplifier, the Model EA-3, for use in conjunction with Astatic Corporation's Magneto-Induction Pickup Cartridge, brings to a total of three such accessory units produced by this pioneer Conneaut, Ohio, sound equipment manufacturer.

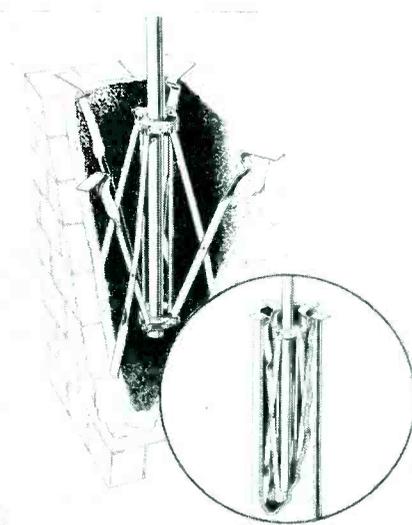


Here is how Astatic's accessory units now stand. The Model EA-1 Equalizer-Amplifier, designed for installation in radio sets and audio amplifiers, provides the necessary equalization and preamplification to adapt Magneto-Induction Cartridges to standard phonograph input circuits. It also provides "bass-boost." The Model EA-2 is self-powered and provides adjustable "bass-boost," adjustable treble "roll-off," and selection of "turnover-frequency."

The new Model EA-3 is another self-powered unit, providing "bass-boost" and equalization.

## NEW VEE-D-X CHIMNEY MOUNT

The LaPointe Plascomold Corp., Unionville, Connecticut, manufacturers of Vee-D-X TV accessories announces a new chimney and vent pipe antenna mount which mounts inside the chimney or vent pipe. The unit fits into any opening from 4" to 22", whether it be round, square, rectangular or oval. It will accommodate masts of 1", 1 1/8", and 1 1/4" diameter.



No steel straps or cable are required, and the only tool needed is a screwdriver. Eight points of bearing contact insure a rigid, safe, and permanent installation. The unit itself is constructed of aluminum castings with cadmium plated steel arms.

## NEW ESPEY CHASSIS LINE

Espey Mfg. Co. Inc., 528 E. 72 St., N.Y. 21, N.Y., announces their new Custom Built Espey chassis line. With special extended range, the High Fidelity AM-FM radio chassis offers ease of installation, plus such special features



as drift compensation, automatic volume control, full range bass and treble controls, phono input provisions, and gives the Radio Service Dealer a quality instrument that can be readily sold to the most discriminating music lovers.

## MEGACYCLE METER FOR TV

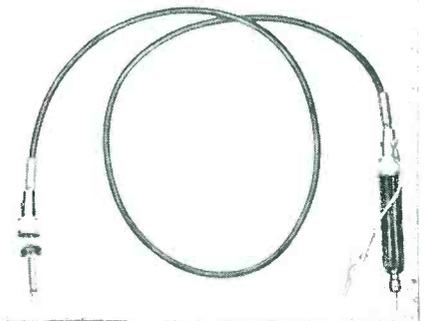
The Model 59 Megacycle Meter manufactured by Measurements Corp., Boonton, N.J. has many applications in the construction and servicing of television receivers. It can be used for aligning video amplifiers, peaking coils, sound traps, filters, stagger tuned i.f.s, stagger tuned amplifiers, sound i.f.s, local oscillators, carrier circuits, grid mixing circuits, etc.



Technical specifications are as follows: Frequency range—2.2 to 400 mc with seven plug-in coils; Modulation—c.w. or 120 cycles fixed approximately at 30% at 15 mc, or external.

## NEW RCA H-F CRYSTAL PROBE

The RCA Crystal Probe is designed for converting the d-c circuit of the VoltOhmyst to read a-c so that voltages up to a frequency of 100 megacycles or more are indicated directly on the d-c scale. The Probe can be used with any model VoltOhmyst, including the original Senior and the Junior, and it can also be used on the Voltmeter channel of the RCA Chanalyst.



The Crystal Probe adapts the VoltOhmyst for fm, television, and other h-f testing requirements, within the sensitivity range of the instrument. It gives excellent linearity even at both ends of the scale. Because of its low input capacity and high impedance, this Probe is especially suited for accurate reading without regard to load resistance.

[Continued on page 33]

# ONE OF THESE 5 WILL BEST FILL YOUR V.O.M. REQUIREMENTS



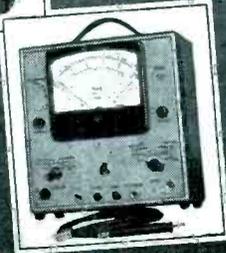
MODEL NO.  
630

MODEL NO.  
666-HH

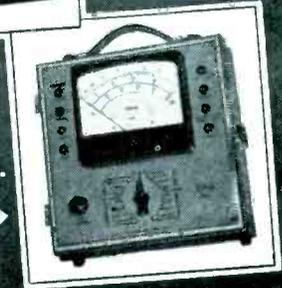


MODEL NO.  
625-NA

MODEL NO.  
2451



MODEL NO.  
2405-A



**MODEL 630.** Outstanding Features: (1) The new Triplett Molded Selector Switch with contacts fully enclosed . . . (2) Has Unit Construction with Resistor Shunts, Rectifier Batteries in molded base . . . (3) Provides direct connections with out cabling . . . no chance for shorts . . . (4) Big easily read 5 1/2" Red • Dot Lifetime Guaranteed Meter.

#### TECH DATA

D.C. VOLTS: 0-3-12-60-300-1200-6000, at 20,000 Ohms/Volt  
 A.C. VOLTS: 0-3-12-60-300-1200-6000, at 5,000 Ohms/Volt  
 D.C. MICROAMPERES: 0-60, at 250 Millivolts  
 D.C. MILLIAMPERES: 0-1-2-12-120, at 250 Millivolts  
 D.C. AMPERES: 0-12, at 250 Millivolts  
 OHMS: 0-1000-10,000; 4.4 Ohms at center scale on 1000 scale; 44 Ohms center scale on 10,000 range.  
 MEGOHMS: 0-1-100 (4400-440,000 at center scale).  
 DECIBELS: -30 to -4, -16, -30, -44, -56, -70.  
 OUTPUT: Condenser in series with A.C. Volt ranges.

**MODEL 630.** . . . . U.S.A. Dealer net price . . . . **\$37.50**  
 Leather Carrying Case, \$5.75. . . Adapter Probe for TV and High Voltage Extra.

**MODEL 666-HH.** This is a pocket-size tester that is a marvel of compactness and provides a complete miniature laboratory for D.C. and A.C. voltages, Direct Current and Resistance analyses. Equally at home in the laboratory, on the work bench or in the field . . . its versatility has labeled it the tester with a thousand uses . . . housed in molded case . . .

#### TECH DATA

D.C. VOLTS: 0-10-50-250-1000-5000, at 1,000 Ohms/Volt  
 A.C. VOLTS: 0-10-50-250-1000-5000, at 1,000 Ohms/Volt  
 D.C. MILLIAMPERES: 0-10-100-500, at 250 Millivolts  
 OHMS: 0-2,000-400,000, (12-2400) at center scale)

**MODEL 666-HH.** . . . U.S.A. Dealer Net Price . . . **\$22.00**  
 Leather Carrying Case, \$4.75.

**MODEL 625-NA.** This is the widest range laboratory-type instrument with long 5.6" mirrored scale to reduce parallax. Special film resistors provide greater stability on all ranges. Completely insulated molded case. Built by Triplett over a long period of time, it has thoroughly proved itself in laboratories all over the world.

#### TECH DATA

SIX D.C. VOLTS: 0-1-25-5-25-125-500-2500, at 20,000 Ohms/Volt  
 SIX D.C. VOLTS: 0-2.5-10-50-250-1000-5000, at 10,000 Ohms/Volt  
 SIX A.C. VOLTS: 0-2.5-10-50-250-1000-5000, at 10,000 Ohms/Volt  
 D.C. MICROAMPERES: 0-50, at 250 Millivolts  
 D.C. MILLIAMPERES: 0-1-10-100-1000, at 250 Millivolts  
 D.C. AMPERES: 0-10, at 250 Millivolts

**TRIPLETT ELECTRICAL INSTRUMENT COMPANY • BLUFFTON, OHIO, U.S.A.**

In Canada: Triplett Instruments of Canada, Georgetown, Ontario

OHMS: 0-2000-200,000, (12-1200 at center scale)  
 MEGOHMS: 0-40, (240,000 at center scale)  
 SIX DECIBELS RANGES: -30 +30, +15, +29, +43, +55, +69.  
 (Reference level "0" DB at 1.73 V. on 500-Ohm line.)  
 Six Output on A.C. Volt ranges

**MODEL 625-NA.** . . . U.S.A. Dealer Net Price . . . **\$45.00**  
 Carrying Case, \$5.50. Accessories available on special order for extending ranges.

**MODEL 2405-A.** This instrument combines ultra sensitivity with a large 5 3/4" scale meter and is housed in a rugged metal case. . . It is furnished with hinged cover so that it can be used for service bench work or for portable field service. Gives A.C. Amperes readings to 10 Amps.

#### TECH DATA

D.C. VOLTS: 0-10-50-250-500-1000, at 20,000 Ohms/Volt  
 D.C. AMPERES: 0-10, at 250 Millivolts  
 D.C. MILLIAMPERES: 0-1-10-50-250, at 250 Millivolts  
 D.C. MICROAMPERES: 0-50, at 250 Millivolts  
 A.C. VOLTS: 0-10-50-250-500-1000 at 1000 Ohms/Volt  
 A.C. AMPERES: 0-0.5-1-5-10, at 1 Volt-Ampere  
 OHM-MEGOHMS: 0-4000-40,000 ohms-0-4.40 megohms (self-contained batteries)  
 OUTPUT: Condenser in series with A.C. Volt ranges  
 DECIBELS: -10 to +15, +29, +43, +49, +55. (Reference level "0" DB at 1.73 V. on 500-ohm line.)  
 CONDENSER TEST: Capacity check of paper condensers is possible by following data in instruction book.

**MODEL 2405-A.** . . . U.S.A. Dealer Net Price . . . **\$59.75**

**MODEL 2451.** Electronic Volt-Ohm-Mil-Ammeter . . . is easy to use in complicated testing . . . A must in F.M. and TV work in any sensitive circuit where low current drain is a factor . . .

#### TECH DATA

D.C.-A.C.-A.F. VOLTS: 0-2.5-10-50-250-500-1000  
 R.F. VOLTS: 0-2.5-10-50  
 D.C. MILLIAMPERES: 0-2.5-10-50-250-500-1000  
 OHMS: 0-1K-10K-100K  
 MEGOHMS: 0-1-10-100  
 INPUT IMPEDANCE: 11 Megohms on D.C. Volts.  
 4.9 Megohms on A.C.-R.F. Volts

**MODEL 2451.** . . . . U.S.A. Dealer Net Price . . . . **\$76.50**  
 External high-voltage probe available on special order. See the Triplett V.O.M. line at your local Radio Parts Distributor or write

*Precision first... to Last*



# CIRCUIT COURT

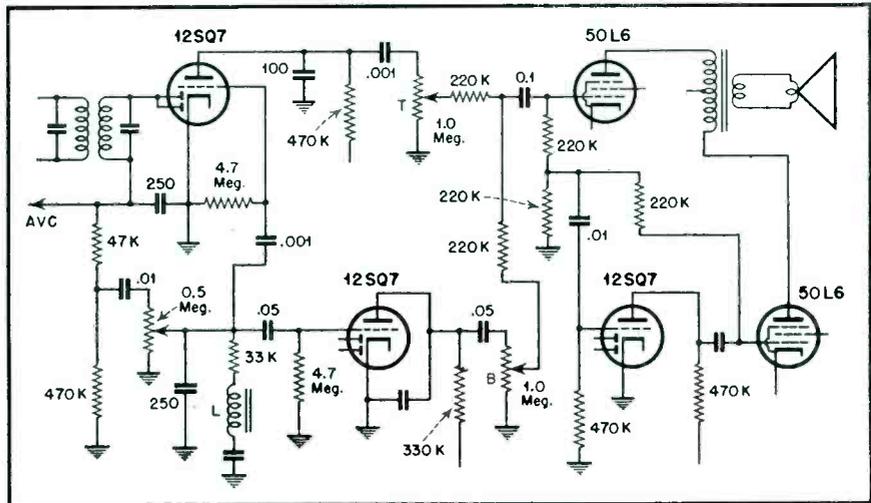
## Electronic Laboratories Model 710

The EL Model 710 has several unique features. For one thing it has an a-c/d-c chassis employing 10 tubes. An outstanding feature is the two tone controls employed. By means of selective circuits it is possible to choose either highs or lows or both at once. Reference to the partial schematic will aid in understanding the method used.

The last i-f coil is shown feeding a signal to the parallel diode plates of a 12SQ7. A.V.C. and audio voltages are developed and the latter taken off between the 47K and 470K load resistors. A volume control determines what part of the i-f voltage reaches the grid of the triode section of the first 12SQ7. In the grid and plate leads of this stage the coupling capacitors are only .001 mfd. This value will pass only high frequencies. The termination (marked *T*) determines how much of this high frequency signal reaches the grid of the top 50L6.

At the arm of the first control a portion of the i-f was amplified in another 12SQ7. In this case, the grid has a low frequency resonant circuit consisting of L-C-R elements. It also uses large (.05  $\mu$ f) coupling units. These will pass lows easily.

The mixed high and low amplifier outputs are supplied to a 50L6 and from its grid circuit to an inverter (12SQ7). The other 50L6 receives a signal, properly phased, from the inverter and produces push-pull output.

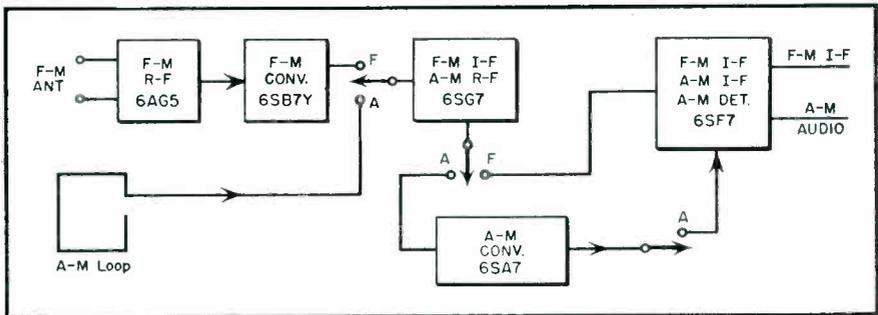


Tone control circuit of Electronic Laboratories Model 710

switches in the *F* position, will disclose that the signal leaves the 6SG7 stage for further amplification in the pentode portion of a 6SF7 stage. Later stages are conventional, utilizing a ratio detector and audio stages.

In the AM position, reference to the diagram with the switches in the *A* positions will show, a radical change takes place in the tube lineup. The 6SG7 which served as first i.f. on 10.7 mc now is switched into

[Continued on page 34]



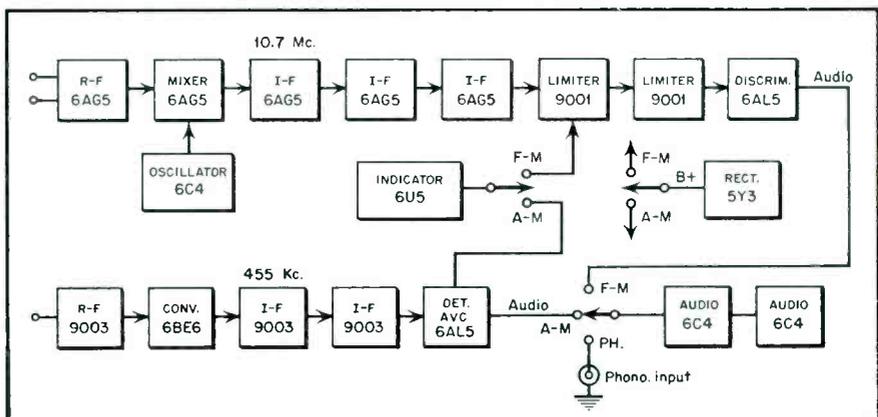
FM-AM switching circuit employed in Brunswick Model T-4000.

## Brunswick Model T-4000

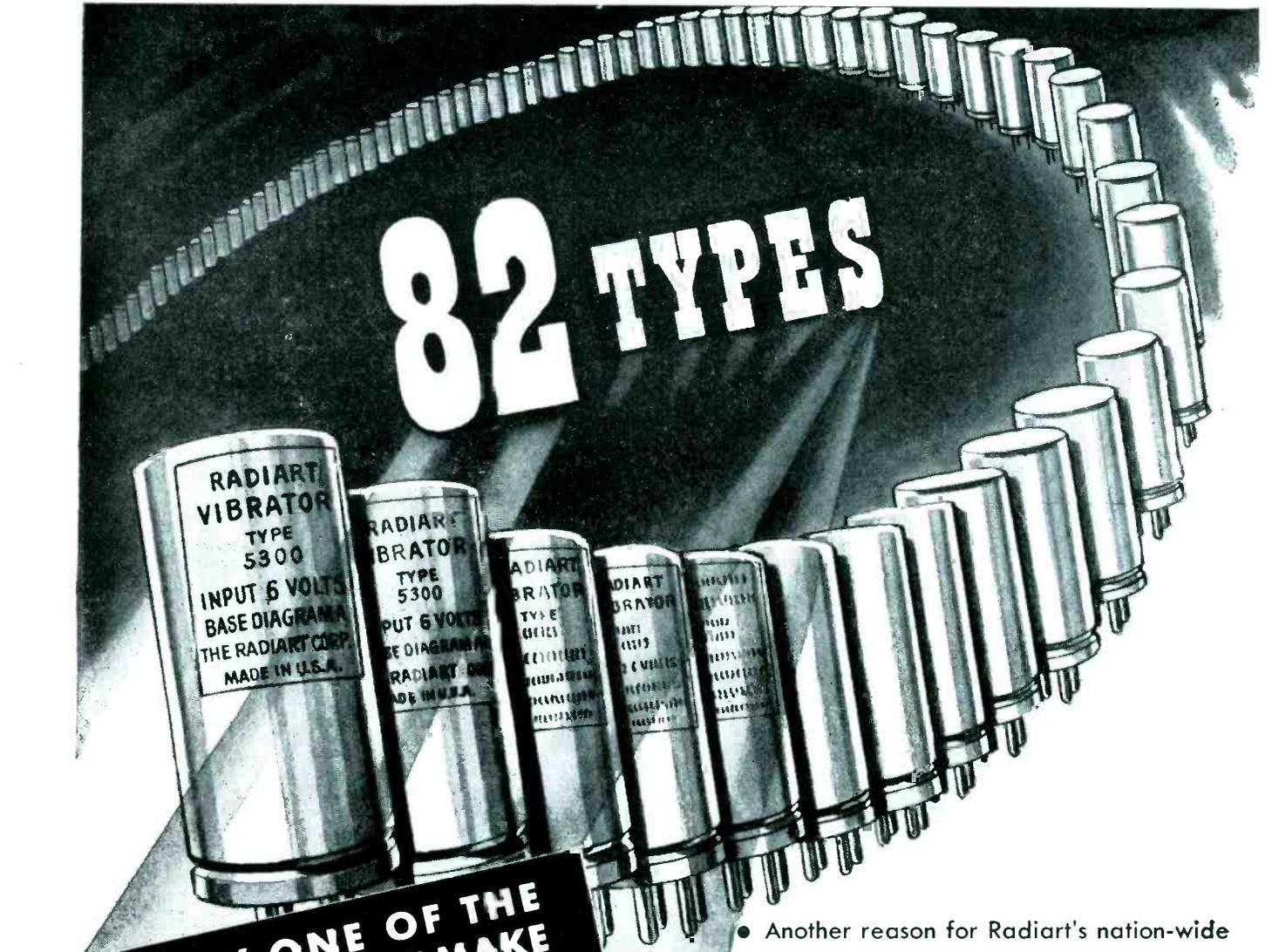
An unusual variation of the principle of using tubes for more than one purpose occurs in the Brunswick Model T-4000. This ten tube set has provision for reception on both AM and FM bands.

Switching in the 100 mc circuits is eliminated by having a head-end permanently connected for this service. The block diagram will illustrate the switching which subsequently takes place.

The first i-f stage for the 10.7 mc. FM channel employs a 6SG7 tube. Following the diagram, with the



Block diagram of circuits employed in Meissner Model 9-1091



# 82 TYPES



**ONLY ONE OF THE REASONS THAT MAKE RADIART THE GREATEST REPLACEMENT VIBRATOR LINE**

• Another reason for Radiart's nation-wide preference is the complete selection of vibrator types manufactured! There is a CORRECT Radiart replacement vibrator for most every need . . . to ORIGINAL SPECIFICATIONS! This completely eliminates guess work . . . and assures peak performance because no "next best" type is installed! Good jobbers everywhere carry almost all types in stock . . . or can get quickly any number you want! In addition . . . each of these 82 types is precision engineered . . . and manufactured under the most careful inspection that assures peak performance from every Radiart vibrator . . . always!



**IT'S RIGHT WHEN IT'S RADIART**

## THE RADIART CORPORATION

CLEVELAND 2, OHIO

MANUFACTURERS OF THE FAMOUS RED SEAL VIBRATORS

Have ALL THE FUN  
SAVE 2/3 THE COST

# Build YOUR OWN TEST EQUIPMENT

## 1 Heathkit VACUUM TUBE VOLTMETER KIT

Everything you want in a VTVM. Shatterproof solid plastic meter face, automatic meter protection in burn-out proof circuit, push pull electronic voltmeter circuit assuring maximum stability. Linear DC and AC scales. AC and DC full scale ranges of 3V-10V-30V-100V-300V-1000V. A total of 24 ranges. Isolated DC test prod for signal tracing and measurements of voltage while instrument is in operation. An ohmmeter section accurately measuring resistance of 1/10 ohm to one billion ohms with internal battery. Extremely high input resistance 11 megohms on all ranges DC and 6.5 megohms on AC. All these features and many more are the reasons hundreds of radio and television schools are using Heathkit VTVM's and recommending them to all students. Like all Heathkits, the VTVM kit is complete, 110V. 60 cycle power transformer, 200 microamp meter, tubes, grey crackle cabinet, panel, test leads, 1% ceramic precision divider resistors and all other parts. Complete instruction manual. Better start your laboratory now.

Shipping weight 8 lbs. **\$24.50**

## 2 Heathkit SINE AND SQUARE WAVE AUDIO GENERATOR KIT

The ideal instrument for checking audio amplifiers, television response, distortion, etc. Supplies excellent sine wave 20 cycles to 20,000 cycles and in addition supplies square wave over same range. Extremely low distortion, less than 1%, large calibrated dial, beautiful 2 color panel, 1% precision calibrating resistors, 110V. 60 cycle power transformer, 5 tubes, detailed blueprints and instructions. R.C. type circuit with excellent stability.

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## 3 Heathkit CONDENSER CHECKER KIT

Checks all types of condensers, paper mica — electrolytic — ceramic over a range of .00001 MFD. to 1000 MFD. All on readable scales that are read direct from the panel. NO CHARTS OR MULTIPLIERS NECESSARY. A condenser checker anyone can read without a college education. A leakage test and polarizing voltage of 20 to 500 volts provided. Measures power factor of electrolytics between 0% and 50%. 110V. 60 cycle transformer operated complete with rectifier and magic eye tubes, cabinet, calibrated panel, test leads and all other parts. Clear detailed instructions for assembly and use. Why guess at the quality and capacity of a condenser when you can know for less than a twenty dollar bill.

Shipping weight 7 lbs. **\$19.50**

## 4 Heathkit SIGNAL TRACER KIT

Reduces service time and greatly increases profits of any service shop. Uses crystal diode to follow signal from antenna to speaker. Locates faults immediately. Internal amplifier available for speaker testing and internal speaker available for amplifier testing. Connection for VTVM on panel allows visual tracing and gain measurements. Also tests phonograph pickups, microphones, PA systems, etc. Frequency range to 200 Mc. Complete ready to assemble. 110V. 60 cycle transformer operated. Supplied with 3 tubes, diode probe, 2 color panel, all other parts. Easy to assemble, detailed blueprints and instructions. Small portable 9" x 6" x 4 3/4".

Shipping Wt. 10 lbs. **\$19.50**

Heathkits are beautiful factory engineered test equipment kits supplied complete but unassembled with all parts — tubes, grey aluminum cabinets, punched, formed and plated chassis, calibrated panels, ready wound coils and complete detailed instruction manuals for assembly and use. With costs zooming up, Heathkits save the labor cost of assembly enabling thousands to have equipment which they otherwise could not afford.

## 5 The NEW 1949 HEATHKIT 5-INCH OSCILLOSCOPE KIT

New improved model of the famous Heathkit Oscilloscope. Building an oscilloscope is the finest training for television and newer servicing technique and you save two-thirds the cost. All the features and quality of instruments selling for \$100.00 or more. Supplied complete with cabinet, two color panel, 5BP1 tube, 2 5Y3 tubes, 2 6SJ7 tubes and 884 generator tube. Power transformer supplies 1000 volt negative and 350 volt positive. Sweep generator 15 cycles to 30 M. cycles. Has vertical and horizontal amplifiers. Oil filled filter condensers for long life. Complete blueprints and instructions included. Shipping weight 25 pounds.

Express only **\$39.50**

## 6 Heathkit FM AND TELEVISION SWEEP GENERATOR KIT

A necessity for television and FM. This Heathkit completely covers the entire FM and TV bands 2 megacycles or 230 megacycles. The unit is 110V. 60 cycle transformer operated. Uses two 6J6 tubes, two 6C4 tubes and a 6X5 rectifier. An electronic sweep circuit is incorporated allowing a range of 0 to 10 MC. A sawtooth horizontal sweeping voltage and phase control are provided for the oscilloscope.

The coils are ready assembled and precision adjusted to exact frequency. As in all Heathkits, the best of parts are supplied, Mallory filter condenser, zero coef. ceramic condensers, all punched and formed parts, grey crackle cabinet, 5 tubes, test leads, etc. Better get it built now and be ready for the FM and TV business. Shipping Wt. 6 lbs. **\$24.50**

## 7 Heathkit SIGNAL GENERATOR KIT

Every shop needs a good signal generator. The Heathkit fulfills every servicing need, fundamentals from 150 Kc. to 30 megacycles with strong harmonics over 100 megacycles covering the new television and FM bands. 110V. 60 cycle transformer operated power supply.

400 cycle audio available for 30% modulation or audio testing. Uses 6SN7 as RF oscillator and audio amplifier. Complete kit has every part necessary and detailed blueprints and instructions enable the builder to assemble it in a few hours. Large easy to read calibration. Convenient size 9" x 6" x 4 3/4". Ship. Wt. 7 lbs. **\$19.50**

ORDER DIRECT FROM THIS AD.

WE WILL SHIP C. O. D.  
Add Postage for Weight Shown

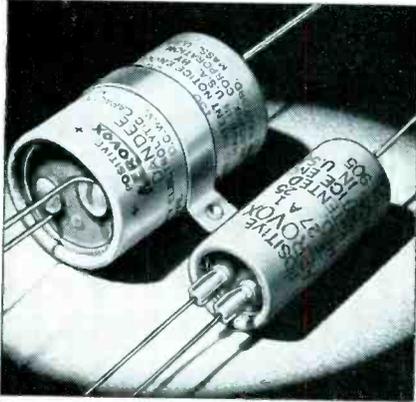
**HEATH COMPANY**  
BENTON HARBOR 12,  
MICHIGAN

## NEW PRODUCTS

[from page 28]

### NEW SIZE AEROVOX ELECTROLYTICS

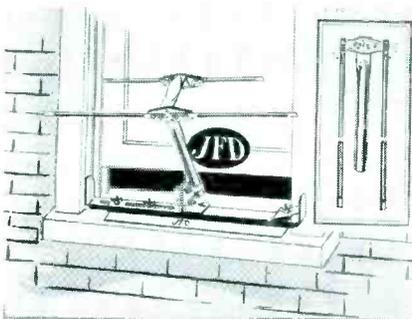
Stud terminals in place of conventional rivet-type terminals for the dual leads, have slashed the bulk of the new PRS midget-can dual-section electrolytics to considerably less than the previous sizes, according to Aerovox Corporation of New Bedford, Mass.



The dual-terminal end tells the story at a glance. The new stud terminals to which the usual bare pigtailed leads are positively crimped, have reduced terminal diameters without loss in mechanical strength or change of standard pigtail leads. The diameters of these new Dual Dandees now range 11/16", 13/16", 15/16" and 1-1/16", as against a previous single size of 1-1/16".

### JFD MARKETS NEW WINDOW ANTENNA

The JFD Manufacturing Co., Inc., 4117 Ft. Hamilton Parkway, Brooklyn 19, N.Y., is now distributing their new Quik-Rig Window Antenna. Especially designed for locations where no permanent installations are allowed, it employs a dipole and reflector for complete 12 channel reception.



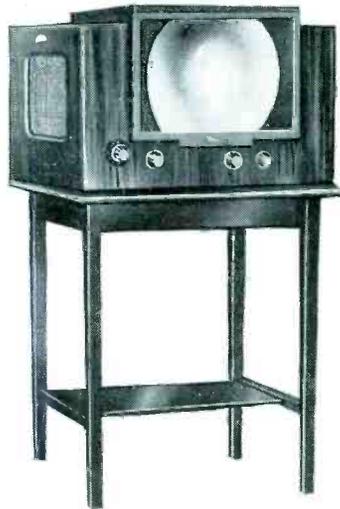
The dipoles and reflectors which are folded up against the side of the mast are simply swung up into position and tightened by means of attached wing nuts. No special tools or accessories are necessary for a slotted base mount permits full adjustment of the antenna to receive signals from any direction for higher gain. When not in use, this compact array can be folded up like an umbrella and stored away. Materials used are of light-weight aluminum and steel. Bulletin available on request.

### NEW TAPE RECORDING DEVICE

Amplifier Corp. of America, 398-9 Broadway, N.Y. 13, N.Y., is now offering E-Z-Cue models of tape and wire indexers for all other popular magnetic tape and wire recorders. This product

# TRANSVISION

PRESENTS  
THE NEW



**MODEL 12CL TV-FM KIT**  
Brings the biggest and best in television within the reach of everyone.

**GIGANTIC VALUE!**

OVER

**200**

**SQ. IN. PICTURE**  
**VISIBLE from ALL ANGLES**

With FM Radio

(De Luxe Continuous TV-FM Inputuner)  
(Picture much bigger than a tabloid newspaper page)

IMAGE IS EQUAL to that of a 20" tube—  
even sharper and clearer—and it is visible  
from all angles.

**\$ 399.00**  
NET

Includes Kit, Cabinet, Lens, Table, Antenna,  
and 60 ft. of Lead-in Wire

**EQUIVALENT OF \$100.00 SETS!**

Price of the new 12CL electromagnetic kit  
includes these outstanding features:-

- 12½" picture tube with special fitted All-Angle Lens and color kit.
- Beautiful select-grain cabinet and roto-table.
- De Luxe Continuous TV-FM Inputuner.
- New all-channel hi-gain antenna and 60 feet of lead-in wire.
- Nothing else to buy.

- MODEL 12CL TV-FM KIT**
- Features 12½" tube with fitted All-Angle Lens, giving over 200 sq. inch picture which is visible from anyplace in a room.
  - De Luxe Continuous TV-FM Inputuner gives ideal long-range reception with CONTINUOUS TUNING on ALL CHANNELS.
  - COMPLETE with Cabinet, Lens, Roto-Table, Antenna, Lead-in Wire.
  - A BIG PROFIT-MAKER for service dealers. This kit is TOPS—ideal for homes, clubs, taverns, and other commercial installations.
- EASY TO ASSEMBLE . . .**  
**NO TECHNICAL KNOWLEDGE REQUIRED**  
Transvision's simple step-by-step Instruction Sheet makes assembling a TV Kit a pleasure. Each kit comes complete with all-channel double-folded dipole antenna and 60 ft. of lead-in wire. Nothing else to buy!

### TRANSVISION ALL-CHANNEL TELEVISION BOOSTER

To assure television reception in weak signal areas, or areas which are out of range of certain broadcast stations, Transvision engineers have designed this new booster. It increases signal strength on all television channels. Tunes all television channels continuously. Can be used with any type of television receiver. Unusually high gain in upper television channels.

Model B-1 . . . . . LIST \$44.95

### TRANSVISION COMPLETE LINE OF TELEVISION COMPONENTS

Essential units for building a quality television set . . . Transvision makes available a complete line of high quality parts competitively priced. Included in this line are Filter Chokes, all types of Transformers, Focus Coils, Deflection Yokes, Coils—and of course major units such as Picture Tubes, Antennas, Lenses, etc., etc.

WRITE FOR COMPONENTS FOLDER P-1

**RADIOMEN..You Can GET INTO The**  
**TELEVISION BUSINESS**  
IN A BIG WAY WITH THE  
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Write for Dealer Folder D-1

**TRANSVISION, Inc. Dept. RSD New Rochelle, N. Y.**

In Calif.: Transvision of California, 8572 Santa Monica Blvd., Hollywood 46.  
All prices 5% higher west of Mississippi; all prices fair traded. All Prices Subject to Change.

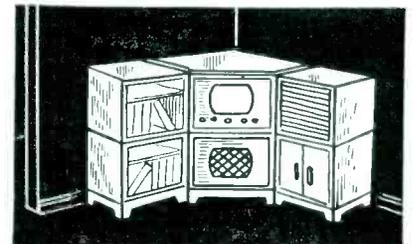
### Transvision Remote Control Unit Kit

Will operate any TV receiver from a distance. Turns set on, tunes in stations, controls contrast and brightness, turns set off. Ideal for installations where the television receiver is inaccessible. Tuner unit is a high gain, all-channel unit with about 50 micro-volt sensitivity. Easy to assemble in about an hour.

Model TRCU, with 25 feet of cable Net \$69.00  
Without cabinet.....Net \$65.00

### ASSEMBLE Your Own CABINETS

Transvision's "MODULAR" Cabinets come in knock-down, unpainted units, offering an unlimited range of combinations, including even a bar. Finish them off to suit your taste.

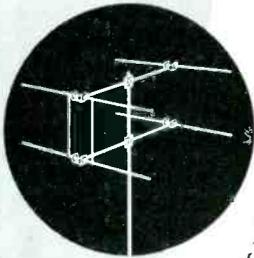


Corner piece, shown above, has room for TV, Phono, Record Storage, and open Book Case. COMPLETE . . . . . Net \$84.00

For other units and prices, write for "Modular" Catalog.

# Flexibility makes

## "the Service Man's Line"



Brach antennas . . . long known for dependability . . . maximum reception . . . trouble-free operation . . . durability and ease of installation . . . now feature an added extra . . . Flexibility. Unique construction features aid the service man in making a more rapid installation to which future additions or modifications can be easily made.

**1. FLEXIBILITY** A complete line designed with basic antenna parts which are convertible to more complex arrays as required by location and reception problems.

**2. COMPLETE KITS** Each antenna model is independently designed and furnished in a completely packaged kit containing all necessary hardware, downlead (when desired) and the Universal Base Mount . . . ready for installation.

**3. PRE-ASSEMBLY** Each antenna is factory pre-assembled as far as possible, ready to erect. Complete and simple installation instructions. Saves valuable man-hours on the roof.

**4. MECHANICAL STRENGTH** Weather - tested for durability, Brach Antennas feature a husky steel mast, rigid connections, sturdy base mount, neat appearance. All parts corrosion resistant.

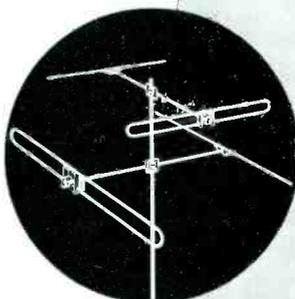
**5. SUPERIOR RECEPTION** Designed with engineering "know-how". All Brach antennas are factory pre-tuned, matched for 300 ohm transmission line with large diameter aluminum elements for better signal pick-up. Directivity patterns and standing wave ratios available upon request.

## New! Tops in TV! HI-LO ROTATABLE Antenna

Here it is! A rotatable antenna to provide peak performance with any station at any time. Brach introduces the new "Superview" Rotatable, covering both high (174 MC to 216 MC) and low (88 MC to 108 MC) TV bands. High band extension available for easy addition to standard dipole array for separate orientation. No more multiple images. No more "weak" stations. Brach's Superview HI-LO assures television reception that's tops. Make sure and investigate the new Superview line today.

Write for Free Brach catalog showing complete line of TV and FM antennas and accessories.

Send for Catalog No. D-304



is designed to index and catalogue the contents of a recorded reel of magnetic tape on Magnetic Twin-Trax Recorders for easy future reference.



A cueing indicator counts each revolution of the wire or tape spool, and reverses when the wire or tape is rewound, automatically bringing the reading back to zero after the rewinding is completed. Average accuracy is within approximately one second of recording time on standard spools of wire or tape. Literature available on request.

## CIRCUIT COURT

[from page 30]

use as a tuned r-f stage. The 10.7 mc. coils are left in the circuits since they appear as very low impedances at the low frequency of the AM band.

The output of the 6SG7 stage is switched to the input of the 6SA7 AM converter stage. The 455 kc AM i.f. receives amplification in the pentode section of the 6SF7 and is rectified in the diode plate of the same tube, after which it passes to the audio stages.

While there are three sections to the tuning gang used on FM, there being tuned circuits in all tube sections, there are but two tuned circuits for AM. The r-f input and oscillator circuits are tuned, the r-f Mixer coupling being of the impedance type.

### Meissner Model 9-1091

This tuner, covering the regular broadcast and FM bands, is probably one of the most elaborate yet to be placed on the market. Seventeen tubes and a rectifier are employed to form what amounts to two separate receivers. Only the audio, indicator and power circuits are common to both functions.

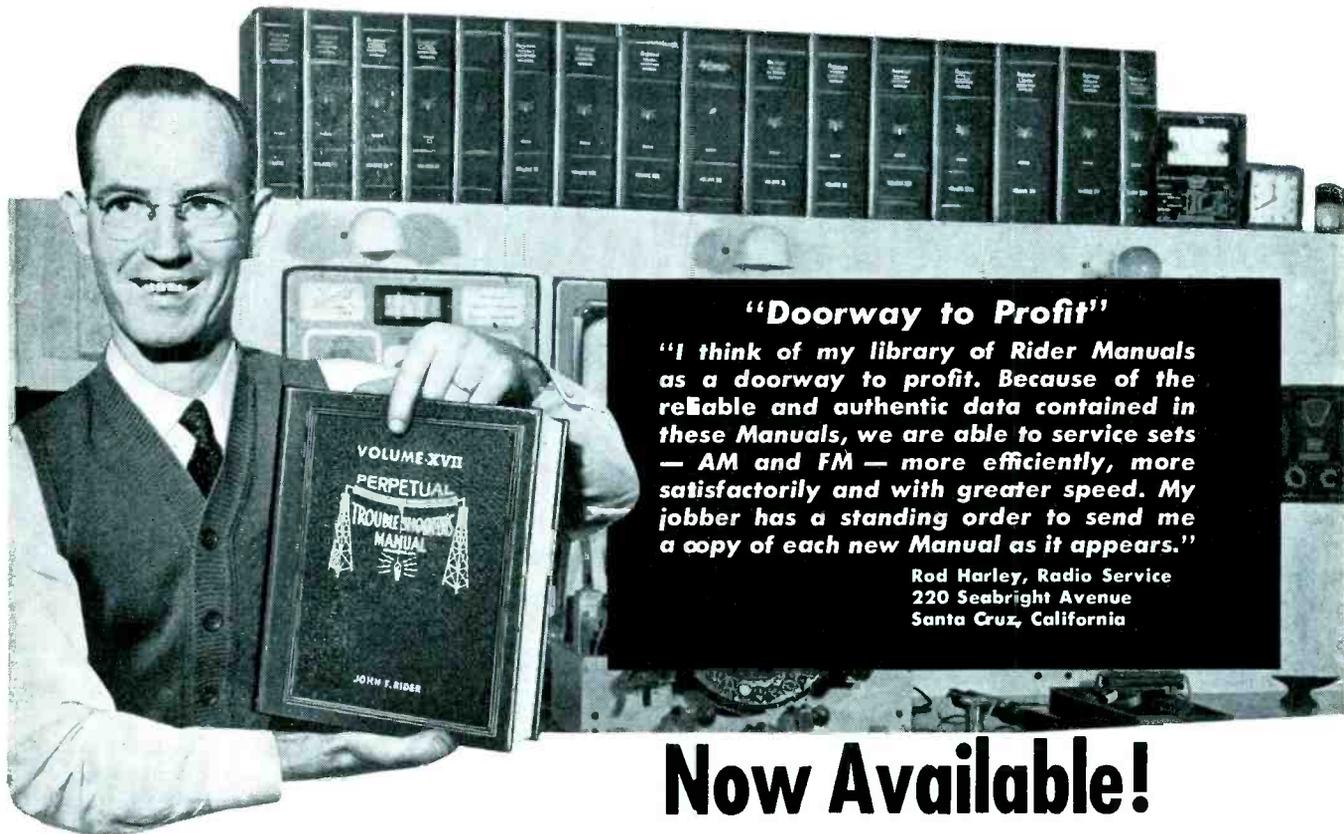
A block diagram of the stages and their functions is shown. A brief discussion of the progress of signals through the instrument and the switching involved in changing functions will indicate the straight-forward design.



# L. S. BRACH MFG. CORP.

200 CENTRAL AVENUE, NEWARK, N. J.

WORLD'S OLDEST AND LARGEST MANUFACTURERS OF RADIO ANTENNAS AND ACCESSORIES



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Rod Harley, Radio Service  
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**Now Available!**

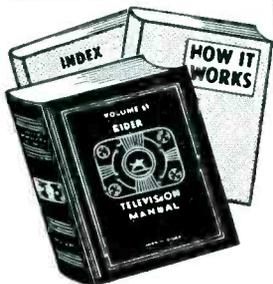
**Volume XVIII in the profit-building library of RIDER MANUALS** *The World's Greatest Compilation of Radio Servicing Data — Including AM, FM and TELEVISION — and allied equipment*

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This is the biggest RIDER MANUAL of them all. 2036 FACTORY-AUTHORIZED, fact-crammed pages . . . comprising the greatest number of models and chassis of AM and FM receivers and record changers of more than 100 manufacturers . . . up to date to January, 1949. Here are the exclusive RIDER "Clariskematix" to help you do a better, faster, more profitable job. Here is the famous "HOW IT WORKS" Book which fully explains electrical and mechanical innovations in VOLUME XVIII. Here is the authentic, reliable data direct from the manufacturers themselves . . . data which make RIDER MANUALS the easiest to understand, the simplest to use, and the best to help you make more money.

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**Plus Separate "How It Works" Book**

Volume I was an instantaneous "hit" . . . volume II is sure to be even more in demand—BECAUSE no serviceman in a TV area can afford to be without RIDER TV MANUALS. They contain the OFFICIAL Manufacturer's authorized data from the set makers themselves, and include Double spread, Triple spread, and GIANT SCHEMATICS to put you on the right track toward solving any TV problem.

Equivalent of 2300 pages—"How It Works" Book; cumulative Vol. I and Vol. II, and Index. . . . **\$18<sup>00</sup>**

**RIDER PA MANUAL**

The first industry-wide Public Address Equipment Manual, incorporating the amplifier production of 147 manufacturers from 1938 to 1948. 2024 Pages PLUS "How It Works" book which explains theory of various PA circuits and method of rapidly locating faults.

**\$18<sup>00</sup>** including Index.

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- Volume XVI . . . . . **8.40**
- Volume XV . . . . . **19.80**
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- Record Changers and Recorders . . . . . **9.00**
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JOHN F. RIDER, PUBLISHER, Inc., 480 Canal Street, New York 13, N. Y.  
Export Agent: Rocke International Corp., 13 E. 40th St., N.Y.C., Cable, ARLAB.

**RIDER MANUALS mean SUCCESSFUL SERVICING**

NOTE: The Mallory Radio Service Encyclopedia, 6th edition, makes reference to only one source of radio receiver schematics—Rider Manuals.  
ANOTHER NOTE: The C-D Capacitor Manual for Radio Servicing, 1948 edition No. 4, makes reference to only one source of receiver schematics—Rider Manuals.





SNAIDER TELEVISION CORPORATION . . .

Presents the "AUDITORIUM"

*The Greatest Set  
of them all!*

**520 Sq. Inches**

of brilliant • sharp • steady picture!  
(20" x 26" screen)



SNAIDER "AUDITORIUM"  
**PROJECTION  
TELEVISION**

Fair trade price **\$1495**

Everything you want in television and more. Brilliant, huge size picture that is easy on the eyes, remarkable reception, attractive cabinet. Here is America's greatest television value per square inch of picture. All channels of TV and all FM channels as well. A triumph of electronic engineering.

*Features*

BAUSCH & LOMB  
F/1.9 LENS

5" RCA PROJECTION  
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EASTMAN KODAK  
VIEWING SCREEN

DUMONT INPUTUNER

37 RCA TUBES

"VIVIDeo" FEATURE  
(Patents Pending)

MANY OTHER  
GREAT FEATURES

**20 TIMES AS LARGE**  
as a 7-in. tube picture

**10 TIMES AS LARGE**  
as a 10-in. tube picture

**7 TIMES AS LARGE**  
as a 12-in. tube picture

**OVER 4 TIMES AS LARGE**  
as a 15-in. tube picture

*Can be viewed from as far as 120 feet*

*Dealers!..*

Our factory and staff have been in production on television for several years. Our engineers and research personnel have been experimenting and testing and planning this set for a long time and we believe it to be an extraordinary achievement.

Write for our **very** profitable discount structure and the name of your nearest distribution source.

Subsidiaries: TELEVISION ASSEMBLY CO. and TELEVISION INDUSTRIES CO.



**SNAIDER TELEVISION CORPORATION**

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*Ideal for*

- HOMES ● SCHOOLS
- CLUBS
- COMMERCIAL ESTABLISHMENTS
- OFFICES
- INSTITUTIONS OR ANY MASS VIEWING

2,750,000 TV sets in use by the end of 1949 . . . the young industry now takes its rightful place among the billionaire industries . . . the outstanding development must be the lifting of the "freeze" and the early exploitation of the UHF frequencies . . . In fact, it seems now as though the densely populated areas will continue to be served by VHF transmitters tuned in by present types of receivers, while the smaller cities, towns, villages and wide open spaces will be served by UHF transmitters

calling for new types of receivers . . . One thing is certain: No obsolescence of present TV receivers is yet in sight. Existing operational standards have been set for years to come . . . Many of these stations are linked together by the Bell System Networks in the East . . . In the Mid-West, Chicago, Milwaukee, St. Louis, Toledo, Cleveland and Buffalo are linked together by coaxial cable . . . Corresponding network progress along the Pacific Coast must ultimately be climaxed in the joining to-

gether of the East and West for coast to coast telecasting . . . Marked progress made in tele-transcriptions or the filming of TV programs directly from the monitor screen, will contribute much to 1949 telecasting variety especially among smaller and isolated stations . . . Television news coverage during 1949 will spread out to the entire world . . . theatres may be joined together by wired television or special radio relay . . . I anticipate still greater emphasis on the educational potentialities of television.

Finally, the non-telecasting applications of television are yet to be touched upon. The "seeing at a distance" technique offers many challenging possibilities in everyday life."

#### New Projection Receiver

Snaider Television Corp., Brooklyn, N. Y. has announced the release of the "Auditorium", a projection television receiver that delivers a picture of 520 square inches. The



screen, which is a product of Eastman Kodak research is 20" by 26". The set is distributed nationally through Television Industries Co., 540 Bushwick Ave., Brooklyn, N. Y.

#### New Brach Catalog

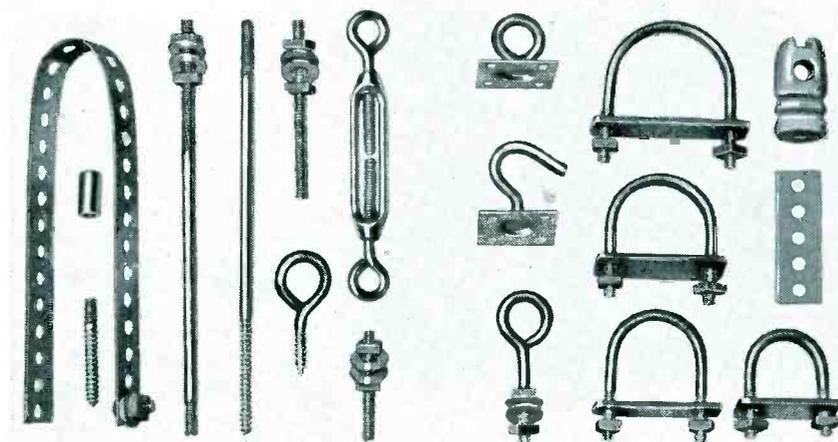
L. S. Brach Manufacturing Corp., of Newark, N. J., maker of radio antennas and accessories, has issued a loose leaf catalog #1304, giving details of its TV and FM antennas, antenna accessories, etc.

## RADIODYNE\* Introduces

*a Complete Line of*

**HEAVY-DUTY**

# ANTENNA HARDWARE



### THE LINE OF A THOUSAND COMBINATIONS

Here's good news for Servicemen! You can now get all the heavy-duty antenna hardware you need . . . you can be completely equipped before you start an installation job. The Radiodyne line of a thousand combinations features heavy-duty stand-off insulators that embody actual insulating qualities even in rain or sleet; all hardware is heavily zinc plated to withstand long outdoor service (passes 100 hr. salt test); all small woodscrews are case-

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## VTVM

[from page 17]

current (with no voltage applied to the grid) as well. This disadvantage may be overcome by using some type of bridge circuit, an elementary type being illustrated in *Fig. 2*. In this diagram, *tube 2* forms the fourth arm of a Wheatstone bridge; the other three arms are made up of the resistors  $R_1$ ,  $R_2$  and  $R_3$ . With no voltage applied to *tube 1*, the bridge is balanced by varying control  $R_4$  so that the meter,  $M$ , reads zero. The voltage to be measured is then applied to the grid of *tube 1*. The plate current of this tube increases, upsetting the balance of the bridge and the meter will then give an indication. A bucking voltage is now applied to *tube 1* through a second control,  $R_5$ . This control is adjusted so that the plate current of *tube 1* is returned to normal, restoring the balance of the bridge and restoring the reading of the meter to zero. The amount of bucking voltage needed to produce this result is then measured by the d-c voltmeter,  $M_1$  and this is the value of the applied voltage.

A bridge-type vacuum tube voltmeter circuit used in a current model analyzer (Precision Model EV-10) appears in *Fig. 3*. It should be noted that this diagram represents only that portion of the entire analyzer circuit which is used in measuring d-c voltages from 3 to 600 volts. The voltage to be measured is applied to the voltage divider,  $R_1$ , which provides a constant input resistance of over 13 megohms up to 600 volts. This input resistance is doubled when the 1200-volt range is used, and becomes more than 133 megohms for the 6000-volt range. As you will observe, the meter,  $M$ , (a 400-microampere movement) is connected between the cathode of the 6C5 tube and the slider of the potentiometer,  $R_2$ . Adjustment of this potentiometer brings the meter pointer to zero; the zero point, incidentally, is located at the center of the scale for all vacuum tube voltmeter ranges. When used as an ohmmeter or as a conventional voltmeter, the zero is at the left of the scale. The value of the zero-center feature will readily be seen in such applications as discriminator alignment, bias measurements and in any other test in which the polarity is unknown. Another feature of this particular analyzer is the voltage-regulated power supply, which employs a type VR-150 tube to maintain constant voltage at

the plate of the voltmeter tube; this prevents shifts in meter readings which may result from line voltage variations. For r-f voltage measurements, a special high frequency probe using a type 9002 tube is available as optional equipment.

*Fig. 4* is quite interesting, since it illustrates two features of the Triplett Model 2451 Electronic Volt-Ohm-Milliammeter. Again, you are reminded that this is a simplified, partial circuit and includes only those components which are essential to the particular function and ranges under

discussion. This diagram shows the set-up used in measuring a-c and r-f voltages, and the crystal probe supplied for this purpose appears at the top of the drawing. The measuring portion of the circuit is a balanced arrangement of two 7A5 tubes. Notice that the voltage to be measured is applied to the grid of the upper tube while the grid of the lower tube is maintained at ground potential. With no voltage applied, balance is obtained by adjusting the potentiometer  $R_{23}$ . When measurements are to be made, the applied voltage at the grid

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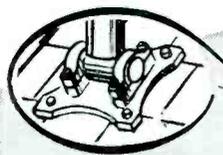
# VEE-D-X LIGHTWEIGHT ANTENNA MAST

PROTECTS  
YOUR  
PROFIT  
MARGIN  
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T-V SALES  
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Profits vanish when you waste time with poorly designed and hard-to-erect antenna installations. Why gamble when you can be sure with VEE-D-X — the complete single source quality line. For example, there is nothing finer — or faster to install — than the new VEE-D-X light weight, yet sturdy, magnesium mast. Designed and made by antenna specialists exclusively. Comes in 12 or 20' lengths. Can be coupled to a height of 40'. Rotates easily with guy cables installed. Adaptors for all antenna masts from 1" to 2" O.D.

NOTE (circle below) all-angle swivel base for either flat or peaked roofs. Antenna illustrated is a famous VEE-D-X that holds all records for long distance reception.



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MEANS VIDEO DISTANCE

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- VEE-D-X Single Source Plan
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NAME \_\_\_\_\_  
 COMPANY \_\_\_\_\_  
 STREET \_\_\_\_\_  
 CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_

of one tube causes an unbalance which results in a meter reading.

### Crystal Probes

For high frequency measurements either the crystal probe shown, or a tube probe may be used. The crystal probe appears to be very convenient to use as it is only  $\frac{5}{8}$ " in diameter. Accurate readings at frequencies up to 125 megacycles may be obtained with this probe; for frequencies up to 400 megacycles, a special probe using a subminiature tube is available. When the analyzer is to be used on low frequencies, the voltage under test is rectified by one half of the 6H6 tube shown at the left of the drawing, and this rectified voltage is then applied to the grid of the 7A5 tube.

### Ohmmeter

Again making use of a partial schematic, your attention is directed to Fig. 5, which is a simplified version of the ohmmeter circuit used in the instrument described above (Triplet Model 2451). Voltage supplied by two 1- $\frac{1}{2}$  volt flashlight cells is applied to the voltage divider circuit consisting of  $R_{39}, R_2, R_3, R_4, R_5, R_6$ . When the ohmmeter test leads are shorted a current flows through a part, or all, of the voltage divider, depending upon the setting of the range switch. Current flow through the divider applies a voltage to the grid of the upper 7A5 tube, unbalancing the circuit. With the test leads still shorted, the meter is adjusted to zero by operating the "Zero Adjust" control,  $R_{23}$ . The test leads are then separated and the meter set to full scale reading by means of the "Ohm Adjust" control  $R_{32}$ . The instrument is then ready to read any value of resistance placed between the test leads.

### Volt-Ohmyst

Up to this point we have discussed simplified circuits of several types of instruments, each diagram representing the circuit arrangement used for a particular function, such as d-c voltage measurement, a-c and r-f measurements and resistance measurement. By way of concluding, we shall consider a complete analyzer circuit as represented by the RCA Advanced Volt-Ohmyst, shown in Fig. 6.

The basic measuring circuit of this instrument consists of two 6K6 tubes in a push-pull circuit. These tubes have a common cathode bias resistor,  $R_{27}$ . At any setting of the selector switches  $S_1$  and  $S_2$ , the voltage to be measured is applied to the grid of one of the tubes, while the grid of the other is kept at a constant potential by grounding of its input circuit. Applying a voltage to the input produces an equal change in the cathode-to-ground voltage for both tubes, because of the common cathode resistor. As the grid-to-cathode voltage of one tube increases, the grid-to-cathode voltage of the other decreases. Therefore, the plate voltage change in one tube is opposite to that produced in the other. This voltage difference is measured by the meter,  $M_1$ . In tracing through this schematic, note that the range switch,  $S_1$ , consists of four decks, which are labeled  $A, B, C$  and  $D$ , and which are actuated by a common shaft, permitting the operator to select the desired range. In the drawing, this switch is shown in the "3-V." position. The selector switch  $S_2$ , which is used to select the desired function or type of measurement, has six decks labeled  $A, B, C, D$ , and  $F$ . These also are operated by a common shaft. In the schematic, this switch is shown in the "OFF" position.

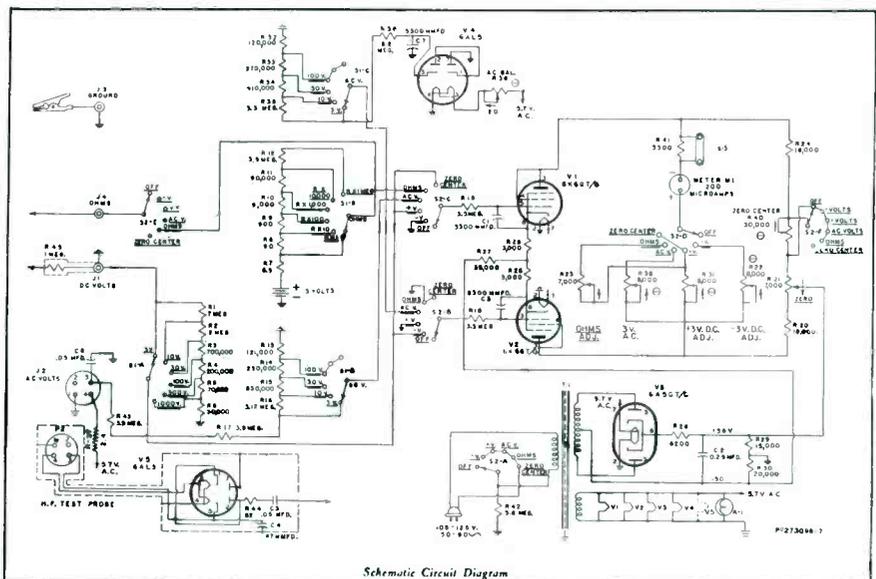


Fig. 6—R.C.A. Advanced Volt-Ohmyst schematic circuit diagram.

## ASSOCIATION

### NEWS

*Long Beach Radio Technicians Association, Inc., Long Beach, Cal*

Officers elected at the November meeting of this association are: Pres.—Frank Gregson; V.P.—Jack Ward, Sec.—Danny Occoner; Treas.—Abraham . . . Shown below is a pic of Radio Service Dealers getting an advance course in TV under the instructorship of Bob Smith (formerly



with Philco). Cooperating companies in this program which is given under the auspices of the Long Beach City Schools system are Gough Industries, G. E., Hallierafter, Packard Bell, Hoffman, and Motorola.

*Federation of Radio Servicemen's Associations of Pa.*

Officers elected for the coming year were: Dave Krantz—Chairman; Robert Riedy—Vice Chairman; John Rader—Sec.-Treas. A series of technical meetings were arranged for member associations, and include such men as Pickering on Hi-Fi pickups, Milton Shapp on Fringe Area Reception. Members are invited to the G. E. school on TV to be held in Reading on Feb. 1, 2, and 3. The Plaque for Outstanding Service to the Radio Industry for the year of 1948 will be awarded to the Philco Corp. at the Feb. 13 meeting.

*Midstate Radio Servicemen's Association of Pennsylvania*

Officers elected for the year were: T. L. Clarkson, Chairman; Jay T. Sweeney, Vice-Chairman; Paul W. Smith, Sec.; L. B. Smith, Treas.

*Radio Technicians Guild of Rochester, N. Y.*

Mr. Sam Sheer of Philco Corp. spoke on "Merchandising Service" on Tuesday, Dec. 14. All who attended the JFD meeting on Nov. 23 expressed the opinion that this meeting alone was worth the price of a year's



Model 260 in bakelite roll top carrying case

There are more  
**Simpson 260**  
 high sensitivity  
 Volt-Ohm-Milliammeters  
 in use today than all others  
 combined! Your Parts Jobber  
 can tell you why

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**RANGES: ±20,000 ohms per volt DC, 1000 ohms per volt AC**  
**VOLTS: AC & DC—2.5, 10, 50, 250, 1,000, 5,000**  
**DC CURRENT: 10, 100, 500 MA—10 AMP—100 MICRO AMP**  
**OHMS: 0-2,000 (12 center), 0-200,000 (1200 center), 0-20 MEGOHMS (120,000 ohms center)**  
**DECIBELS: (5 ranges) —10 to +52 DB**

For **HIGH** Performance  
In **LOW** Signal  
Areas . . .

The  
**ALL NEW**  
JFD **Super-Beam**  
HI-LO TV Array



No. TA116

Also available  
without Hi-Band  
Array as  
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STACKED FOLDED  
DIPOLES with  
REFLECTORS**

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PERFORMANCE FIGURES  
FROM ACTUAL REPORTS!**

CITIES	DISTANCE IN MILES
Albany - New York	125
Cleveland - Pittsburgh	120
New Haven - New York	110
San Diego - Los Angeles	100
South Bend - Chicago	90

**OUTSTANDING FEATURES!**

- ✓ Gives full 12 channel TV reception plus FM.
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- ✓ U-Bolt Clamp construction provides 1/4, 1/2 or 3/4 wavelength spacing of 2, 4, 6, or more bays on mast for tremendous stacking flexibility—also permits independent orientation of each bay.
- ✓ Lightning-fast assembly time.
- ✓ Impedance of 150-260 ohms and +8.6 DB gain.
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"Manufacturers of the World's Largest Line of  
TV/FM Antenna Equipment"

dues. Several more top quality service meetings are now being planned.

*Associated Radio-Television Servicemen of New York City*

Officers elected for the coming year were: Max Liebowitz, Pres.; Harry Weigand, V.P.; Jack Edel, Treas.; Arthur Silverberg, Recording Sec.; Noel Payne, Corresponding Sec. Dr. Victor Wolk of Beta Electronics presented a very informative talk with slides on TV Power Supplies on Jan. 5, and on Jan. 19, Ira Kamen spoke on TV Interference, also very well received.

*The Empire State Federation of Electronic Technicians Associations*

The following officers were elected at the Binghamton meeting Oct 31 1948. Their term of office ends April 1949. President, T. Lawrence Raymo, president of RTG of Rochester; Vice President, Max Leibowitz, president of the ARSNY of New York City; Secretary, Wayne Shaw, president of the RSA of Binghamton; Treasurer, Ben De Young, president of the RTG of Central New York; Sergeant at Arms, Ewart M. Holland, president of the Hudson Valley RSA.

Elected to the Board of Directors were Herb Snyder, RSA Binghamton; Robert L. Bryan, RTG Rochester; Fred Booth, Hudson Valley RSA; Morris Ross, Central New York RTG; and Jack Edel, ARSNY New York City.

*Associated Radio Servicemen of Central Pennsylvania*

TV was the keynot of the October meeting of the ARSCP, held in the Brown Library in Williamsport. Pres. Robert Stout announced that it was pleased to have full facilities available—power, a forty foot tower with platform, at least two types of antennas, suitable test equipment, etc., at the Association's TV lab on Mosteller Hill. The November meeting featured a talk on TV by John F. Rider

*Associated Radio Service Dealers of Columbus, Ohio.*

On Dec. 1, 1948 the association was five years old . . . Happy birthday. A bouquet to FM Station WKCO for their 15 minute program dedicated to the radio service men of Columbus, and particularly ARSD. Proud because when we leaf through the telephone directory 13 out of the 18 Radio Service Dealer Display ads carry our Insignia. John F. Rider presented library with copies of "Television-How it Works", "FM Transmission and Reception", "Understanding Vectors & Phase."

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● Convert radio noises into extra sales dollars! Aerovox Type ANL-37 Selector does the trick. Connect it with noise-producing source. Various plugs and clips permit variety of connections and ground. Turn knob when interference is minimized, dial indicates correct Aerovox Type filter to install. It's simple, positive, profitable.

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## INCOME TAX

[from page 26]

sary to pay on only fifty percent of the profit.)

Both of these transactions were capital gains, and so they were entered by Mr. Jones in Supplementary Schedule D.

Jones elected to list all of his personal expenses that were allowable as tax deductions, rather than use the blanket \$1000 that Uncle Sam permits as an optional blanket deduction. Here is how they ran:

To the Community Chest, he had contributed \$250.00. The church he attended got \$300.00. The college he had attended nicked him for \$50.00 as an alumni contribution. That made a total of \$600 given as *personal* contributions of one sort or another, aside from whatever amounts may have been given by the business as a matter of business operation.

Aside from a business loan and the mortgage on the brick duplex he rented, Joe Jones had two personal debts outstanding. On his home, he paid \$250.00 interest to the home-stand, and he paid the local bank \$500 interest on a personal note. \$750 was entered under interest on page three of the long income tax form.

Joe Jones also sustained a personal money loss. His automobile was destroyed by a fire. This left him \$1200.00 poorer. This, too, was entered on page three.

Certain taxes that business men pay as individuals can be deducted when making out a Federal income tax return. Generally speaking, most state, county and municipal taxes go into this classification. So Jones put down on page three the fact that he had paid \$420.50 to the state as property tax, \$175.00 as real estate tax, and \$45.24 in state sales tax on his personal purchases. Total taxes: \$640.74.

Mrs. Jones was pretty sick during the year, and the medical expenses ran high. On Jones' tax return, he showed payment of \$200.00 to a local doctor, \$500.00 to a big city specialist, \$90.00 to a hospital, and \$50.00 for medicines.

(It is permissible to list under medical expenses the money you pay out for prescriptions and medicines, and dentists' as well as doctors' bills.)

Since Jones' income was a pretty good one, he elected to take advantage of the provision of the 1948 law allowing "community property returns" to citizens of all states. His

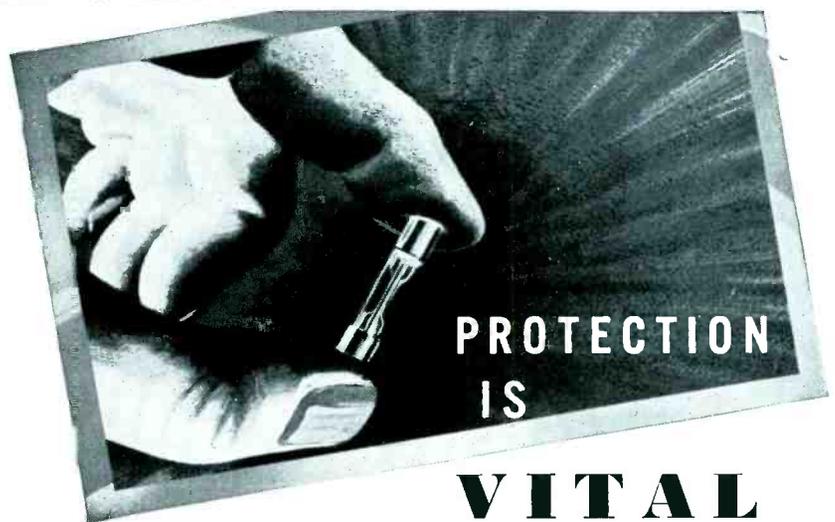
## The Quickest Change ON RECORD(S)



LIKE THE DEMANDS on Television entertainers for speed in changing costumes—there is need for greatest possible ease and speed when phonograph owners change back and forth from LP Micro-groove to standard 78 RPM Records. Public satisfaction and convenience demand it. That's why the two-in-one feature of Astatic's new FL Series Long-Playing Pickups is considered of first importance. Each of these amazing units plays both types of recordings . . . and makes the change-over in seconds. There is no changing of needle pressure, no similar adjustments to make. All that the user need do is change cartridges. Takes only seconds, because the FL Pickups' tiny LP Cartridges fix themselves into playing position on the same slip-in principle which firmly joins barrel and cap of many modern fountain pens. Write for new brochure, giving full details, illustrations, on the complete Astatic Long-Playing Line.

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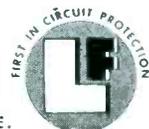
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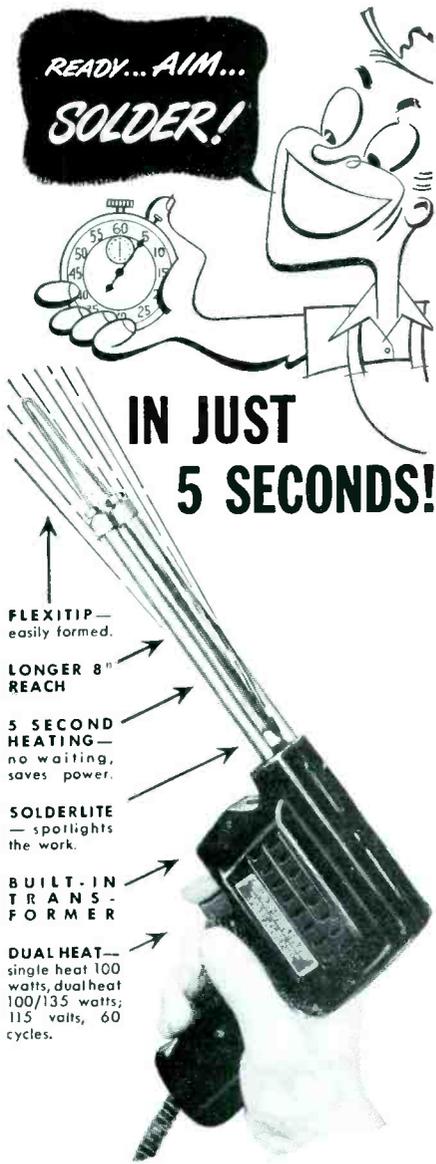


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spotlights the work.

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income was split evenly in two. Mrs. Jones declared one half of it as hers, Jones declared the other half. They realized a neat saving by doing this because each return fell into a lower bracket with a lower surtax rate.

If you choose to use the long form and itemize your personal expenses, you must be careful. There are many things you may not deduct. In fact, there are probably more things you can't deduct than there are things you can.

You can't deduct any personal expenses, living expenses, or family expenses. You aren't allowed to claim wages paid to a domestic servant—even if paying them releases your wife to work for you, thus saving the business expense of an additional employee. You can't take off medical expenses unless you have spent more than five percent of your adjusted gross income on the doctors, dentists and drug stores. Furthermore, you are allowed to take off only the portion of your medical expenses that runs over five percent of this figure.

However, there are some items of income on which you do not have to pay tax at all. One example is insurance payments you may receive. Here is a ready-reference list of items of income, and items of both business and personal expense, showing whether or not they qualify as income or as legitimate tax deductions. It does not include every possibility, but it covers most of the things the average appliance dealer will encounter:

**INCOME**

Accident insurance receipts—tax free.

Annuities—taxable.

Bad debt recoveries—taxable.

Bonuses—taxable.

Commissions—taxable.

Corporation dividends—taxable.

Dividends on unmaturing life insurance—tax free.

Gambling profits—taxable.

Gifts and bequests—tax free (over \$1000, gifts are subject to gift tax, and bequests come under the inheritance tax.)

Income from sale of property—taxable.

Interest received on loans to others—taxable.

Interest you receive on hooks you hold—taxable.

Interest on tax-exempt bonds—tax free.

Sums paid you by a life insurance company—tax free.

Employee trust pensions—tax free.

**EXPENSES**

Accountant's fees—deductible.

**Camco**

**TV and FM  
ANTENNAS**  
(Swift-Rig)

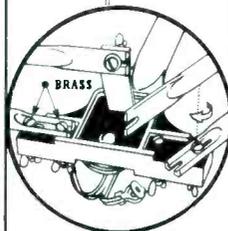
**Directional High Gain  
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**Presto! . . .  
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"Swift-Rig" antennas are completely assembled—Just Unfold and Lock in Place . . . A matter of minutes.

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**Outstanding Features**

- PERMANENT LOW RESISTANCE . . . nickel plated brass screws and "SWIFT RIG" LUGS at electrical contacts
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Upkeep on car or truck used for business—deductible.

Upkeep and taxes on personal automobile—not deductible.

Loss by fire or theft of a car used for either business or pleasure—deductible (if you use the car for business, take it off as a business expense in arriving at the adjusted gross income figure; if you use it for pleasure, take it off as a loss on the long form.)

Bad debts—deductible (the same consideration applies here. If it's a bad business debt, take it off before arriving at your adjusted gross income figure; if it's a bad personal debt, take it off on the long tax form.)

Contributions—deductible (again, consider whether it's business or personal contribution.)

Depreciation—deductible (this applies only to income-producing property. Depreciation on personal property, such as your family automobile or your home, is not allowed. In the case of Joe Jones, note that he took deductions for depreciation on the brick duplex that he rented—because it produced income—but not on the home in which he and his family lived.)

Dues to business organizations—deductible.

Dues to social clubs—not deductible.

Business rent—deductible.

Home rent—not deductible.

Interest—deductible (once more, how you take it depends upon whether the loan is a business loan or a personal one.)

Life insurance premiums that you pay to the insurance company—not deductible.

Premiums on business insurance—deductible (premiums on group life insurance that you pay for your employees are a business expense. Deduct it before arriving at your adjusted gross income.)

Losses on sale or exchange of capital asset—deductible.

Medical and dental expenses (above 5% of the adjusted gross income)—deductible.

Old Age Insurance Benefit payments—not deductible.

Subscriptions to business magazines—deductible.

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U.S. income taxes—not deductible.

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Completely eliminating any capacity between outer foil and chassis, the new Amcon Shielded Condenser is highly effective in stopping hum or other extraneous signal noise.

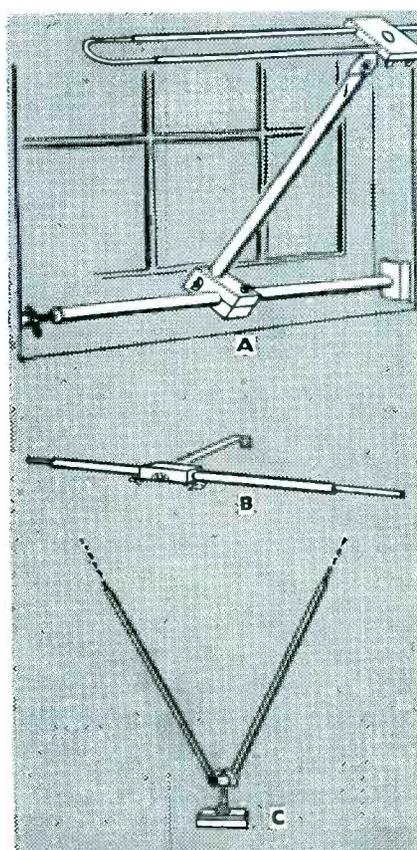


Here is a new condenser that really "stands up" under the voltage and temperatures encountered in Television circuits. Amoil Processed, these new capacitors approach closely the electrical properties of fine mineral oil impregnated units. Simple tubular construction with high melting point wax seal results in an attractive price range.

Ask Your Jobber About These Two New Amcon Condensers

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## GYRO-TENNA

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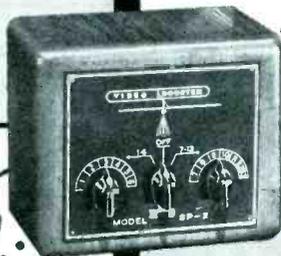
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not only because of  
rapid turnover—but

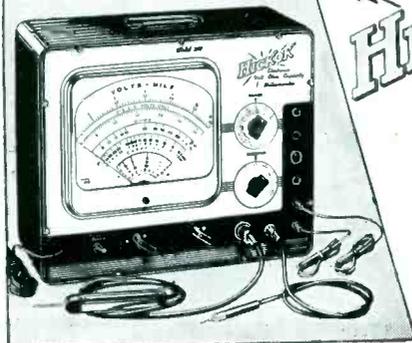
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**SQUARE WAVES**

[from page 19]

waveforms of *Fig. 1* are those result-  
ing from 2,000 cps square wave  
at the input. (B) represents the out-  
put from an amplifier which has  
some loss of high frequencies, but  
which is otherwise satisfactory. Note  
the rounding of the leading edges of  
each wave. As attenuation of high  
frequencies is increased, such as  
when a tone control is turned to ob-  
tain a more "mellow" reproduction,  
the wave passes through (C) and (D)  
to a limit shown by the sine wave  
(E).

Poor transient response to high  
frequencies, or poor damping, is  
shown by a slight oscillation, result-  
ing in a train of waves starting at  
each half of the square wave. This  
effect is shown at (F). From these  
waveforms, it may be deduced that  
high-frequency attenuation affects  
the leading edge of each half cycle.

With a 60-cps square wave at the  
input, the characteristics of the am-  
plifier at low frequencies is shown  
by the output waveform. The effect  
of low-frequency attenuation is ob-  
served as a change in the slope of  
the wave tops. As low frequencies  
are attenuated, the top of the wave  
slopes more and more as shown in  
*Fig. 2* (A), (B), (C), and (D). Ac-  
tually, no information directly rela-  
tive to response below the frequency  
of the square wave is obtainable by  
this method. However, most ampli-  
fiers having poor low-frequency re-  
sponse at the very low frequencies  
also have a phase shift which reflects  
into the transmission at 60 cps, so  
that an amplifier which transmits a  
60-cps square wave perfectly is usu-  
ally exceptionally good down to 15  
or 20 cps.

To become conversant with this  
method of testing, it is desirable to  
experiment with a square-wave gen-  
erator and an amplifier with con-  
trollable response characteristics.  
Changes in control settings will vary  
the output waveform, and experience  
gained by this type of familiariza-  
tion may be used in the analysis of  
an amplifier of unknown character-  
istics. Once the technician learns the  
uses of any new method of testing,  
and is fully acquainted with its ad-  
vantages and limitations, he has  
added another "tool" to his array of  
servicing helps.



Get **YOUR All-Plastic Cabinet** by Purchasing the Resistor Assortment of 1/2-watt "Little Devils" . . . **\$12<sup>50</sup>**

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## CATHODE RAY OSC.

[from page 14]

regulated and the 'scope connected directly across a resistor representing the impedance of the voice coil and taking its place. When the 'scope shows the first signal of distortion, read the RMS value of the voltage across the resistor, and compute the output power from that.

For aligning broadcast i-f transformers use the 'scope as VTVM as described above.

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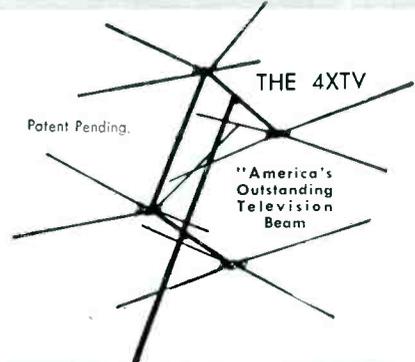
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# Telrex INC.

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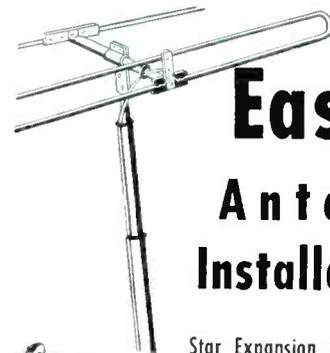
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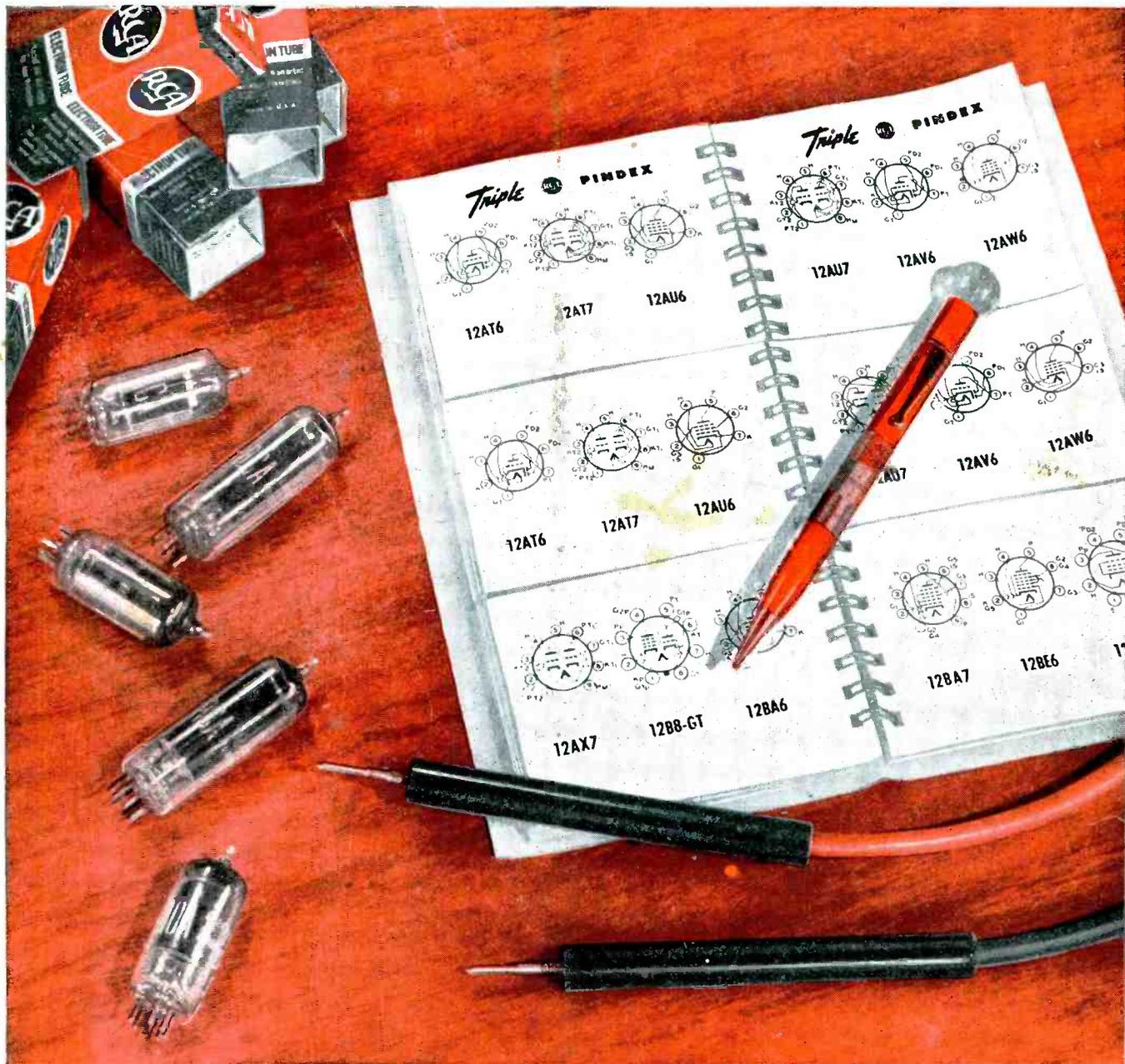
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